LAMBDA PHYSIK®

Lambdachrome®
Laser Dyes

Ulrich Brackmann

Ulrich Brackmann

Lambdachrome®

Laser Dyes

3rd Edition

Lambda Physik AG · D-37079 Goettingen · Germany

Dr. Ulrich Brackmann
Lambda Physik AG
Hans-Boeckler-Strasse 12
D-37079 Goettingen· Germany
Tel.: +49 (551) 6938-0

Lambda Physik AG
Hans-Boeckler-Strasse 12
D-37079 Goettingen· Germany
Tel.: +49 (551) 6938-0/0800EXCIMER
Fax: +49 (551) 6869-1
Email: salesgermany@lambdaphysik.com

Lambda Physik USA, Inc.
3201 West Commercial Boulevard
Fort Lauderdale, FL 33309 · USA
Tel.: +1 (800) EXCIMER/+1 (954) 486-1500
Fax: +1 (954) 486-1501
Email: laserdyes@lambdaphysik.com

Marubun Corp.
Marubun Daiya Building
8-1 Nihonbashi Odenmacho
Chuo-ku, Tokyo 103-8577 · Japan
Tel.: +81 (3) 3639-9811
Fax: +81 (3) 3662-1349

World Wide Web: www.lambdaphysik.com

All laser dyes mentioned in this book are immediately available from Lambda Physik. For more information please call or write. All major credit cards accepted.

Lambda Physik reserves the right to modify any information given herein. Every effort is made to ensure utmost accuracy; however, no liability is assumed for errors occurring in the tables.

Lambdachrome® is a registered trademark of Lambda Physik.

Third Edition (January 2000)

Contents

Preface to the 3rd Edition

Dyes and solvents from Lambda Physik periodically change in availability and composition. In order to ensure that researchers and users of Lambda Physik products have the most up-to-date information possible, this 3rd Edition of Lambdachrome® Laser Dyes is provided as an update to previous editions.

Lambda Physik reserves the right to modify any information given herein. Every effort is made to ensure utmost accuracy; however, no liability is assumed for errors occurring in the tables.

January 2000

Preface to the 2nd Edition

The second edition of *Lambdachrome® Laser Dyes* has been updated with additional dyes, dye laser measurements, and evaluation of the latest literature. In this way it should be possible for any dye laser user to get a quick overview of the most important information regarding the use of laser dyes.

Meanwhile, the standard dye laser technique has been completed by several solid state lasers showing very interesting features such as high operating lifetime of the active medium and high output power in a small IR spectral range (compared to the accessible fundamental tuning range of an excimer laser pumped dye). However, the use of laser dyes still guarantees:

- easy tunability over a *wide range* of frequencies or wavelengths without the need of changing gratings or mirrors
- hyperfine tuning
- high average power in pulsed and cw operation mode
- high peak power
- ideal light source for the generation of ultrashort pulses

February 1994

Preface to the 1st Edition

The intention of this book is to give information on the most frequently asked questions about commercially available dyes, their chemical formulas, lasing wavelengths, solvents, pump sources, performance, and literature references. The following topics are discussed:

- Solvents frequently used for laser dyes and their general and physical properties, safety precautions, and waste disposal procedures
- General considerations about the choice of a solvent for laser dyes, solvent handling, preparation of dye solutions, and the cleaning of the dye circulation system
- Precautions for the use of laser dyes and their solutions
- All Lambdachrome® laser dyes are listed, including more than one hundred dyes along with their chemical names, chemical structures, trivial names, and trade names
- Absorption and fluorescence data in addition to appearance
- The absorption spectrum of each dye
- The application of the dyes in a variety of solvents under the most common pumping conditions as well as the dye laser characteristics (peak, range, efficiency, concentration, and solvent)
- Tuning curves for excimer, nitrogen, and ion laser pumped dye lasers
- Several hundred literature references

This book is written for general users of dye lasers. Researchers of laser dyes may refer to the mentioned publications for more detailed information.

July 1985

Dye Lasers and Laser Dyes

Dye lasers are "the fulfillment of an experimenter's pipe dream that was as old as the laser itself: To have a laser that is easily tunable over a wide range of frequencies or wavelengths" (Schaefer, 1977). Dye lasers can be pumped by incoherent or laser sources, both pulsed and continuous wave (CW), and offer the possibilities of broad wavelength control, multijoule pulsed operation, ultranarrow linewidths, or ultrashort pulses. They are conveniently divided into three broad technological categories:

- *Continuous-wave* jet-streamed dye lasers can provide narrow CW bandwidths and can be synchronously pumped or passively modelocked to generate short pulses.
- *Flashlamp*-pumped dye lasers have a larger bandwidth and less wavelength stability than CW laser-pumped dye lasers, but they have the advantage that large volumes of active dye medium can be pumped, yielding large output pulse energies and active powers.
- Dye lasers that are pumped by Cu vapor or nitrogen, excimer lasers, and the frequency-doubled or -tripled output from pulsed Nd:YAG lasers provide high peak powers. Also, the pulse duration of 4 to 60 nsec makes narrow bandwidths and a high spectral purity possible.

Typical output characteristics from commercial dye lasers are shown in Table 1.

Continuous-Wave Dye Lasers

CW laser systems consist of three major elements: the optical resonator, the dye flow system, and the tuning element. The resonator is responsible for maintaining a rigid optical alignment of all cavity components. The dye

Table 1.
Commercial Dye Laser Output Characteristics

Pump Source	Argon/Krypton Ion Laser		Flashlamp	Nd:YAG	Excimer
	CW	Mode-Locked/ Cavity Dumped		Laser	Laser
Tuning Range [nm]	380-950	580-880	335-850	410-880	320-1,024
Average Power [W]	5	0.1	3	2	10
Repetition Rate [Hz]	CW	3.8M	2-30	10-40	1-500
Peak Power [kW]	-	10	7,000	20,000	10,000
Energy/pulse [mJ]	-	0.01	3,500	10-120	40-120
Pulsewidth [nsec]	-	0.0001	260-600	5-10	7-250
Linewidth [GHz]	0.0005 to 40	Various	2	0.6	0.15

flow system, consisting of dye, circulation pump, and dye jet nozzle, must provide an optically flat stream of dye across the laser's optical axis. The tuning element allows the user to continuously tune to the required output wavelength.
Excitation in a CW dye laser is provided by an input pump beam from another CW light source, typically an ion laser. This beam is focused onto the dye stream and causes an extremely high level of fluorescence. The fluorescence is focused between two highly reflective concave mirrors that feed back the fluorescent light, initiating the lasing process.

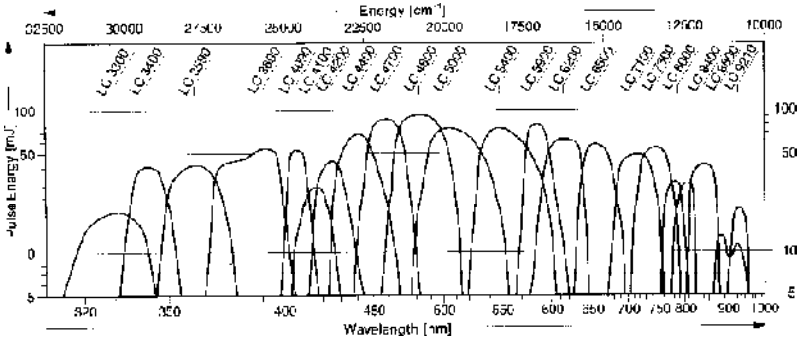
The dye laser emission described above is broadband, typically exhibiting a 40-GHz linewidth. Many applications require narrow-linewidth single-frequency operation. This is accomplished by inserting one or two etalons into the dye laser cavity. A dye laser with an etalon, when coupled with electronic stabilization, can narrow the linewidth to less than 1 MHz.

Pulsed Dye Lasers

Of the various pulsed dye lasers, two types tend to dominate because of their versatility, broad spectral coverage and high output power. They are Nd:YAG and excimer pumped dye lasers.

The use of Nd:YAG and excimer pump lasers allows dye laser pulses to be produced at energy levels up to 100 mJ or more. Their performance is wavelength-dependent. At the long wavelengths, more energy is provided by pumping with a frequency-doubled Q-switched Nd:YAG than with an excimer laser. However, UV-emitting excimer pumps allow dye lasers to operate directly at UV wavelengths down to 308 nm and at repetition rates of 500

Figure 1.
Tuning Range of Dyes for Excimer-Pumped Dye Lasers

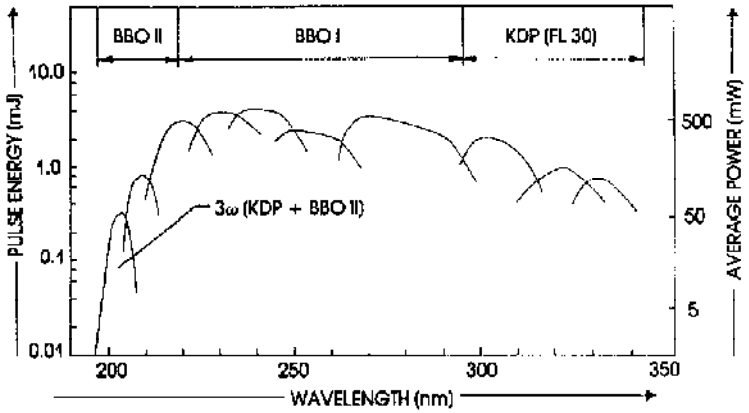


Hz. The strongest Nd:YAG lasing line is at 1064 nm, which is unsuitable to pump dyes. Fortunately, its high peak power and near-diffraction-limited beam quality lend themselves to rather efficient frequency doubling, tripling and quadrupling. This provides suitable pump wavelengths of 532, 355, and 266 nm. Considerable engineering effort has gone into reducing the intensity fluctuations that are amplified by the inherent nonlinear frequency-doubling process. The tuning range can be covered by using one of these pump wavelengths and an appropriate dye.

The Nd:YAG laser has certain advantages with respect to the efficient pumping with certain dyes, especially when pumped longitudinally, i.e., collinearly to the laser beam. Rhodamine 6G, for example, can be excited very efficiently in this manner (>50 percent). Since excellent beam quality is achieved with the longitudinal arrangement, one also gets high conversion rates with all nonlinear frequency changes (by frequency mixing, 367 nm, and by frequency doubling, 280 nm).

The discovery of rare gas halide lasers, i.e., the excimer laser, in 1976, introduced a new and powerful tool for dye laser pumping. It combines the advantages of the nitrogen system (high repetition rate, ease of operation, and low cost) with those of the Nd:YAG system (high peak power and sufficiently long pulse duration). Furthermore, the excimer laser is scalable to very high repetition rates (>1 kHz) and high pulse energies (>1 J).

Figure 2.
Extension of Tuning Range of Pulsed Dye Lasers into UV



Excimer laser wavelengths range from 193 nm (ArF) to 351 nm (XeF). The strongest lines are at 248 nm (KrF) and 308 nm (XeCl). Most dyes have an absorption band at 308 nm. The result is that nearly the entire range of commercially available dyes can be pumped with a XeCl laser (see Figure 1).

A major advantage of pulsed dye lasers over CW is the ease with which the output can be frequency-doubled, thus extending the tuning range into the UV. Using a combination of KDP and BBO (beta barium borate) crystals, wavelengths from 207 to 350 nm can be produced. Further extension down to 197 nm can be achieved by frequency mixing (see Figure 2).

Dyes

Dyes, either as solutions or vapors, are the active medium in pulsed and CW dye lasers as well as ultrafast shutters for Q-switching and passive modelocking. They emit in a comparatively narrow spectral region (typically 30 nm); thus a variety of dyes is necessary in order to cover the entire (visible) spectral range (Figure 1).

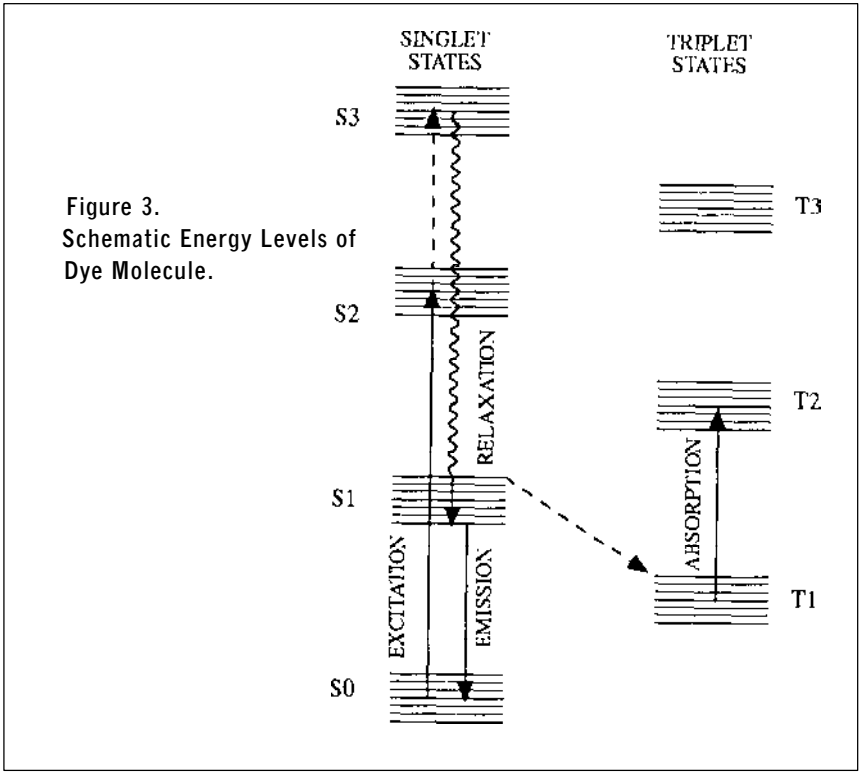


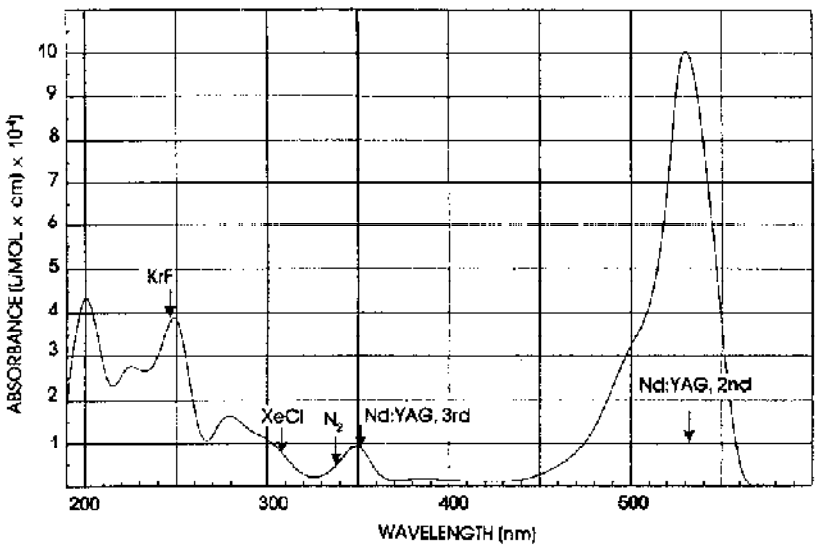
Figure 3.
Schematic Energy Levels of Dye Molecule.

The optical excitation of dyes corresponds to transitions of molecules in the singlet state, with the absorption S_0 --> S_1 being the strongest (see Figure 3), and is specific for each dye molecule. For optimum pumping (S_0 --> S_1) of the various dyes, one would therefore need a number of pump-laser wavelengths.

Fortunately, nearly all dyes have additional absorption bands in the UV range (see Figure 4). These absorptions correspond to transitions to higher singlet states (Figure 3) from which fast internal relaxation processes lead to the upper laser level (S_1) with high quantum efficiency. This is the reason most dyes can be pumped by a single UV laser. However, the attractive excitation scheme of one pump laser for all dyes brings other problems:

(a) The inner efficiency of dye lasers is lower as a result of excitation in higher S-states because a considerable part of the excitation energy is converted into heat (large Stokes shift). However, the high efficiency of pulsed lasers more than compensates for this disadvantage.

Figure 4.
Absorption Bands of Rhodamine 6G
Note the small absorption cross section of UV wavelengths.



(b) A multiphoton excitation can lead to destruction of the cell and the solvent molecules. In this process, a previously excited molecule absorbs additional photons (sequential absorption), or a molecule absorbs several photons at the same time. In these absorption processes, the molecule can absorb so much energy that the binding energy is surpassed, and the molecule dissociates, or at least changes, its structure. This process is more probable during excitation with UV light than with visible light. Thus, one must expect a reduced photostability of the dye when pumping with UV light.

The photostability of the most common dyes is summarized in Table 2 (Antonov and Hohla, 1983). For example, the value of 50 Wh/l corresponds to 5 x 10^5 total shots as the point at which the dye laser energy falls to 50 percent of the initial value, i.e., when the dye solution (one liter) is excited with 360 mJ per pulse at 10 Hz.

(c) Another problem results from the small absorption cross section at short wavelengths (Figure 4). To excite as many molecules as possible, a very high pump power density I_p (I_p being inversely proportional to the absorption cross section), or high dye concentrations is required. I_p is limited to values <30 MW/cm^2 due to the stability of most solvents. To

Table 2.
Photochemical Stablility of Laser Dyes

Dye	Center of Emission [nm]	Excimer-pumped [Wh]	CW laser-pumped [Wh]
p-Terphenyl	340	451	-
QUI	380	1457	-
Polyphenyl 1	380	870	-
Stilbene 1	410	10	200
Stilbene 3	430	14	300
Coumarin 2	450	31	100
Coumarin 47	470	45	-
Coumarin 102	480	244	100
Coumarin 30	515	-	100
Rhodamine 6G	590	316	1000
Rhodamine B	610	144	200
DCM	650	348	500
Rhodamine 700	700	80	1000
Styryl 9	840	73	500
HITCI	875	12	100
IR 140	960	10	100

keep I_p as low as possible, high-power dye lasers have to be pumped transversely.

Transverse pumping configurations have been used for some time, and in contrast to the end-on pumped configurations, they lead to a non-Gaussian energy distribution, for which rising spatial filters can compsensate.

There are two types of transverse-pumped dye laser cells: the longitudinal and the transverse flowing. The transverse configuration, in which the dye flows vertically to the dye laser, results in a high repetition rate, whereas longitudinal flowing, in which dye flows in the direction of the dye laser, is characterized by a symmetrical energy distribution but small repetition rates.

References

Antonov, V. V. and K. L. Hohla. *Appl. Phys.* B30 (1983): 109 - 166, B32 (1983): 9 - 14

Berlman, I. B. *Handbook of Fluorescence Spectra of Aromatic Molecules*. 2d ed. New York, New York, USA: Academic Press, 1971.

Birks, J. B. *Photophysics of Aromatic Molecules*. New York, New York, USA: John Wiley and Sons, 1970.

Brackmann, U. *Lambdachrome Laser Dyes*. First edition compendium. Goettingen, Germany: Lambda Physik GmbH, 1986.

Drexhage, K. H. "Structure and Properties of Laser Dyes." *Dye Lasers*. Vol. 1 Topics in Applied Physics, F. P. Schaefer, ed. (1973/1977) Springer Verlag, Hamburg, Germany.

Jaffe, H. H. and M. Orchin. *Theory and Applications of Ultraviolet Spectroscopy*. New York, New York, USA: John Wiley and Sons, 1962.

Maeda, M. *Laser Dyes*. Tokyo, Japan: Ohmsha Ltd./Tokyo, Japan, Orlando, Florida, USA, & London, UK: Academic Press, 1984.

Schaefer, F. P. *Dye Lasers*. 2d ed Vol. 1. Topics in Applied Physics, F. P. Schaefer, ed. (1977) Springer Verlag, New York, New York, USA.

Steppel, R. "Organic Dye Lasers." *Lasers and Masers*. Vol. 1. Handbook of Science and Technology. M. J. Wever, ed. Boca Raton, Florida, USA: CRC Press, 1982.

Suzuki, H. *Electronic Absorption Spectra and Geometry of Organic Molecules*. New York, New York, USA: 1967.

Dye Solvents

The heart of any dye laser is the laser dye. Either dissolved in an appropriate solvent or in a vapor state, these very often highly colored substances play the major role in the overall performance of any dye laser. Both pulsed and continuous operation is possible. In addition, their unique photophysical properties make them ideal candidates for the generation of ultrashort light pulses. With mode-locking, pulses shorter than 100 femtoseconds have been obtained. Hyperfine tuning of the output has permitted many exciting experiments in spectroscopy.

Solvents for Laser Dyes

Prepared laser dye solutions usually contain very small quantities of dye. Typical dye concentrations are 10^{2} to 10^{5} molar. For this reason, the solvent in which the dye is dissolved plays an important role when defining physical properties and potential hazards.

Lasing wavelength and energy are very sensitive to the choice of solvent. Most laser dyes are polar molecules, and excitation into their lowest-lying singlet state is accompanied by an increase in the dipole moment. Accordingly, solvent polarity plays an important role in shifting the lasing wavelength. In a majority of circumstances, increasing solvent polarity will shift the gain curve toward longer wavelength. In the case of more polar dyes, the shift can be as high as 20-60 nm. Table 3 gives an impression of this effect (Drexhage, 1973).

Some solvents cannot be used with longer wavelength lasing dyes because the solvents have vibrational overtones that interfere with the lasing process. Solvents such as water, methanol and ethanol, which would appear to be optimal for many dyes, are often not useful solvents for near-IR and IR dyes

Table 3.
Maximum of Main Absorption Band in Different Solvents

RHODAMINE 6G	
Solvent	Labs [nm]
HFIP	514
TFE	516
EtOH	530
DPA	537
DMSO	540

COUMARIN 102	
Solvent	Labs [nm]
HFIP	418
TFE	405
MeOH	390
NMP	383

because of the presence of hydroxyl group overtones in this spectral range. Accordingly, the solvent DMSO or polychlorinated aromatics, which lack hydroxyl resonances, are commonly used for dyes that lase in the near-IR and IR regions of the spectrum. Unfortunately these solvents are toxic. DMSO especially facilitates the transfer of toxic dyes through the skin and into the body if accidentally spilled. Therefore, it is strongly recommended that all laser dyes and solutions containing laser dyes are handled in well ventilated environments. All individuals handling the solutions should wear rubber gloves.

A summary is given below of the general and physical properties, application, and safety of the most frequently used solvents for laser dyes. Most of this information has been taken from the literature cited at the end of this article.

Choice of Solvent

Although very often a specific solvent is recommended for use with a particular dye, it is important to recognize that other solvents can also be used, particularly if the user is interested in shifting the gain curve to different wavelengths.

The following are criteria for choosing appropriate solvents for laser dyes:

a) The solvent must be transparent at the pump wavelength and the emission wavelength of the dye laser.
b) The dye should be soluble in the solvent under consideration. In all cases, the rule "similia similibus solvuntur" applies, meaning that the solubility of nonpolar dyes, e.g. PTP, in nonpolar solvents, e.g. cyclohexane, is greater than in polar solvents, e.g. methanol, and vice versa.
c) The solvent must be photochemically stable when exposed to the pump light. In particular, solvents containing chlorine, such as chloroform, and secondary alcohols, such as isopropanol, are not useful as solvents for laser dyes because of their low photochemical stability.
d) Some solvents are often not useful for near-IR and IR dyes due to the presence of hydroxyl group overtones in this spectral region (see above).

The following solvents are recommended for different pumping conditions:

a) Those appropriate for pumping with a pump source emitting below 300 nm (e.g., KrF: 248 nm, Nd:YAG 4th harmonic: 266 nm):
    - Cyclohexane
    - Ethylene glycol
    - Glycerol
    - Trifluoroethanol
    - p-Dioxane

- Ethanol
- Methanol
- Hexafluoroisopropanol

b) Solvents appropriate for pumping with a pump source emitting between 300 and 400 nm (e.g., XeCl: 308 nm, nitrogen: 337 nm, Nd:YAG 3rd harmonic: 355 nm), in addition to those listed in (a):

- N,N-Dipropylacetamide
- Dimethylsulfoxide (DMSO)
- N,N-Dimethylformamide (DMF)
- Tetrahydrofurane
- 1-Methyl-2-pyrrolidinone (NMP)
- Tetrahydrothiophenedioxide (sulfolane)

c) Appropriate solvents for pumping in the visible and near-IR spectral range (e.g., Nd:YAG 2nd harmonic: 532 nm, CW-ion lasers), in addition to those listed in (a) and (b):

- Toluene
- Chlorobenzene
- Chloroform
- Benzylalcohol
- 1,2-Dichloroethane
- 1,1,1-Trichloroethane
- o-Dichlorobenzene
- Dichloromethane

Purity of Solvent

The output power of dye lasers is strongly dependent on the purity of the solvent. Impurities and additives may strongly affect upper state lifetime of the dye or may catalyse photochemical reactions. Therefore, for best results, only high quality solvents are to be recommended.

Very often we are asked whether it is necessary to use spectroscopic grade solvents. Our experience is that it is NOT necessary. Commercially available qualities of the grade "pro analysis" (p.a.) or "for synthesis" are sufficient for dye laser applications. Some suppliers will call them HPLC.

However, bulk quantities of these solvents are very often of poor quality and are not offered as p.a. grade. Under such circumstances, it is highly recommended that the transparency of the solvent is checked in a 1 cm cuvette at the pump wavelength of the dye laser with a simple absorption spectrometer. The measured value should be greater than 98 percent.

Solvent Handling

With the exception of water, all solvents should be considered hazardous. In many instances, the solvent in which the dye is dissolved plays a major role in the hazard presented by the final solution. Some of the solvents listed above are highly toxic, irritants, narcotics, and/or anaesthetics. These hazards must be addressed carefully in dye handling and solution preparation.

Nearly all solvents are highly flammable. Therefore, a small fire extinguisher should be installed near the laser in a readily accessible and unobstructed area.

A particular fire hazard that is not commonly known occurs with nonpolar and, hence, nonconductive solvents. If these solvents are circulated at a high speed through plastic tubings, the pump unit acts as a van de Graff generator, producing up to 100 kV, and sparks may pierce the tubing and ignite the solvent. The dye selectors use grounding wires inside the plastic tubings to eliminate these problems. However, when using such solvents, check first for static electricity before opening the reservoir. Static electricity is present when hair on the back of your hand or forearm is attracted to the plastic tubing. Do not circulate dye solutions made with such solvents for more than a minute, unless the cuvette has been placed into the crate and is grounded.

Preparation of the Dye Solution

As a rule of thumb, the dye concentration is selected to absorb 90 percent of the pump light within 0.5 mm, or the dye solution has to have an absorbance of OD = 2/mm for the wavelength of the pump light.

When in doubt about the concentration of the dye solution, measure the absorbance of the dye solution used for the oscillator in a spectrophotometer, using either a 1 mm cuvette or, after diluting by a factor of 10, a 10 mm standard cuvette. The cuvettes must be of fused-silica type if you measure the absorbance for a pump wavelength smaller than 300 nm. The absorbance of your oscillator dye solution should be within the range of OD = 1.8 to 2.2/mm. For an unknown dye, dissolve a known amount (a few milligrams) in a known volume and measure the absorbance at the pump wavelength in use; the dye concentration (in g/l) is then calculated according Beer's law:

$$g/l = \frac{20}{OD\,(\text{solution}/10\ \text{mm})} \times \frac{g\,(\text{sample})}{Vol\,(\text{sample})}$$

The measurements should, of course, be made against pure solvent in a cuvette of the same pathlength in the reference beam of the spectrophotometer.

A concentration of OD = 2/mm is convenient for the oscillator solution. The amplifier needs only 1/3 this concentration. The amplifier solution is prepared by filling the reservoir bottle of the amplifier circulator with one part stock solution and then adding two parts pure solvent.

To prepare the dye solution, weigh out the amount of dye and transfer it into a 500 ml (or 1 liter) glass bottle. If some are available, use brown bottles. Make sure that the entire measure of dye is transferred to the bottle and be careful not to spill it. Most errors occur at this step. Fill the bottle to the 500 ml (or 1 liter) mark. Adding 10 percent more or less solvent does not affect the operation appreciably. Make the stock solution "fatter" than recommended, since solvent can always be added directly to the reservoir of the circulators later on. Some dyes do not dissolve instantly. Use of an ultrasonic bath is recommended.

NOTICE:
Do not use the dye solution until it is completely translucent and no floating dye particles are observed.

Some dyes have to be used close to their saturation level. It may take some dyes up to 30 minutes to dissolve completely. If necessary, heat gently and with caution.

Optimizing the Dye Solution

There is an optimum concentration for a given dye gain, i.e. for a given dye, wavelength, and input power. This optimum concentration may vary from that giving an optical density of OD = 2/mm. Higher concentrations will cause a slightly red shift the tuning curves, while lower concentrations will result in a blue shift.

Optimization of the dye concentration is accomplished by adding either pure solvent or solution of higher concentration than that recommended in small increments to the solution in the dye circulation system until power is at maximum.

The concentrations for the amplifier solutions of excimer and Nd:YAG-pumped dye lasers are about 1/3 and 1/6 of the oscillator solutions, respectively.

Cleaning the Dye Circulation System

Should it be necessary to change the dye solution, it is only necessary to rinse three times with 100 to 200 ml of solvent. It is recommended that the dye filter be changed. If it is not possible to change the dye selector when changing the dye, especially when going from a longer wavelength to a shorter one, the cuvette, the reservoir, the pump, and the tubings must be carefully cleaned and

the filter must be exchanged. The cleaning process is complete only when no fluorescence is observed after rinsing for approximately 15 minutes. It is advisable to use small quantities of solvent and few rinses. The rinsing process can take many hours. Low output power on changing the dyes can often be traced to dye residue in the pump and the tubings.

Precautions for the Use of Laser Dyes

Cautious handling of dyes and dye solutions is advised, especially because those used in the infrared may be toxic or because solvents such as DMSO, Methanol, Dioxane, and Benzyl Alcohol have the ability to carry their solutes through the skin and into the body (Mosovsky, 1983; Kues, 1975).

In most cases the exact toxicity of laser dyes is not well known, but they should, like all chemicals, be considered dangerous until proven otherwise. The safest precaution is to use butyl rubber gloves when handling the dye solutions and to immediately clean any skin that comes into contact with the dye solutions or the dye itself.

Solvents should be kept away from heat, sparks, and open flames because they are extremely flammable or combustible. They should be handled in a hood due to their stench or potential danger if inhaled.

Lambda Physik provides, on request, a complete set of Material Safety Data Sheets (MSDS). These data sheets give more information on laser dye toxicity, hazards, and recommended controls. As already mentioned above, the exact toxicity of laser dyes is not well known in most cases. Therefore, it is important to know that the MSDS only describes general aspects of dye toxicity.

NOTICE:
The responsibility for the safe use of our Lambdachrome laser dyes rests with the user.

Hazards

Solvents should be handled only by qualified people trained in laboratory procedures and familiar with their potential hazards. Some solvents are highly toxic, irritants, narcotics, and/or anaesthetics. Some form hazardous compounds upon decomposition; others are highly reactive. In the following tables, hazard warnings and literature references, such as Sax (Dangerous Properties of Industrial Materials) and the Registry of Toxic Effects of Chemical Substances (RTECS) are provided, so that the information about possible hazards are available to the trained technical person using the dye, solvent, and/or dye solution.

The absence of a warning must not be interpreted as an indication of safety. In several cases information is not available on the possible hazards of many compounds.

Waste Disposal Procedures

The disposal methods outlined below are intended as guides to the users of laser dye solutions or solvents. Careful consideration must be given to the chemical and physical properties of the substances. In addition, local laws and regulations may preclude the use of these methods which are primarily designed for quantities of one to five liters. All federal, state, and local laws concerning health and pollution must be observed.

Definitions

Boiling point
The temperature at which the vapor pressure of the liquid is equal to the opposing pressure. Values listed in the tables refer to an opposing pressure of 760 torr unless otherwise stated.

Density
The density of a substance is defined as the mass per unit of volume.

Dielectric constant
A measure of the relative effect a solvent has on the electronic force with which two oppositely charged plates are attracted to each other.

Flash point
The flash point is usually not considered a common physical property. It is included because of its widespread use in classifying solvents for storage and shipping.

Ionization potential
The work (expressed in electron volts) required to remove a given electron from its atomic orbit and place it at rest at an infinite distance.

Melting point
The temperature at which a solid compound changes into the liquid state.

Minimum ignition temperature
The minimum temperature at which, under certain conditions, the mixture combined with air may ignite.

Molecular weight
The sum of the atomic weights of all atoms in a molecule.

Refractive index
The the ratio of the velocity of light in a particular substance to the velocity of light in vacuum. Values usually reported refer to the ratio of the velocity in air to that in the substance saturated with air.

Threshold Limit Value (TLV)
The maximum permissible concentration of a chemical that is permissable for prolonged exposure. The TLV gives a conentration of vapors to which an average sized person can safely be exposed for 8 hours per day, 5 days per week.

Viscosity
The coefficient of viscosity is defined as the force per unit area necessary to maintain a unit velocity gradient between two parallel planes a unit distance apart.

Benzyl Alcohol

Phenylcarbinol

General Properties

Colorless liquid with aromatic odor. It is only slightly soluble in water.

Physical Properties

Molecular weight:	108.14
Freezing point (°C):	-15.3
Boiling point (°C):	205.45
Flash point (°C):	100
Min. ignition temp. (°C):	435
Density (g/cm^3):	1.0493^{15} 1.0413^{25} 1.03765^{30}
Refractive Index:	1.54035^{20} 1.453837^{25}
Viscosity (cPoise):	7.76^{15} 4.65^{35}
Dielectric constant:	13.1
Ionization potential (eV):	9.14
Solubility:	0.08% in water, organic solvents
Optical properties:	

Wavelength (nm)	290	300	310	320	340	350	380
Transmission (%)	4	23	70	85	90	95	98

Application

Benzyl alcohol, due to its high viscosity, is a frequently used solvent in jet stream dye lasers. Its dissolving capacity makes it suitable for polar dyes like Coumarins.

Safety

RTECS # DN3150000; Sax 5, 409 · TLV:

Hazards

Harmful by inhalation and if swallowed. Benzyl alcohol is a toxic solvent. It is believed that benzyl alcohol that is present in a poorly ventilated area is the cause of violent headaches, vertigo, nausea, and other symptoms.

Safety Precautions

In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Don't smoke, eat, or drink when handling the solvent. Keep all containers and solutions tightly closed.

WasteDisposal Procedures

Do not dispose of Benzyl Alcohol in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

Cyclohexane

Hexahydrobenzene

General Properties

Colorless, water insoluble, highly flammable liquid. Sweet, aromatic odor.

Physical Properties

Molecular weight:	84.16						
Freezing point (°C):	6.54						
Boiling point (°C):	80.73						
Flash point (°C):	-18						
Min. ignition temp. (°C):	260						
Densitiy (g/cm^3):	0.7785^{25}	0.7738^{25}					
Refractive Index:	1.4262^{20}	1.4235^{25}					
Viscosity (cPoise):	0.98^{20}	0.898^{25}					
Dielectric constant:	2.023						
Ionization potential (eV):	9.8						
Solubility:	0.01 % in water, nonpolar organic solvents						
Optical properties:							
Wavelength (nm)	200	210	220	230	240	250	300
Transmission (%)	5	15	45	75	90	98	100

Application

Suitable solvent for nonpolar laser dyes like p-Terphenyl. Its high optical transparency in the UV allows the application in dye lasers pumped below 300 nm. The photochemical stability of Cyclohexane is poor.

Safety

RTECS # GU6300000; Sax 6, 831 · TLV: 300 ppm or 1050 mg/m^3

Hazards

Highly flammable. Absorbed by inhalation. The vapor is mildly irritating to the mucous membranes. The liquid is a fat solvent and thus irritates the skin.

Safety Precautions

Keep container in a well-ventilated place. Keep away from source of ignition. Take precautionary measures against static dis-charges. Avoid skin contact. Do not smoke, eat, or drink when handling the solvent. Keep all containers tightly closed away from sparks and open flames.

Waste Disposal Procedures

Do not dispose of Cyclohexane in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

Dichloroethane

Ethylene chloride · 1,2-Dichloroethane

General Properties

Dichloroethane is a colorless, water-insoluble liquid with a sweet odor.

Physical Properties

Molecular weight:	98.96						
Freezing point (°C):	-35.7						
Boiling point (°C):	83.5						
Flash point (°C):	13						
Min. ignition temp. (°C):	440						
Density (g/cm^3):	1.2531^{20}	1.2458^{25}	1.2383^{30}				
Refractive Index:	1.4448^{20}	1.4421^{25}					
Viscosity (cPoise):	0.887^{15}	0.73^{30}					
Dielectric constant:	10.36						
Ionization potential (eV):	11.12						
Solubility:	0.81% in water, organic solvents						
Optical properties:							
Wavelength (nm)	225	230	240	250	260	270	300
Transmission (%)	10	30	80	95	98	98	98

Application

See Dichloromethane.

Safety

RTECS # KI0525000; Sax 6, 944 · TLV: 50 ppm or 200 mg/m^3

Hazards

Highly flammable. Harmful by inhalation. One can become adapted to the odor of Dichloroethane at low concentrations, therefore it cannot be considered as a reliable warning. The acute and chronic effects of the solvent can be significant.

Safety Precautions

Keep container tightly closed. Keep away from sources of ignition. Do not smoke. Take precautionary measures against static discharges.

Waste Disposal Procedures

Do not dispose of Dichloroethane in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

Dichloromethane

Methylene chloride

General Properties

Dichloromethane is a colorless, water-insoluble liquid with a sweet odor.

Physical Properties

Molecular weight:	84.93						
Freezing point (°C):	-95.1						
Boiling point (°C):	39.8						
Flash point (°C):	0						
Min. ignition temp. (°C):	605						
Densitiy (g/cm^3):	1.3348^{15}	1.3168^{25}	1.3078^{30}				
Refractive Index:	1.4242^{20}	1.4212^{25}					
Viscosity (cPoise):	0.449^{15}	0.393^{30}					
Dielectric constant:	8.93						
Ionization potential (eV):	11.35						
Solubility:	1.3 % in water, organic solvents						
Optical properties:							
Wavelength (nm)	230	240	250	255	270	290	300
Transmission (%)	10	70	95	98	98	98	98

Application

Dichloromethane is used as solvent for laser dyes and saturable absorbers absorbing in the near infrared spectral region.

Safety

RTECS # PA8050000; Sax 6, 1763 · TLV: 500 ppm or 1750 mg/m³

Hazards

Harmful by inhalation. The toxic effect of Dichloromethane is predominately narcosis. It is mildly irritating to the skin on repeat contact if free to evaporate. It is painful to the eyes but no permanent damage may be expected.

Safety Precautions

Avoid contact with skin. Do not smoke, eat, or drink when handling the solvent.

Waste Disposal Procedures

Do not dispose of Dichloromethane in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

Dioxane

p-Dioxane

General Properties

Colorless, volatile, and very hygroscopic liquid with slightly aromatic taste.

Physical Properties

Molecular weight:	88.11						
Freezing point (°C):	11.8						
Boiling point (°C):	101.32						
Flash point (°C):	12						
Min. ignition temp. (°C):	375						
Densitiy (g/cm^3):	1.0336^{20} 1.028^{25}						
Refractive Index:	1.42241^{20} 1.42025^{25}						
Viscosity (cPoise):	1.439^{15} 1.087^{30}						
Dielectric constant:	2.209						
Ionization potential (eV):	9.13						
Solubility:	in water, organic solvents						
Optical properties:							
Wavelength (nm)	225	240	250	260	280	290	300
Transmission (%)	40	50	60	70	85	93	98

Application

Its high photochemical stability and excellent dissolving capacity makes dioxane a versatile solvent for UV and Coumarin dyes.

Safety

RTECS # JG8225000; Sax 6, 1227 · TLV: 100 ppm, 360 mg/m³

Hazards

Highly flammable. May form explosive peroxides. Harmful by inhalation. Painful to the eyes and irritating to the skin upon prolonged contact. It can be absorbed through the skin in toxic amounts. Dioxane is insidious. Its vapors have poor warning properties; they are faint and inoffensive. Concentrations in air of 300 ppm cause irritation of the eyes, nose, and throat. The vapors can be inhaled in amounts that cause serious systemic injury.

Safety Precautions

Keep container in a well-ventilated place. Keep away from sources of ignition. Take precautionary measures against static discharges. Avoid skin contact. Do not smoke, eat, or drink when handling the solvent. Keep all containers and solutions tightly closed.

Waste Disposal Procedures

Do not dispose of Dioxane in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

DMSO

Dimethyl Sulfoxide

General Properties

Colorless, odorless, hygroscopic liquid with a slightly bitter taste. It has an equilibrium moisture content of 10 percent with air at 20°C.

Physical Properties

Molecular weight:	78.13						
Freezing point (°C):	18.54						
Boiling point (°C):	189						
Flash point (°C):	95						
Min. ignition temp. (°C):	383						
Density (g/cm^3):	1.0958^{25}	1.0816^{40}	1.0616^{60}				
Refractive Index:	1.4783^{20}	1.4773^{25}					
Viscosity (cPoise):	1.996^{25}	1.654^{35}					
Dielectric constant:	46.68						
Ionization potential (eV):							
Solubility:	25.3 % in water, organic solvents						
Optical properties:							
Wavelength (nm)	263	270	280	290	300	310	340
Transmission (%)	10	34	60	71	85	90	98

Application

DMSO is an excellent solvent for polar dyes like Rhodamines.

Safety

RTECS # PV6210000; Sax 6, 1201 · TLV:

Hazards

DMSO dehydrates and defats the skin, but seems to be relatively free from toxic effects. Its vapor, mixed with air, may explode above 90° C.

Safety Precautions

Dimethyl sulfoxide may produce eye, skin, and respiratory irritations. The solvent penetrates the skin and that toxic solutes are carried with it into the body fluid. Avoid contact with skin and eyes.

Waste Disposal Procedures

Avoid mixing contaminated solvents because several substances have been reported to have produced an explosion when mixed with dimethyl sulfoxide. Do not dispose of DMSO in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

Ethanol

Ethyl Alcohol

General Properties

Colorless liquid which may be obtained as the water azeotrop containing about 5 percent water or as absolute alcohol containing 0.1 percent or less water.

Physical Properties

Molecular weight:	46.07						
Freezing point (°C):	-114.1						
Boiling point (°C):	78.3						
Flash point (°C):	12						
Min. ignition temp. (°C):	425						
Density (g/cm^3):	0.7936^{15}	0.7894^{20}	0.785^{25}				
Refractive Index:	1.3614^{20}	1.3594^{25}					
Viscosity (cPoise):	1.078^{25}	0.991^{35}					
Dielectric constant:	24.55						
Ionization potential (eV):	10.49						
Solubility:	water, organic solvents						
Optical properties :							
Wavelength (nm)	200	210	220	230	240	250	270
Transmission (%)	5	35	55	72	85	90	98

Application

Ethanol is the most frequently used solvent for laser dyes. As it is highly polar, its application is restricted to polar dyes such as the Rhodamines.

Safety

RTECS # KQ6300000; Sax 6, 1316 · TLV: 1000 ppm or 1900 mg/m³

Hazards Highly flammable. It is practically impossible to produce any toxic effects by inhalation of pure ethanol vapors under usual lab conditions. The minimum identifiable odor is about 530 ppm. Concentrations of 6,000-9,000 ppm have an intense odor that may be practically intolerable at first, but one becomes acclimated soon. Concentrations of about 1,000 ppm cause slight irritation of mucous membranes and other symptoms.

Safety Precautions

Keep container tightly closed. Keep away from sources of ignition. Do not smoke. Limit the quantity stored to foreseeable short-term requirements; large quantities should not be allowed to accumulate in the laboratory. If spillage of solvent or accidental release occurs, ventilate the whole laboratory as soon as possible.

Waste Disposal Procedures

Do not dispose of Ethanol in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

Ethylene Glycol

1,2-Ethanediol

General Properties

Ethylene glycol is a colorless, odorless liquid with a bittersweet taste. It is very hygroscopic.

Physical Properties

Molecular weight:	62.07						
Freezing point (°C):	-13						
Boiling point (°C):	197.3						
Flash point (°C):	110						
Min. ignition temp. (°C):	410						
Density (g/cm^3):	1.1135^{20}	1.11^{25}	1.1066^{30}				
Refractive Index:	1.4318^{20}	1.4306^{25}					
Viscosity (cPoise):	26.09^{15}	13.55^{30}					
Dielectric constant:	37.7						
Ionization potential (eV):	10.49						
Solubility:	water, alcohols						
Optical properties:							
Wavelength (nm)	210	220	230	240	250	260	280
Transmission (%)	20	35	40	60	75	90	98

Application

Ethylene glycol, due to its high viscosity, is a frequently used solvent in jet stream dye lasers. Its dissolving capacity makes it suitable for polar dyes like Coumarins, Rhodamines, and Cyanines.

Safety

RTECS # KW2975000; Sax 6, 1343 · TLV: 100 ppm or 274 mg/m³

Hazards

Harmful if swallowed. Ethylene glycol has a low vapor pressure at normal temperature. It presents negligible hazards to health except, possibly, when being used at elevated temperature. It has a low, acute oral toxicity. There does not appear to be any significant irritation from skin contact.

Safety Precautions

Avoid skin contact. Store in closed container away from heat, sparks and open flame.

Waste Disposal Procedures

Place Ethylene Glycol in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

Hexane

n-Hexane

General Properties

Hexane is a colorless, water-insoluble, and highly flammable liquid.

Physical Properties

Molecular weight:	86.18						
Freezing point (°C):	-95.4						
Boiling point (°C):	68.74						
Flash point (°C):	-26						
Min. ignition temp. (°C):	240						
Density (g/cm^3):	0.6594^{20}	0.6548^{25}					
Refractive Index:	0.3749^{20}	1.3723^{25}					
Viscosity (cPoise):	0.3126^{20}	0.2985^{25}					
Dielectric constant:	1.8799						
Ionization potential (eV):	10.18						
Solubility:	0.00095 % in water, nonpolar organic solvents						
Optical properties:							
Wavelength (nm)	190	200	210	220	230	240	250
Transmission (%)	10	30	60	80	94	98	98

Application

Suitable solvent for nonpolar laser dyes. Its high optical transparency in the UV range allows the application in dye lasers pumped below 300 nm.

Safety

RTECS # MN9275000; Sax 6, 1523· TLV: 500 ppm or 1800 mg/m^3

Hazards

Highly flammable. Harmful by inhalation and in contact with the skin. Possible risk of irreversible effects. Hexane is a fat solvent and thus irritates the skin.

Safety Precautions

Keep container in a well-ventilated place. Keep away from source of ignition. Do not inhale gas/fumes/vapor/spray. Avoid skin contact. Do not smoke, eat, or drink when handling the solvent. Keep all containers tightly closed away from sparks and open flames.

Waste Disposal Procedures

Do not dispose of Hexane in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

Methanol

Methyl Alcohol

General Properties

Methanol is a colorless hygroscopic liquid usually containing 0.01 - 0.04 percent water. It is highly inflammable and toxic.

Physical Properties

Molecular weight:	32.04						
Freezing point (°C):	-97.7						
Boiling point (°C):	64.7						
Flash point (°C):	11						
Min. ignition temp. (°C):	455						
Densitiy (g/cm^3):	0.7961^{15}	0.7913^{20}	0.7866^{25}				
Refractive Index:	1.3284^{20}	1.3265^{25}					
Viscosity (cPoise):	0.5506^{25}	0.5445^{35}					
Dielectric constant:	32.7						
Ionization potential (eV):	10.84						
Solubility:	water, organic solvents						
Optical properties:							
Wavelength (nm)	200	210	220	230	240	250	260
Transmission (%)	2	20	50	75	85	95	98

Application

Methanol is a polar, protic solvent frequently used to dissolve laser dyes like Coumarins, Rhodamines, and Cyanines. Its excellent optical transparency makes it the ideal solvent for UV-pumped dye lasers.

Safety

RTECS # PC1400000; Sax 6, 1764 · TLV: 200 ppm or 260 mg/m^3

Hazards

Highly flammable. Toxic by inhalation and if swallowed. Methanol does not have suitable warning or irritating properties except at high concentrations. Ingestion of methanol can cause blindness and death.

Safety Precautions

Keep container tightly closed. Keep away from sources of ignition. Do not smoke. Avoid contact with skin. Methanol vapor/air mixtures may produce explosible mixtures. Keep containers tightly closed. If spillage of solvent or accidental release occurs, ventilate the whole laboratory as soon as possible.

Waste Disposal Procedures

Do not dispose of Methanol in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

Toluene

Methylbenzene

General Properties

Colorless, water-insoluble, and highly flammable liquid with aromatic odor.

Physical Properties

Molecular weight:	92.14						
Freezing point (°C):	-95						
Boiling point (°C):	110.6						
Flash point (°C):	7						
Min. ignition temp. (°C):	535						
Density (g/cm^3):	0.867^{25}	0.8623^{25}	0.8577^{30}				
Refractive Index:	1.4969^{20}	1.4941^{25}					
Viscosity (cPoise):	0.5866^{20}	0.5516^{25}					
Dielectric constant:	2.379						
Ionization potential (eV):	8.82						
Solubility:	0.0515 % in water, nonpolar organic solvents						
Optical properties:							
Wavelength (nm)	285	290	300	310	320	340	350
Transmission (%)	10	50	80	89	93	95	98

Application

Toluene is a suitable solvent for nonpolar laser dyes like p-Terphenyl. Its low optical transparency in the UV range restricts the application on dye lasers pumped above 320 nm.

Safety

RTECS # XS5250000; Sax 6, 2588 · TLV:200 ppm or 7500 mg/m³

Hazards

Highly flammable. Harmful by inhalation. Exposure of humans to Toluene vapor produces mild fatigue, weakness, confusion, and paresthesia of the skin. Toluene is most dangerous by inhalation. It is irritating to the skin, and contact should be avoided when possible.

Safety Precautions

Keep away from source of ignition. Do not smoke. Take precautionary measures against static discharges.

Waste Disposal Procedures

Do not dispose of Toluene in the sink. Place it in appropriately labelled, suitable containers. Only trained and licensed waste disposal experts should dispose of accumulated waste material in accordance with governmental regulations.

References

Handbook of Chemistry and Physics. 62d ed. Robert C. Weast, ed. Chemical Rubber Co., 1982.

Drexhage, K. H. *Laser Focus*, 1973: 73.

Jaffe, H. H. and M. Orchin. *Theory and Applications of Ultraviolet Spectroscopy*. New York, New York, USA: John Wiley and Sons, 1962.Kues, H. A. and G. Z. Lutty. *Laser Focus*, 1975: 5: 59.

Kuhn and Birett. *Merkblaetter Gefaehrliche Arbeitsstoffe*. Munich, Germany: Verlag Moderne Industrie, 1983.

Loesungsmittel und Substanzen fuer die Spektroskopie UVASOLE. E. Merck, ed. Darmstadt, Germany.

Mosovsky, J. A. "Laser Dye Toxicity, Hazards and Recommended Controls." *American Industrial Hygiene Conference*. Philadelphia, Pennsylvania, USA, 1983.

Registry of Toxic Effects of Chemical Substances. Richard J. Lewis and Rodger L. Tatken, ed. U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, 1979.

Riddick, John A. and William B. Bunger. "Organic Solvents." Techniques of Chemistry,Vol. 3, 1970. New York, New York, USA: Wiley-Interscience.

Roth and Daunderer. *Giftliste*. Munich, Germany: Ecomed Verlag, 1983.

Sax, N. I. *Dangerous Properties of Industrial Materials*. New York, New York, USA: Van Nostrand Reinhold, 1975.

Schneider, R. L. "Physical Properties of Some Organic Solvents." *Eastman Organic Chemical Bulletin*. Vol. 47, No. 1, 1975.

Laser Dyes

Properties, Application, and Absorption Spectra

The output power of dye lasers depends on the quality of the dye used. To overcome reduced quantum efficiency and instability due to impurities, Lambdachrome® laser dyes are synthesized and examined by experienced chemists for their chemical and spectral properties. Finally, they are purified by specially developed techniques.

The composition of all dyes is guaranteed with spectrophotometric and chromatographic analysis. Wavelength ranges are given in the following tables to provide assistance in choosing the correct dye for a given application. The ranges were measured by Lambda Physik, taken from Coherent CW Dye Laser Fact Sheets, or taken from the pertinent literature. The exact spectral range depends on the solvent and the concentration as well as on the method of pumping.

Lambda Physik reserves the right to modify any information given herein. Every effort is made to ensure utmost accuracy; however, no liability is assumed for errors occurring in the tables.

Abbreviations Used

MW	Molecular Weight
CAS	Chemical Abstracts Service
Effic.	Efficiency, defined as the ratio of optical input to output
Conc.	Concentration of dye, given in grams per liter solvent
Ref.	Reference
Cyclohex.	Cyclohexane
DCE	1,2-Dichloroethane
DMF	Dimethylformamide
EtOH	Ethanol
MeOH	Methanol
Eg	Ethyleneglycol
Bz	Benzylalcohol
DMSO	Dimethylsulfoxide
Pc	Propylenecarbonate
Tol	Toluene

BEER's Law

Within the absorption spectra, the intensity is expressed as a molar decadic extinction coefficient, ε. The amount of light absorbed depends on the extinction coefficient and the number of molecules in the light path. The latter amount depends on the concentration of the dye in solution and the path length of the absorption cell. The amount of light that passes through a solution (transmittance) is given by BEER's law:

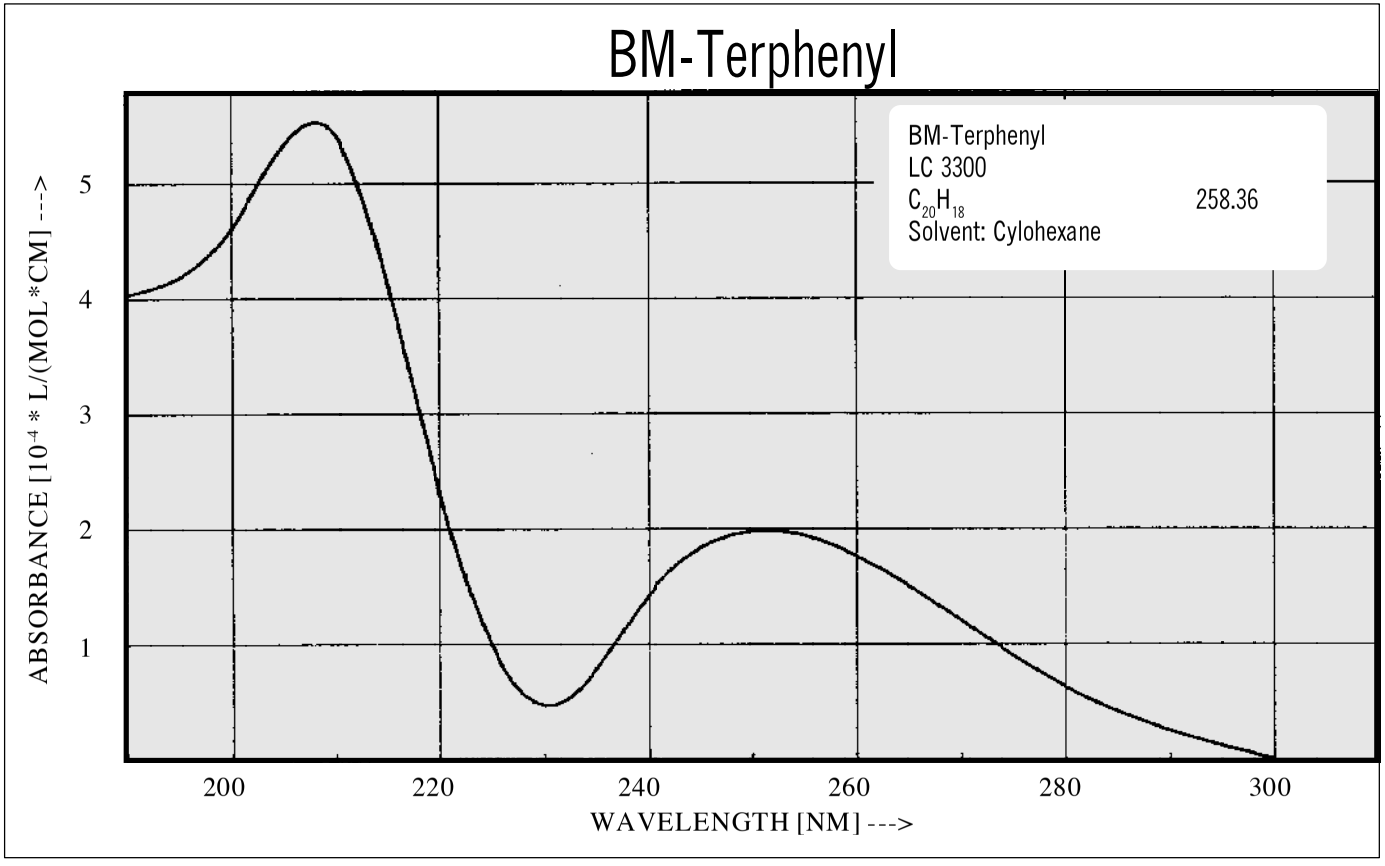
$$\log I_o/I = \varepsilon \cdot c \cdot d$$

where I_0 is the intensity of the light before it encounters the cell, I is the intensity of the light emerging from the cell, c is the concentration in moles per liter, and d is the path length in centimeters.

The absorption cross-section σ can be determined from the extinction coefficient ε by:

$$\sigma = 0.385 \cdot 10^{-20} \varepsilon .$$

Here σ is given in cm^2 (ε measured in liter/(mole · cm)).

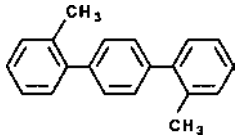

BM-Terphenyl
BM-Terphenyl
LC 3300
$C_{20}H_{18}$ 258.36
Solvent: Cylohexane
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
5
4
3
2
1
200
220
240
260
280
300
WAVELENGTH [NM] --->

BM-Terphenyl (LC 3300)

Constitution

2,2''-Dimethyl-p-terphenyl
DMT

$C_{20}H_{18}$ · MW: 258.36



Characteristics

Lambdachrome® number:	3300
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in cyclohexane):	251 nm
Molar absorptivity:	1.98 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in cyclohexane):	335 nm

For research and development purposes only.

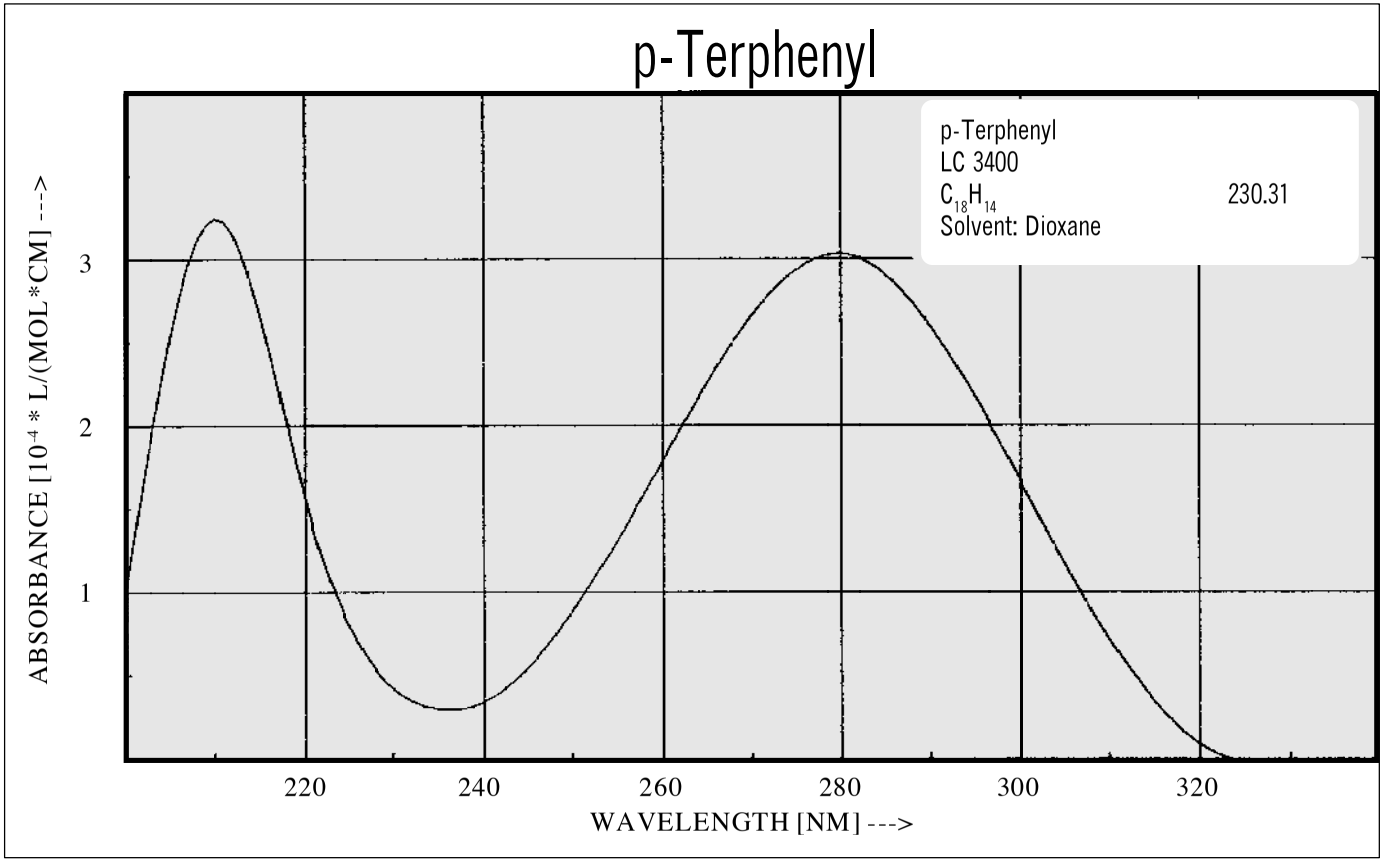
Lasing Performance

Shortest tunable laser dye for pulsed operation; tunable around 336 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
KrF-Excimer	*248*	*334*	*312 - 343*	*4*	*0.50*	*Cyclohex*	*1, 2, 3*

References

1. Lambda Physik, *Wall Chart* 1996.
2. W. Zapka, U. Brackmann *Appl. Phys.* 20, 283 (1979).
3. F.-G. Zhang, F. P. Schäfer *Appl. Phys.* B26, 211 (1981).

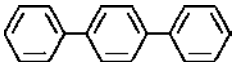

p-Terphenyl
p-Terphenyl
LC 3400
$C_{18}H_{14}$ 230.31
Solvent: Dioxane
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
220
240
260
280
300
320
WAVELENGTH [NM] --->

p-Terphenyl (LC 3400)

Constitution

PTP

$C_{18}H_{14}$ · MW: 230.31



Characteristics

Lambdachrome® number:	3400
CAS registry number:	92-94-4
Appearance:	white, crystalline solid
Absorption maximum (in cyclohexane):	275 nm
Molar absorptivity:	3.21 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in cyclohexane):	339 nm

For research and development purposes only.

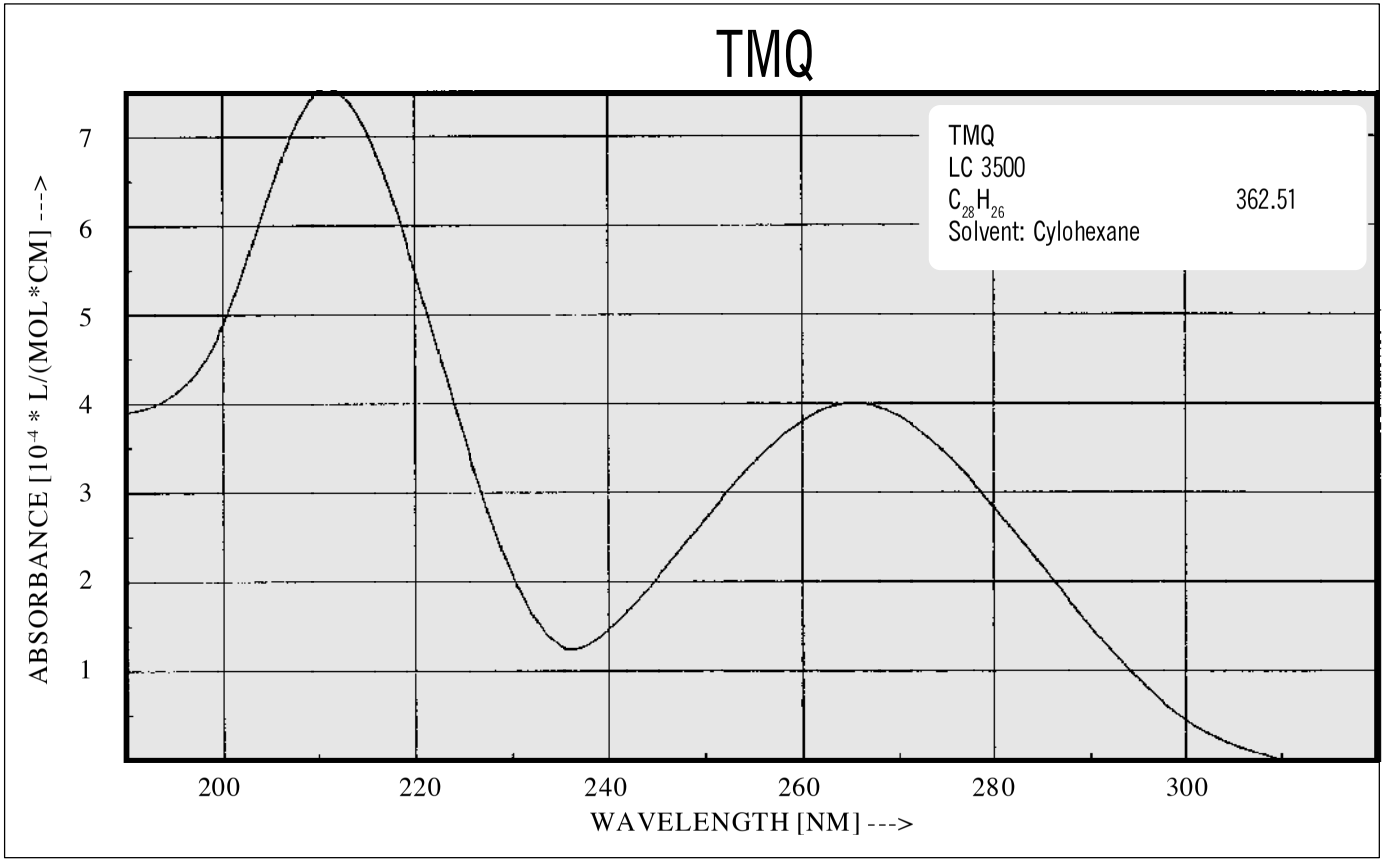
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 340 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
KrF-Excimer	*248*	*339*	*322 - 365*	*14*	*0.02*	*Cyclohex*	*1*
XeCl-Excimer	*308*	*343*	*332 - 360*	*8*	*0.24*	*Dioxane*	*2, 3*
Nd:YAG, 4th	*266*	*340*	*-*	*5*	*0.23*	*Cyclohex.*	*4, 5*

References

1. H. Bücher, W. Chow, *Appl. Phys.* 13, 267 (1977).
2. Lambda Physik, *Wall Chart* 1996.
3. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 402 (1981).
4. G. A. Abakumov et al., *Opto-Electron.* 1, 205 (1969).
5. D. Huppert, P. M. Rentzepis, *J. Appl. Phys.* 49(2), 543 (1978).

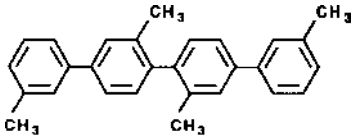

TMQ
TMQ
LC 3500
$C_{28}H_{26}$ 362.51
Solvent: Cylohexane
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
6
7
200
220
240
260
280
300
WAVELENGTH [NM] --->

TMQ (LC 3500)

Constitution

3,3',2'',3'''-Tetramethyl-p-quaterphenyl

$C_{28}H_{26}$ · MW: 362,51



Characteristics

Lambdachrome® number:	3500
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in cyclohexane):	266 nm
Molar absorptivity:	3.99 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

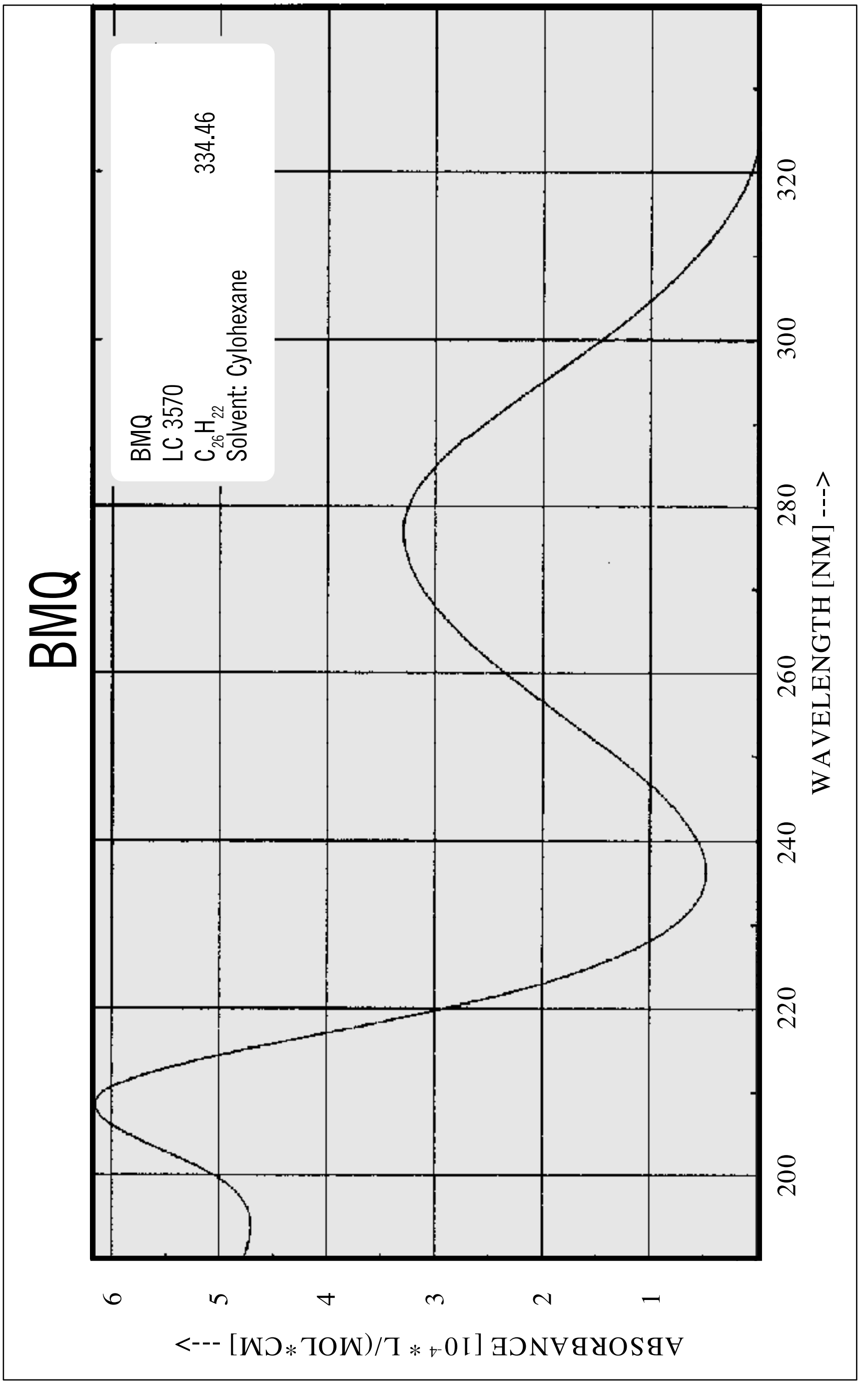
Lasing Performance

Laser dye for pulsed operation; tunable around 350 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG, 4th	*266*	*350*	*338 - 361*	*1.2*	*0.72*	*Cyclohex*	*1*

References

1. L. D. Ziegler, B. S. Hudson, *Opt. Commun.* 32(1), 119 (1980).



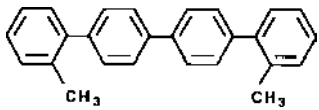
BMQ
BMQ
LC 3570
$C_{26}H_{22}$
334.46
Solvent: Cylohexane
ABSORBANCE [10-4 * L/(MOL*CM)] --->
WAVELENGTH [NM] --->
1
2
3
4
5
6
200
220
240
260
280
300
320

BMQ (LC 3570)

Constitution

2,2'''-Dimethyl-p-quaterphenyl

$C_{26}H_{22}$ - MW: 334.46



Characteristics

Lambdachrome® number:	3570
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in cyclohexane):	275 nm
Molar absorptivity:	3.35×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

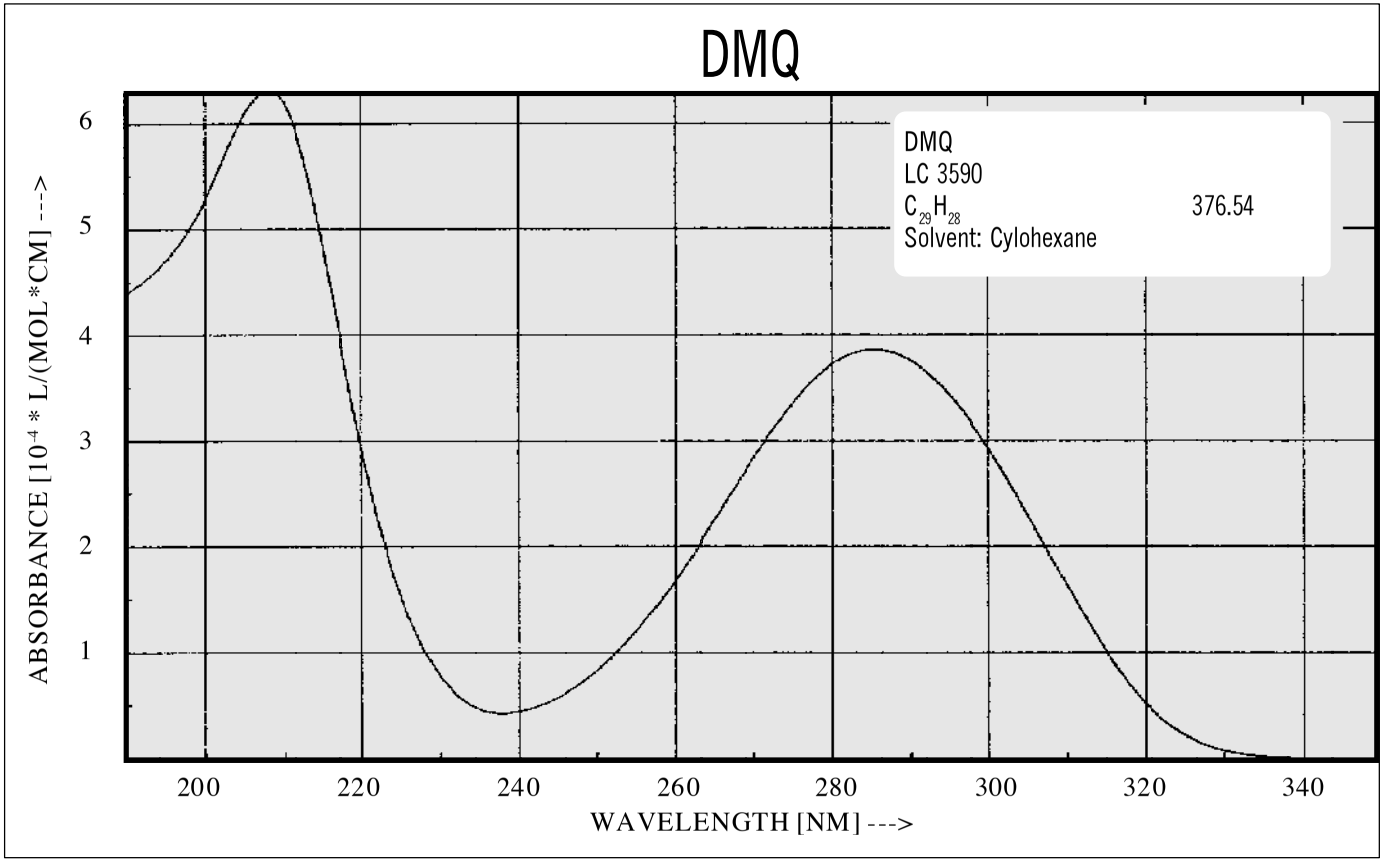
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 357 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*357*	*335 - 375*	*9*	*0.60*	*Dioxane*	*1*

References

1. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).

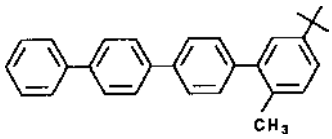

DMQ
DMQ
LC 3590
$C_{29}H_{28}$ 376.54
Solvent: Cylohexane
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
6
5
4
3
2
1
200
220
240
260
280
300
320
340
WAVELENGTH [NM] --->

DMQ (LC 3590)

Constitution

2-Methyl-5-t-butyl-p-quaterphenyl

$C_{29}H_{28}$ · MW: 376.54



Characteristics

Lambdachrome® number:	3590
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in cyclohexane):	285 nm
Molar absorptivity:	3.86 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

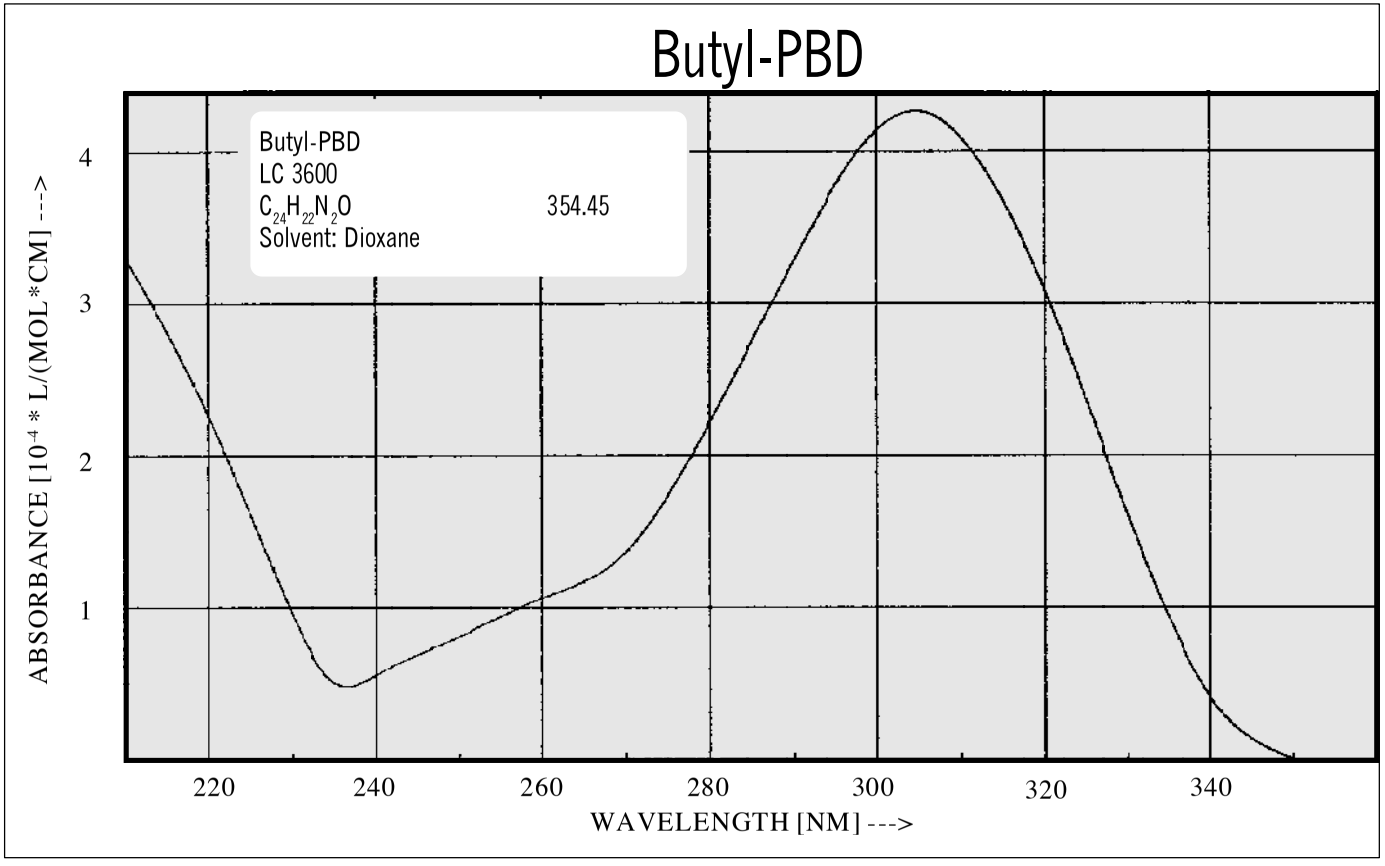
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 360 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*360*	*346 - 377*	*9*	*0.23*	*Dioxane*	*1, 2*

References

1. Lambda Physik, *Wall Chart* 1996
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).

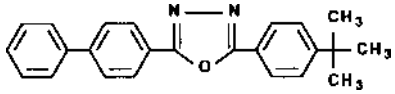

Butyl-PBD
Butyl-PBD
LC 3600
$C_{24}H_{22}N_2O$ 354.45
Solvent: Dioxane
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
220
240
260
280
300
320
340
WAVELENGTH [NM] --->

Butyl-PBD (LC 3600)

Constitution

2-(4-Biphenylyl)-5-(4-t-butylphenyl)-1,3,4-oxadiazol
BPBD-365

$C_{24}H_{22}N_2O$ · MW: 354.45



Characteristics

Lambdachrome® number:	3600
CAS registry number:	15082-28-7
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	302 nm
Molar absorptivity:	4.35 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in cyclohexane):	368 nm

For research and development purposes only.

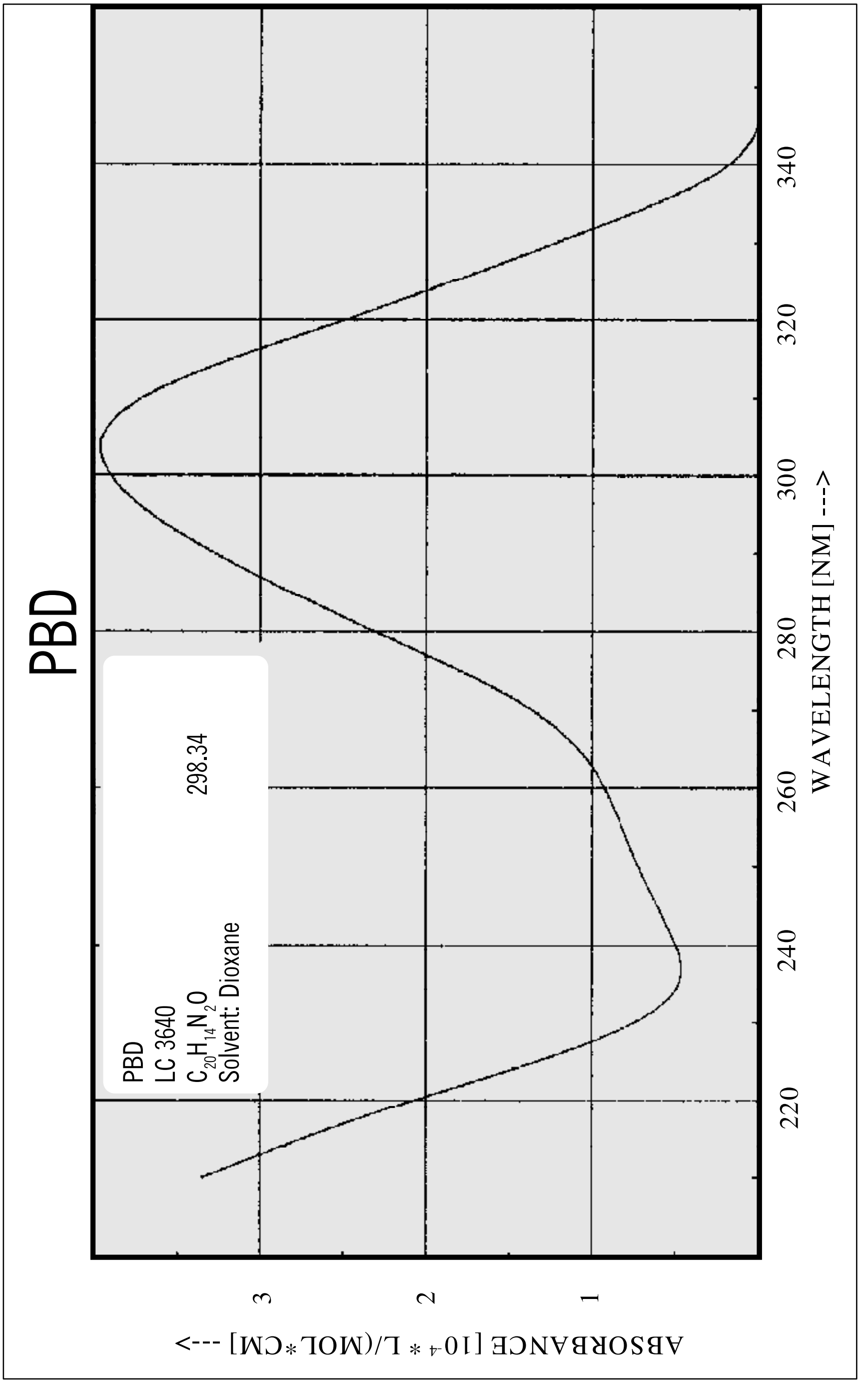
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 360 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*363*	*356 - 385*	*5*	*0.30*	*Dioxane*	*1, 2, 3*
Nitrogen	*337*	*362*	*356 - 390*	*rel.*	*1.60*	*Dioxane*	*3, 4*
Nd:YAG, 4th	*266*	*362*	*354-388*	*4.7*	*1.75*	*Cyclohex.*	*5*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 402 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. L. D. Ziegler, B. S. Hudson, *Opti. Commun.* 32(1), 119 (1980).



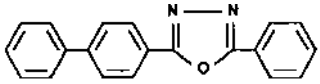
PBD
PBD
LC 3640
$C_{20}H_{14}N_2O$
Solvent: Dioxane
298.34
ABSORBANCE [10-4 * L/(MOL*CM)] --->
3
2
1
WAVELENGTH [NM] --->
220
240
260
280
300
320
340

PBD (LC 3640)

Constitution

2-(4-Biphenylyl)-5-phenyl-1,3,4-oxadiazol

$C_{20}H_{14}N_2O$ · MW: 298.34



Characteristics

Lambdachrome® number:	3640
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	302 nm
Molar absorptivity:	3.90×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in toluene):	360 nm

For research and development purposes only.

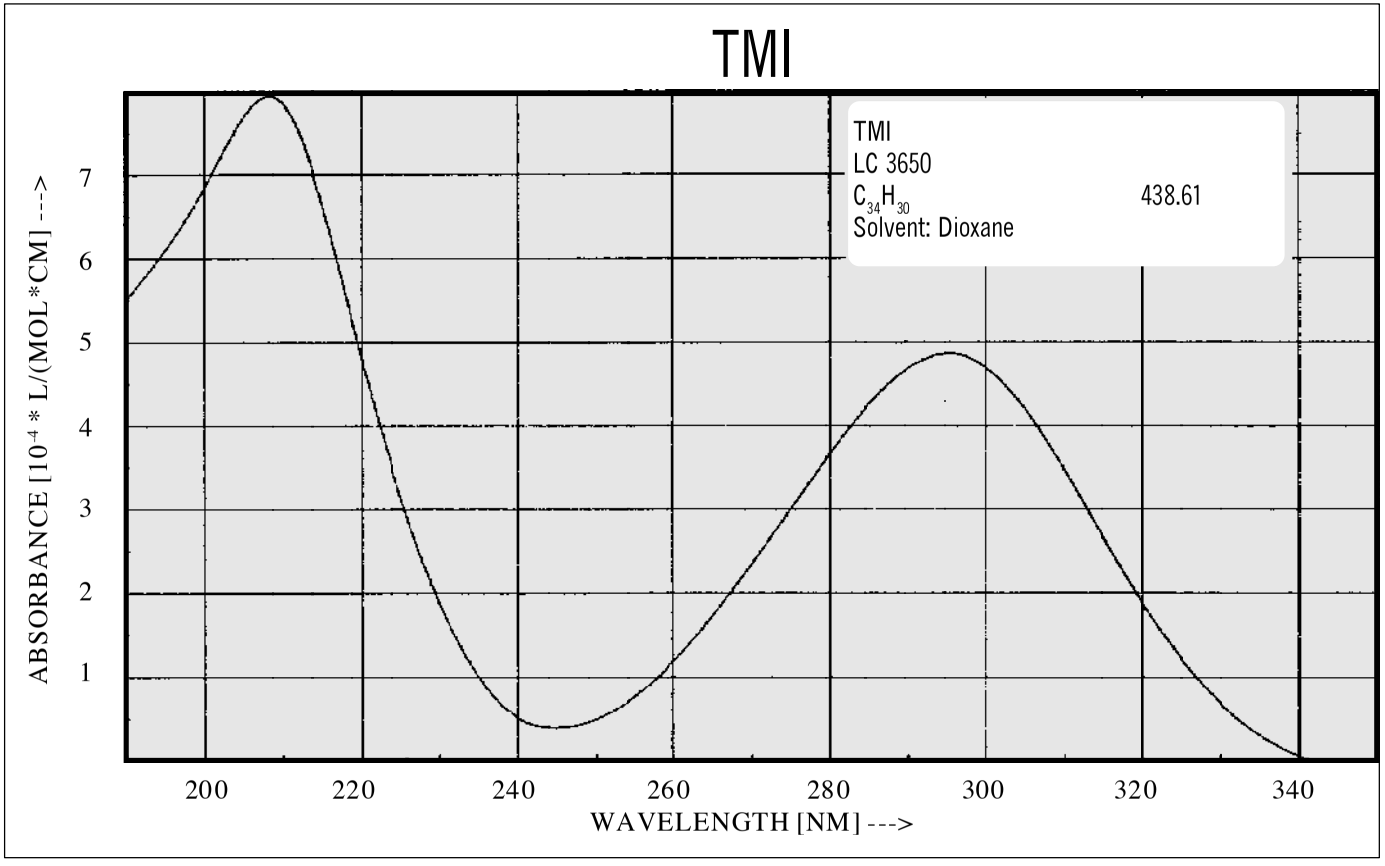
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 360 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*363*	*355 - 390*	*4*	*0.11*	*Cyclohex.*	*1*
Nitrogen	*337*	*362*	*357 - 390*	*rel.*	*1.20*	*Dioxane*	*2*
Flashlamp	*-*	*362*	*-*	*-*	*0.08*	*Ethanol*	*3, 4*

References

1. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 402 (1981).
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. H. W. Furumoto, H. L. Ceccon, *IEEE J. Quant. Electron.* QE-6, 262 (1970).
4. T. Morrow, H. T. W. Price, *Opt. Commun.* 10(2), 133 (1974).

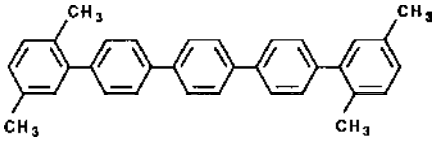

TMI
TMI
LC 3650
$C_{34}H_{30}$ 438.61
Solvent: Dioxane
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
6
7
200
220
240
260
280
300
320
340
WAVELENGTH [NM] --->

TMI (LC 3650)

Constitution

2,5,2'''',5''''-Tetramethyl-p-quinquephenyl

$C_{34}H_{30}$ · MW: 438.61



Characteristics

Lambdachrome® number:	3650
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	295 nm
Molar absorptivity:	4.86 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

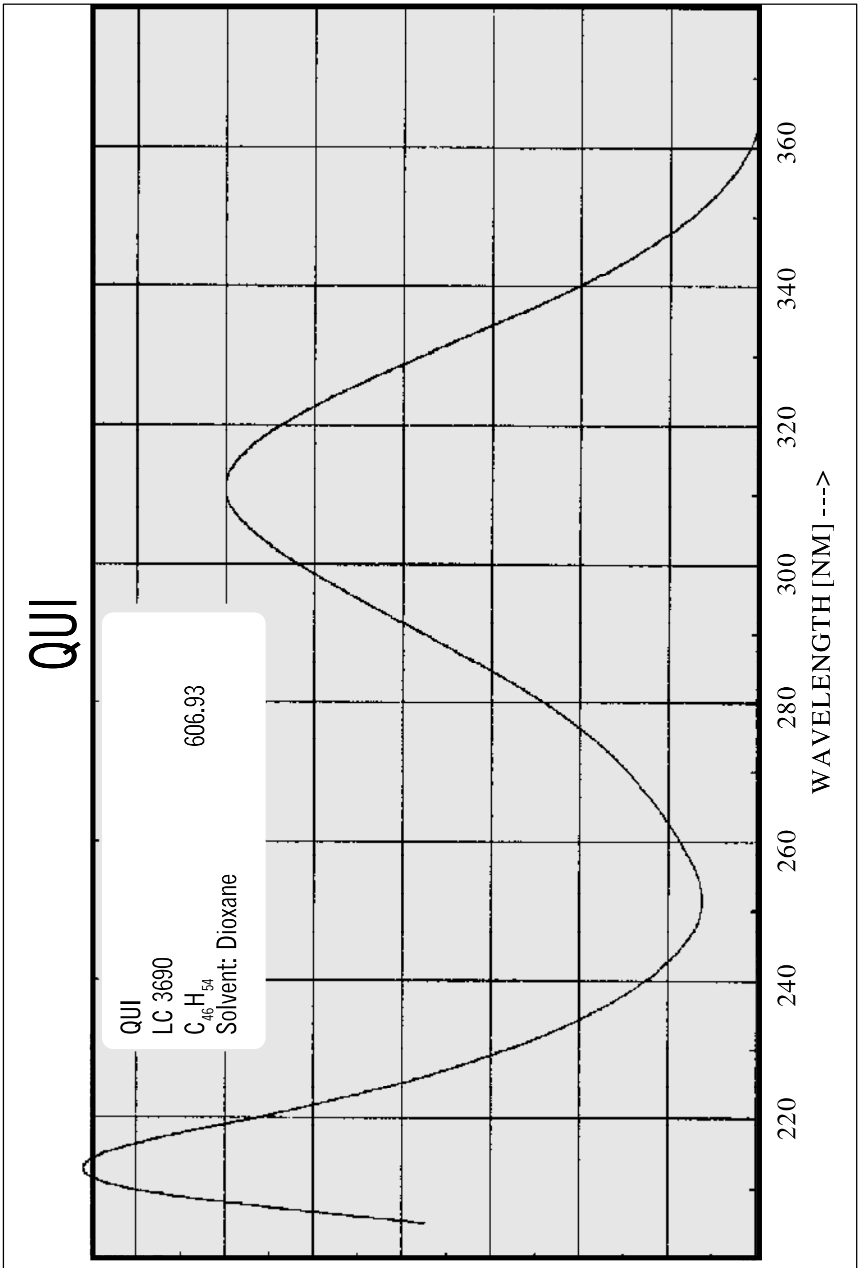
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 370 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*372*	*355 - 395*	*11*	*0.18*	*Dioxane*	*1, 2*

References

1. Lambda Physik, *Data Sheet.*
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).

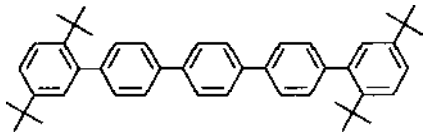

QUI
QUI
LC 3690
$C_{46}H_{54}$
606.93
Solvent: Dioxane
ABSORBANCE [10-4 * L/(MOL*CM)] --->
WAVELENGTH [NM] --->
7
6
5
4
3
2
1
220
240
260
280
300
320
340
360

QUI (LC 3690)

Constitution

3,5,3'''',5''''-Tetra-t-butyl-p-quinquephenyl

$C_{46}H_{54}$ · MW: 606.93



Characteristics

Lambdachrome® number:	3690
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	310 nm
Molar absorptivity:	6.00 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

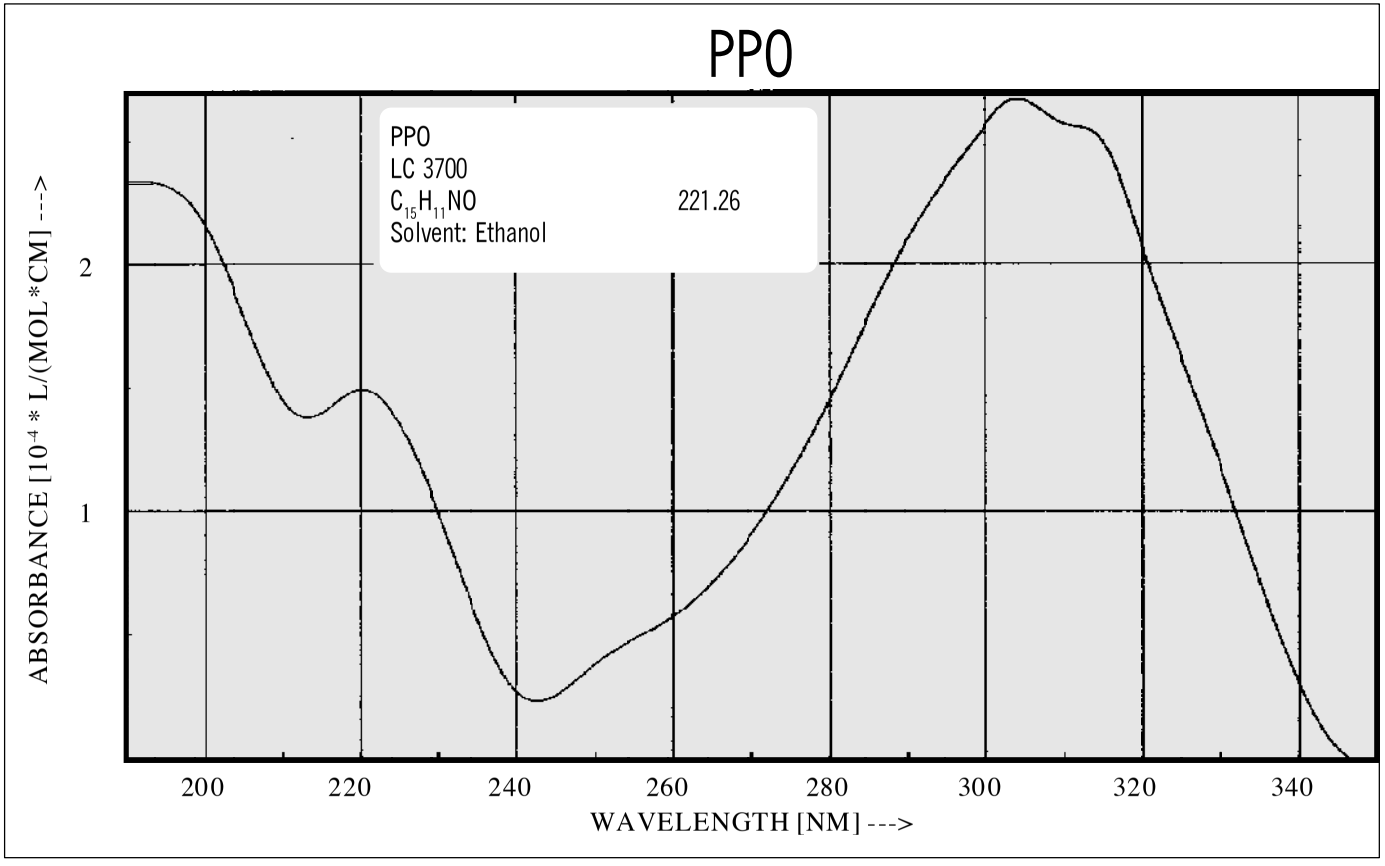
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 390 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*390*	*368 - 402*	*11*	*0.20*	*Dioxane*	*1, 2*
Nitrogen	*337*	*387*	*372-412*	*rel.*	*0.52*	*Dioxane*	*3*

References

1. Lambda Physik, *Wall Chart* 1996.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. Lambda Physik, *Data Sheet.*

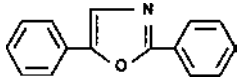

PPO
PPO
LC 3700
$C_{15}H_{11}NO$ 221.26
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
2
1
200
220
240
260
280
300
320
340
WAVELENGTH [NM] --->

PPO (LC 3700)

Constitution

2,5-Diphenyloxazol

$C_{15}H_{11}NO$ · MW: 221.26



Characteristics

Lambdachrome® number:	3700
CAS registry number:	92-71-7
Appearance:	white, crystalline solid
Absorption maximum (in ethanol):	303 nm
Molar absorptivity:	2.80×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	365 nm

For research and development purposes only.

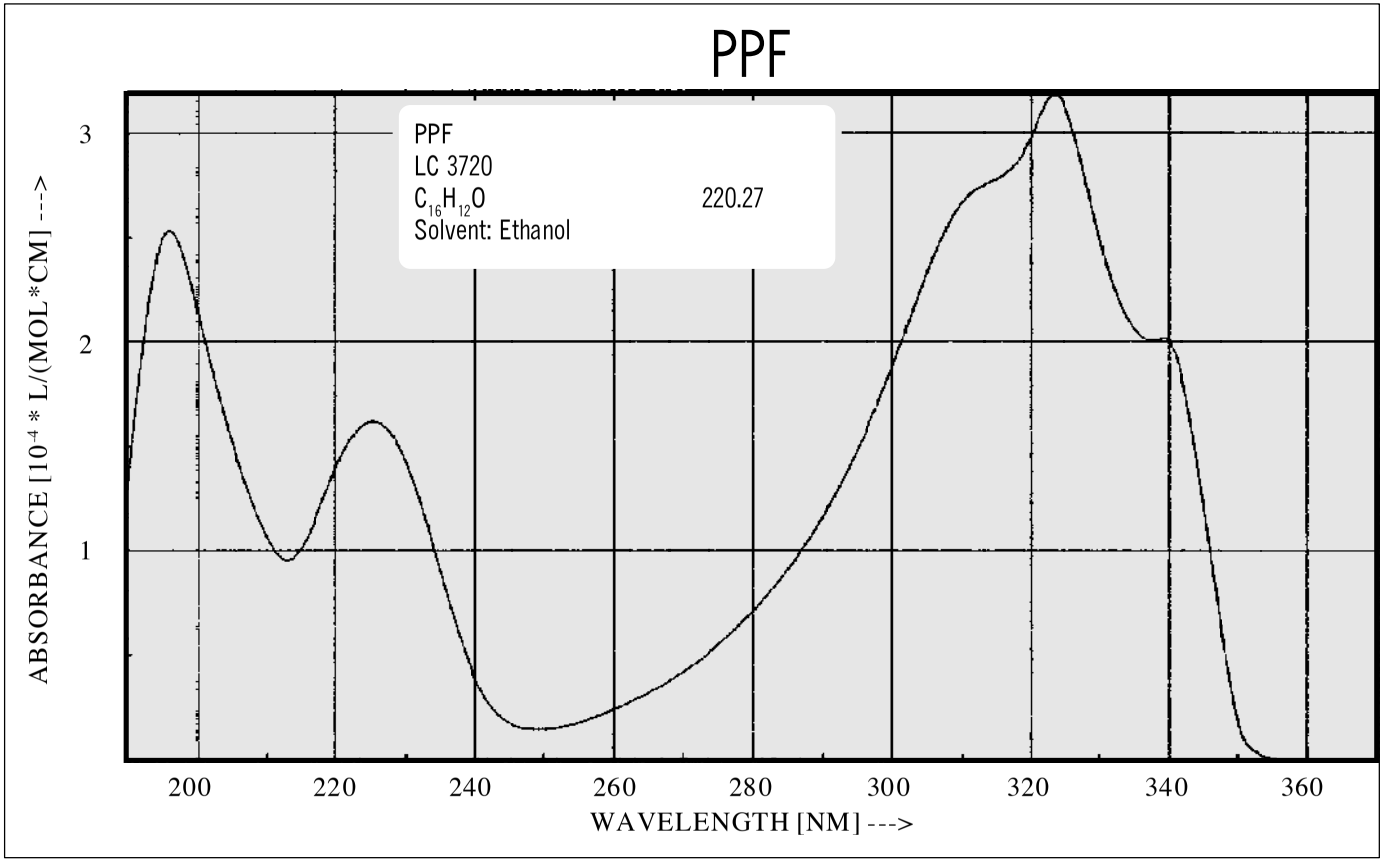
Lasing Performance

Laser dye for pulsed operation; tunable around 380 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*377*	*-*	*2.3*	*0.22*	*Methanol*	*1, 2*
Nitrogen	*337*	*375*	*-*	*rel.*	*0.39*	*Dioxane*	*1*
Nd:YAG, 4th	*266*	*375*	*368-382*	*1.6*	*1.10*	*Cylohex.*	*3*
Flashlamp	*-*	*381*	*-*	*-*	*1.54*	*Dioxane*	*4*

References

1. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
2. O. Uchino et al., *Appl. Phys.* 19, 35 (1979).
3. L. D. Ziegler, B. S. Hudson, *Opt. Commun.* 32(1), 119 (1980).
4. H. W. Furumoto, H. L. Ceccon, *IEEE J. Quant. Electron.* QE-6, 262 (1970).

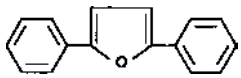

PPF
PPF
LC 3720
$C_{16}H_{12}O$ 220.27
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
3
2
1
200
220
240
260
280
300
320
340
360
WAVELENGTH [NM] --->

PPF (LC 3720)

Constitution

2,5-Diphenylfuran

$C_{16}H_{12}O$ · MW: 220.27



Characteristics

Lambdachrome® number:	3720
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in ethanol):	324 nm
Molar absorptivity:	3.78×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	368 nm

For research and development purposes only.

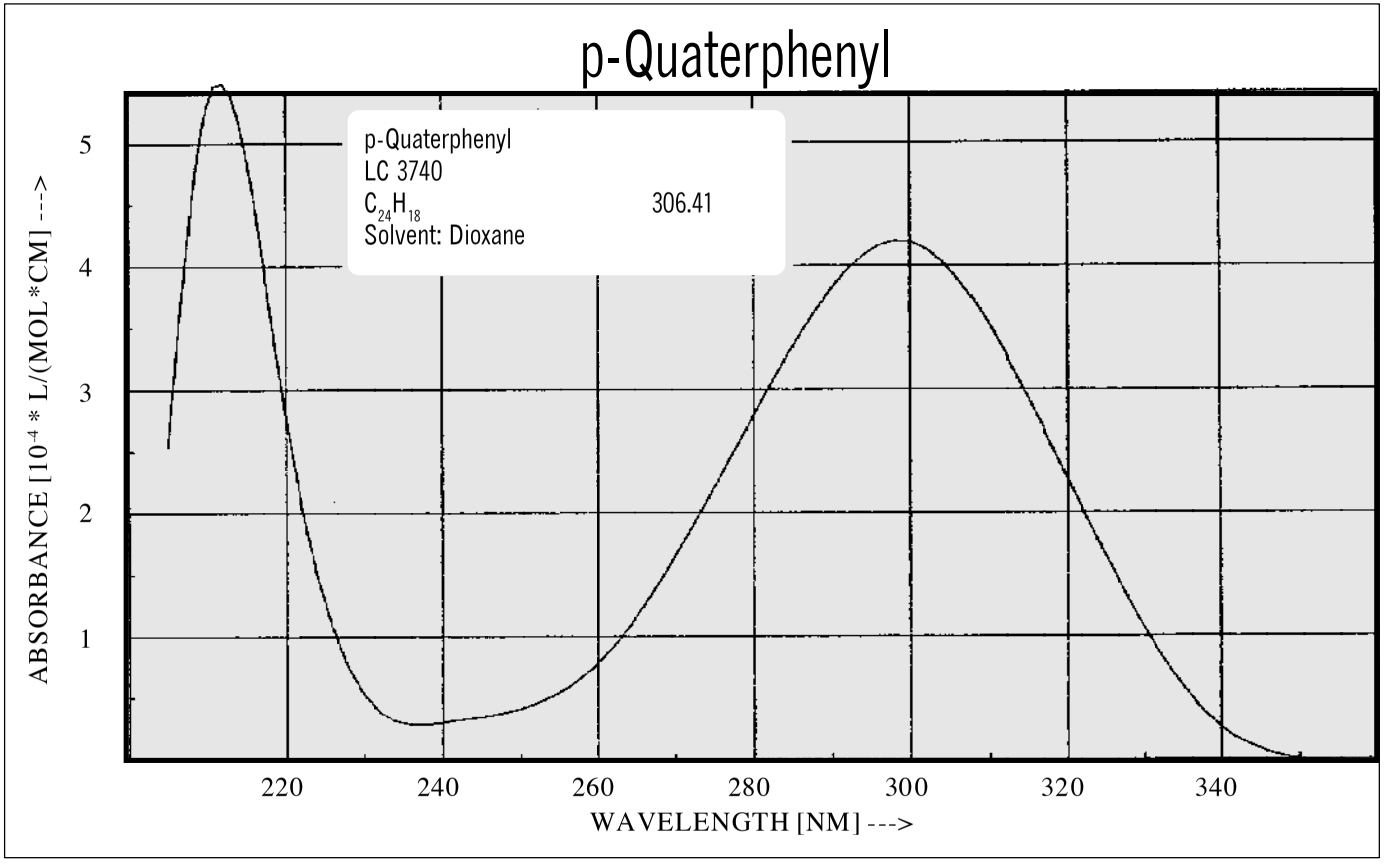
Lasing Performance

Laser dye for pulsed operation; tunable around 370 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nitrogen	*337*	*373*	*369 - 379*	*11*	*0.44*	*Dioxane*	*1,2*

References

1. H. P. Broida, S. C. Haydon, *Appl. Phys. Letters* 16(3), 142 (1970).
2. M. Maeda, Y. Miyazoe, *Jpn. J. Appl. Phys.* 13(5), 827 (1974).

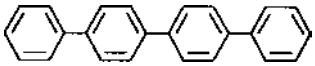

p-Quaterphenyl
p-Quaterphenyl
LC 3740
$C_{24}H_{18}$ 306.41
Solvent: Dioxane
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
5
220
240
260
280
300
320
340
WAVELENGTH [NM] --->

p-Quaterphenyl (LC 3740)

Constitution

PQP

$C_{24}H_{18}$ · MW: 306.41



Characteristics

Lambdachrome® number:	3740
CAS registry number:	135-70-6
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	297 nm
Molar absorptivity:	4.28×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in toluene):	374 nm

For research and development purposes only.

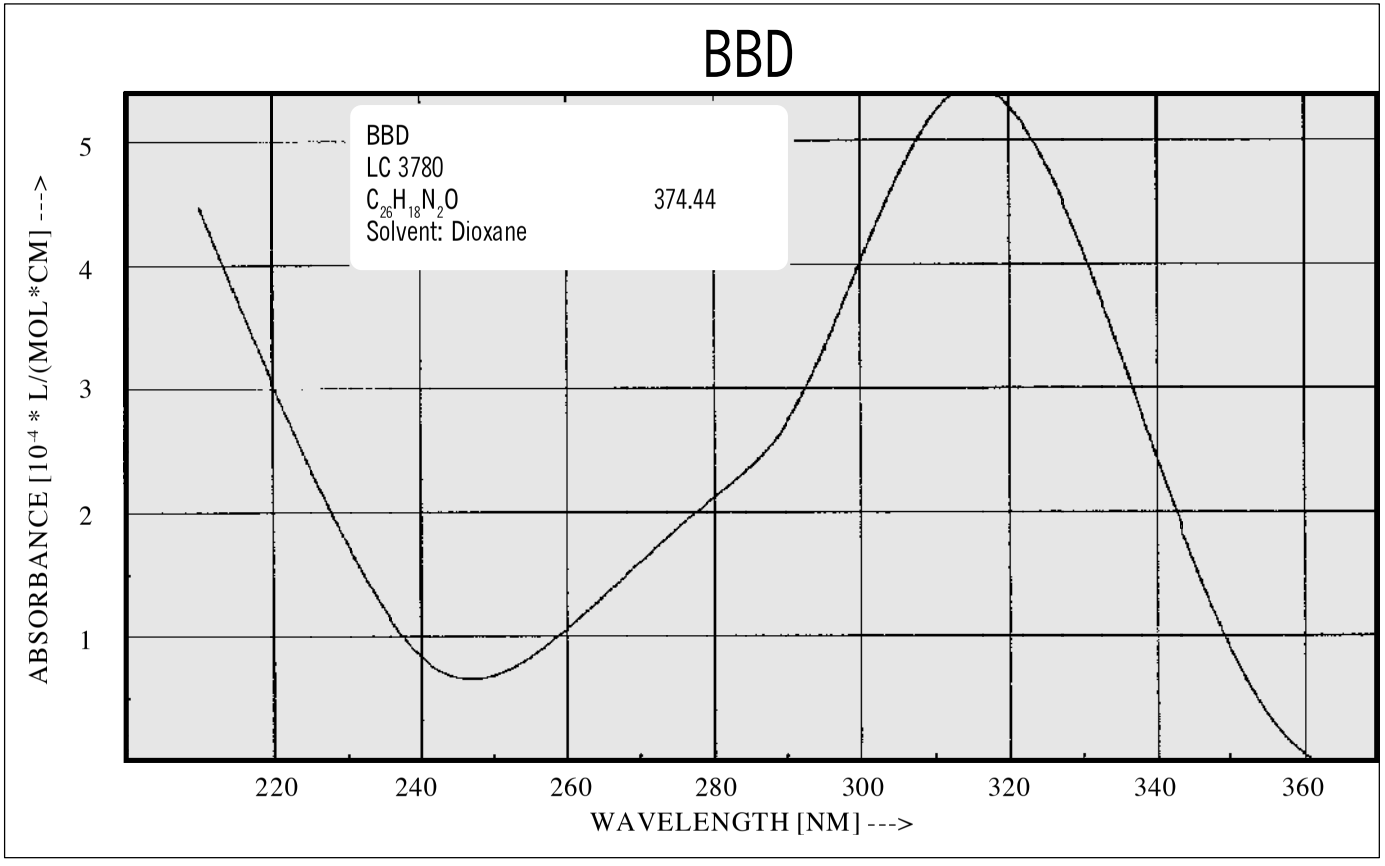
Lasing Performance

Laser dye for pulsed operation; tunable around 370 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*371*	*-*	*20*	*0.09*	*Dioxane*	*1*
Nitrogen	*337*	*370*	*362 - 390*	*11*	*sat.*	*DMF*	*2, 3*
Flashlamp	*-*	*372*	*-*	*-*	*0.08*	*DMF*	*4*

References

1. P. Cassard et al., *Opt. Commun.* 38(2), 131 (1981).
2. M. Maeda, Y. Miyazoe, *Jpn. J. Appl. Phys.* 13(5), 827 (1974).
3. J. A. Myer, I. Itzkan, E. Kierstead, *Nature* 225, 544 (1970).
4. M. Maeda, Y. Miyazoe, *Jpn. J. Appl. Phys.* 11(5), 692 (1972).

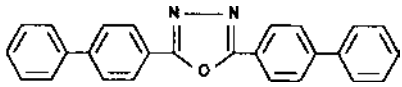

BBD
BBD
LC 3780
$C_{26}H_{18}N_2O$ 374.44
Solvent: Dioxane
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
220
240
260
280
300
320
340
360
WAVELENGTH [NM] --->

BBD (LC 3780)

Constitution

2,5-Bis-(4-biphenylyl)-1,3,4-oxadiazol

$C_{26}H_{18}N_2O$ · MW: 374.44



Characteristics

Lambdachrome® number:	3780
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	314 nm
Molar absorptivity:	5.30 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in dioxane):	373 nm

For research and development purposes only.

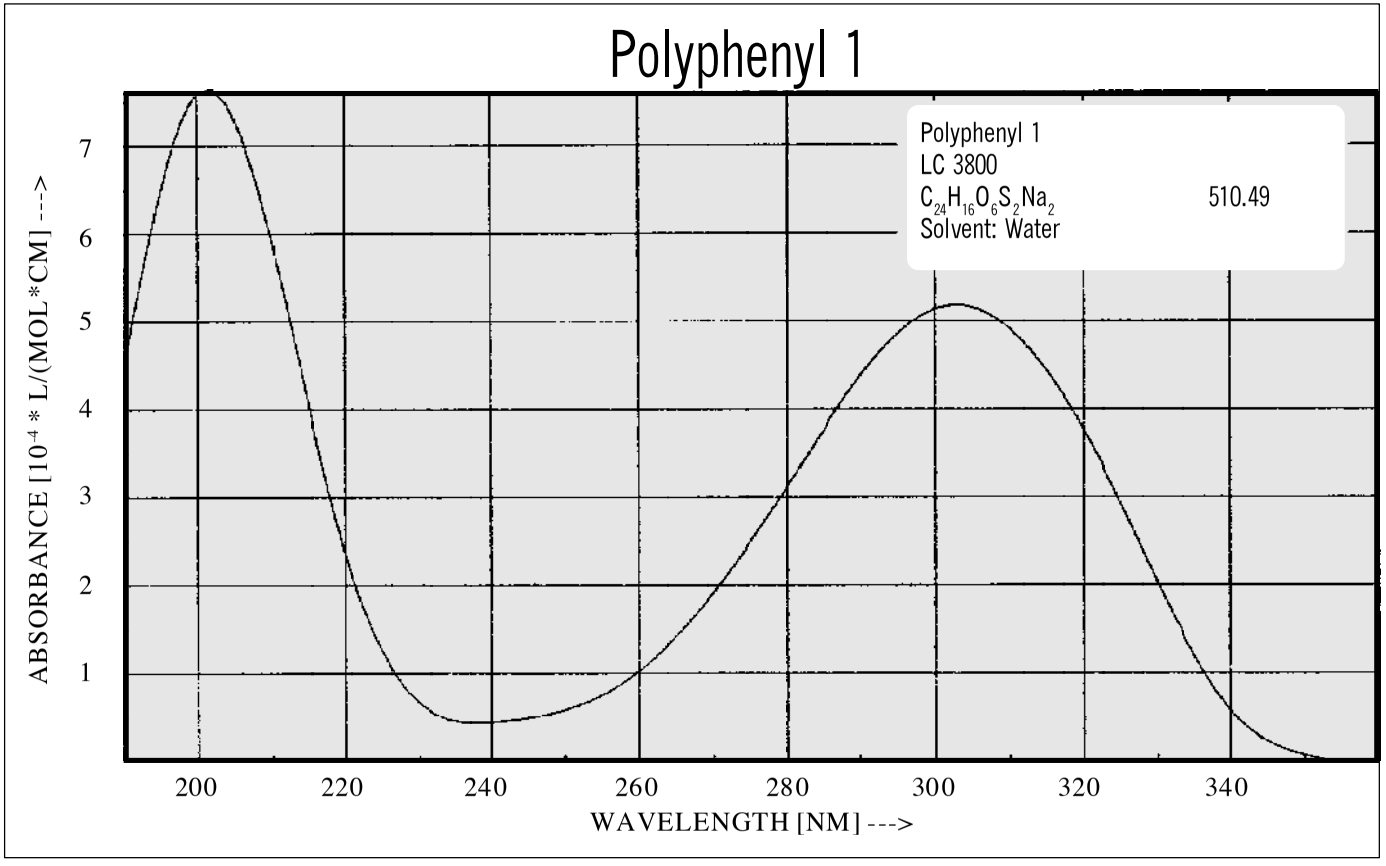
Lasing Performance

Laser dye for pulsed operation; tunable around 380 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*378*	*368 - 399*	*14*	*0.37*	*Dioxane*	*1, 2*
Nitrogen	*337*	*375*	*372 - 405*	*19*	*0.74*	*Dioxane*	*2, 3*
Flashlamp	*-*	*377*	*-*	*-*	*0.74*	*Dioxane*	*4*

References

1. P. Cassard et al., *Opt. Commun.* 38(2), 131 (1981).
2. O. Uchino et al., *Appl. Phys.* 19, 35 (1979).
3. M. Maeda, Y. Miyazoe, *Jpn. J. Appl. Phys.* 13(5), 827 (1974).
4. M. Maeda et al., *IEEE J. Quant. Elec tron.* QE-13, 65 (1977).

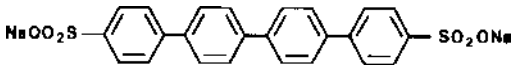

Polyphenyl 1
Polyphenyl 1
LC 3800
$C_{24}H_{16}O_6S_2Na_2$ 510.49
Solvent: Water
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
200
220
240
260
280
300
320
340
WAVELENGTH [NM] --->

Polyphenyl 1 (LC 3800)

Constitution

p-Quaterphenyl-4,4'''-disulfonicacid Disodiumsalt

$C_{24}H_{16}O_6S_2Na_2$ · MW: 510.49



Characteristics

Lambdachrome® number:	3800
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in water):	308 nm
Molar absorptivity:	5.19 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

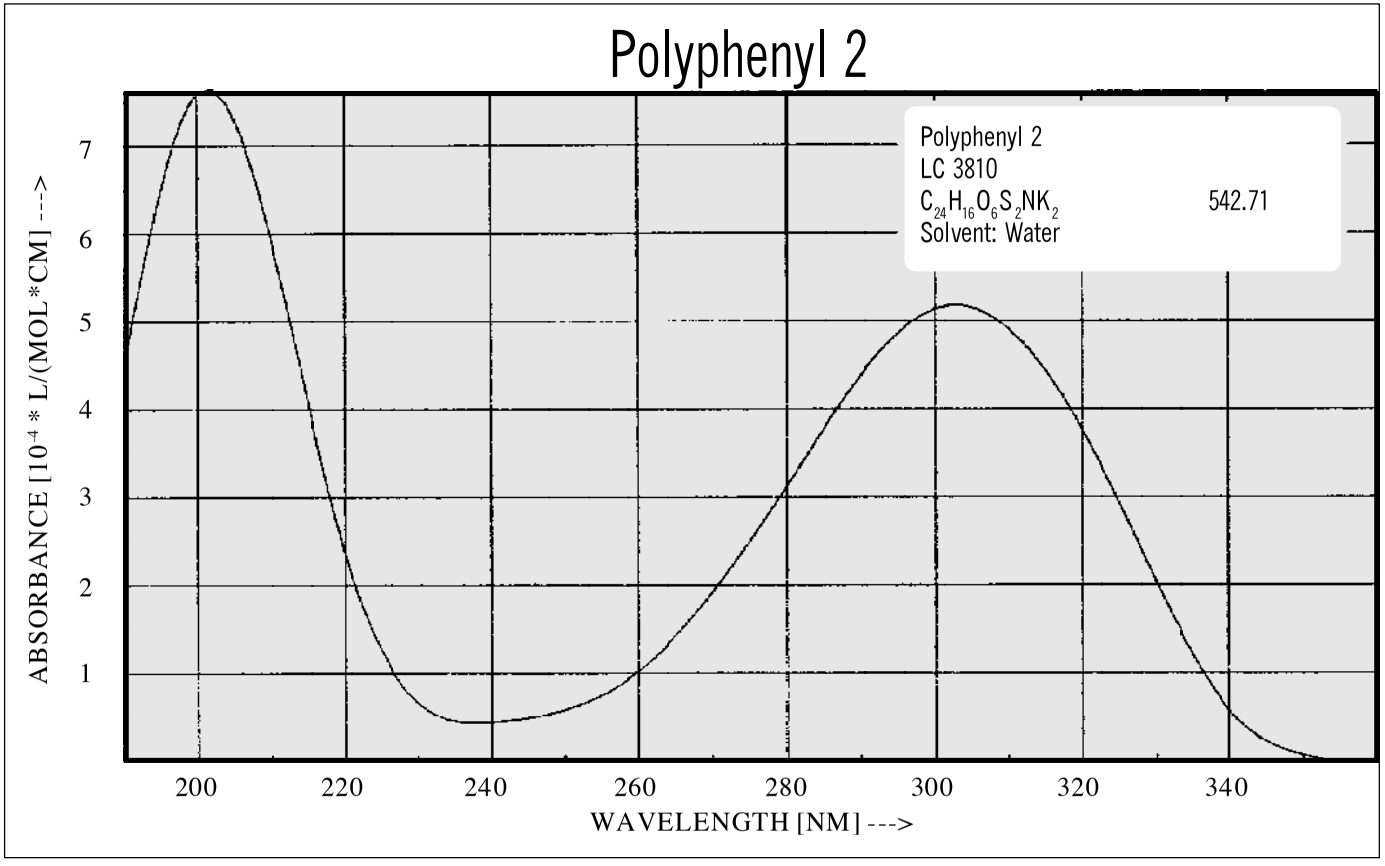
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 380 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*381*	*363 - 408*	*12*	*0.20*	*Eg*	*1, 2, 3*
Nitrogen	*337*	*380*	*362 - 411*	*rel.*	*0.36*	*Eg*	*3*
CW, Ar^+	*UV*	*382*	*362 - 412*	*-*	*1.25*	*Eg*	*3*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 402 (1981).
3. W. Hüffer et al., *Opt. Commun.* 33(1), 85 (1980).

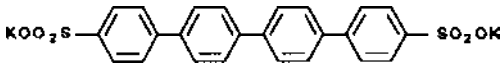

Polyphenyl 2
Polyphenyl 2
LC 3810
$C_{24}H_{16}O_6S_2NK_2$ 542.71
Solvent: Water
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
6
7
200
220
240
260
280
300
320
340
WAVELENGTH [NM] --->

Polyphenyl 2 (LC 3810)

Constitution

p-Quaterphenyl-4,4'''-disulfonicacid Dipotassiumsalt

$C_{24}H_{16}O_6S_2NK_2$ · MW: 542.71



Characteristics

Lambdachrome® number:	3810
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in water):	308 nm
Molar absorptivity:	5.19 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

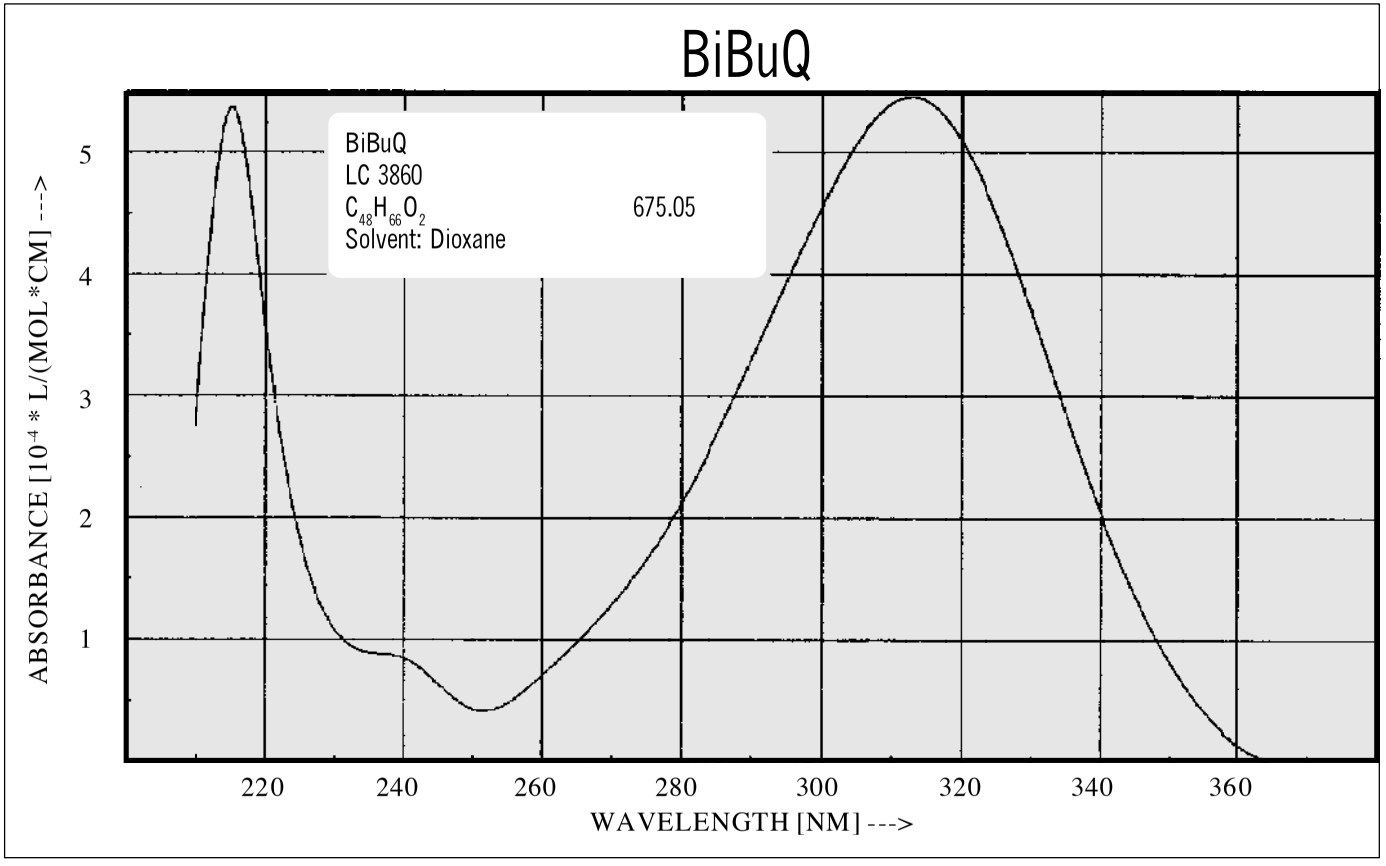
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 390 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*382*	*363 - 400*	*10*	*0.25*	*Eg*	*1*
CW, Ar^+	*UV*	*384*	*370 - 406*	*-*	*2.0*	*Eg*	*1*

References

1. Lambda Physik, *Wall Chart* 1996.

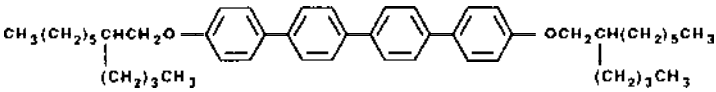

BiBuQ
BiBuQ
LC 3860
$C_{48}H_{66}O_2$ 675.05
Solvent: Dioxane
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
220
240
260
280
300
320
340
360
WAVELENGTH [NM] --->

BiBuQ (LC 3860)

Constitution

4,4'''-Bis-(2-butyloctyloxy)-p-quaterphenyl
BBQ • Pilot 386

$C_{48}H_{66}O_2$ · MW: 675.05



Characteristics

Lambdachrome® number:	3860
CAS registry number:	18434-08-7
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	313 nm
Molar absorptivity:	5.45 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

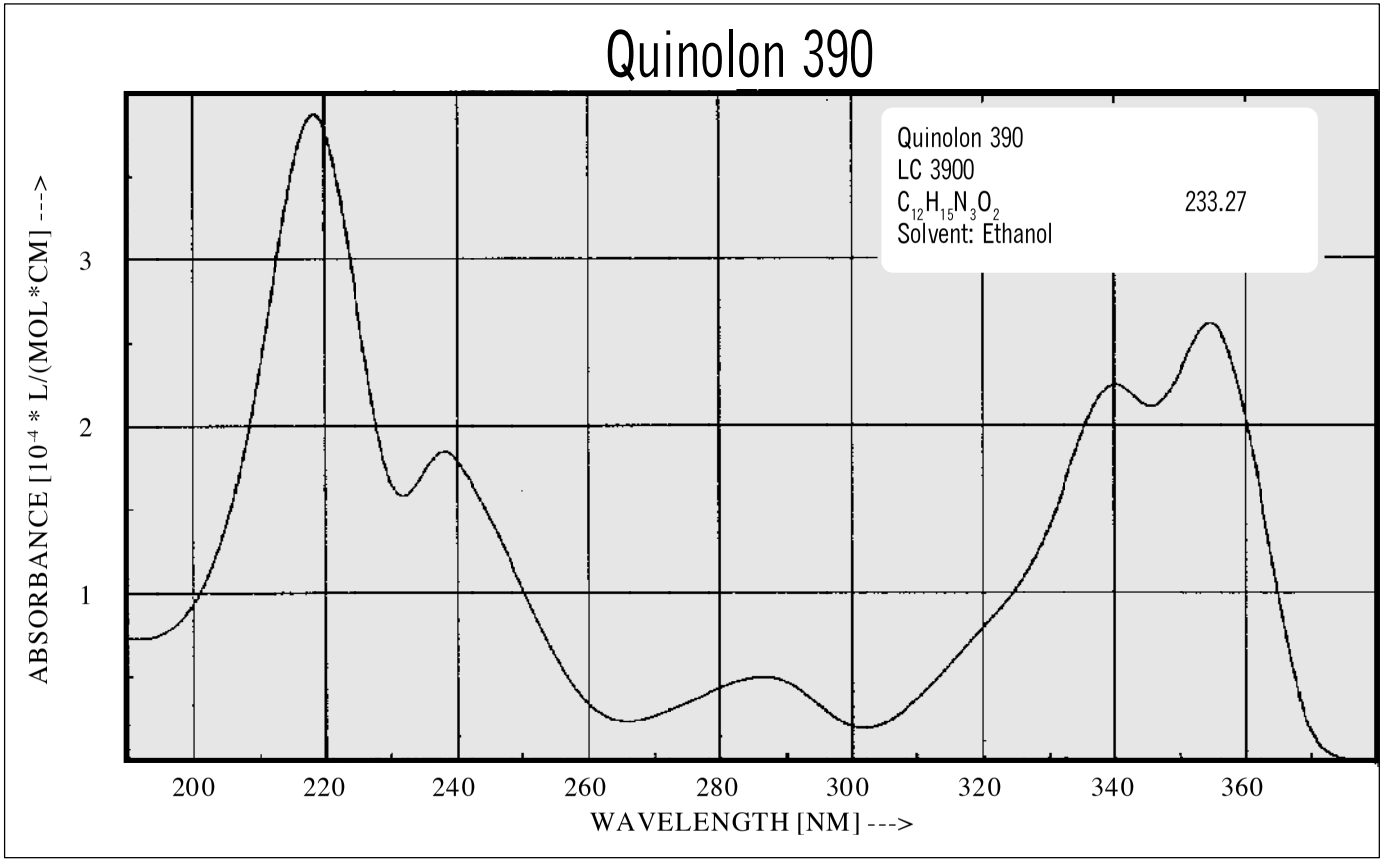
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 390 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*388*	*367 - 405*	*11*	*0.25*	*Dioxane*	*1, 2, 3*
Nitrogen	*337*	*383*	*364 - 405*	*rel.*	*0.41*	*Dioxane*	*3, 4*
Nd:YAG, 3rd	*355*	*392*	*380 - 410*	*-*	*1.34*	*EtOH/Tol*	*5*
Flashlamp	*-*	*-*	*389 - 395*	*-*	*-*	*DMF*	*6*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 402 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. K. Azuma et al., *Jpn. J. Appl. Phys.* 18(1), 209 (1979).
6. P. R. Hammond et al., *Appl. Phys.* 9, 67 (1976).

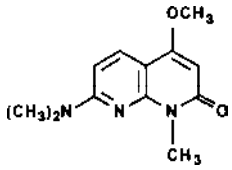

Quinolon 390
Quinolon 390
LC 3900
$C_{12}H_{15}N_3O_2$ 233.27
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
200
220
240
260
280
300
320
340
360
WAVELENGTH [NM] --->

Quinolon 390 (LC 3900)

Constitution

7-Dimethylamino-1-methyl-4-methoxy-8-azaquinolone-2

$C_{12}H_{15}N_3O_2$ · MW: 233.27



Characteristics

Lambdachrome® number:	3900
CAS registry number:	119883-58-8
Appearance:	white, crystalline solid
Absorption maximum (in ethanol):	355 nm
Molar absorptivity:	2.52 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

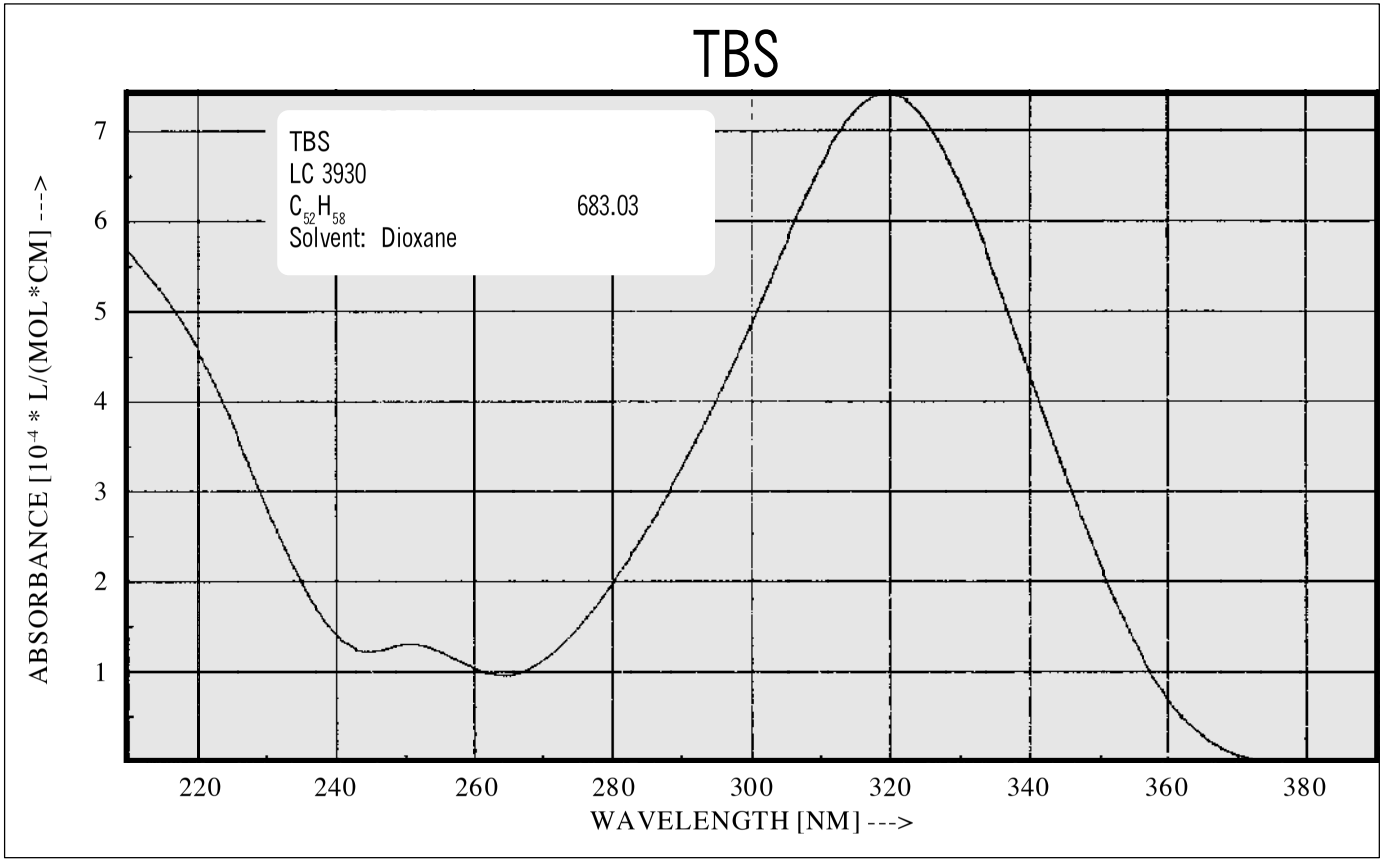
Lasing Performance

Laser dye for pulsed operation; tunable around 390 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG, 3rd	*355*	*390*	*384 - 394*	*4*	*0.25*	*Methanol*	*1*
Flashlamp	*-*	*390*	*-*	*-*	*1.15*	*Ethanol*	*2*

References

1. Lambda Physik, *Wall Chart* 1996.
2. P. R. Hammond et al., *Appl. Phys.* 8, 315 (1975).

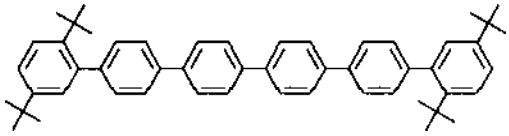

TBS
TBS
LC 3930
C52H58
683.03
Solvent: Dioxane
ABSORBANCE [10-4 * L/(MOL *CM] --->
1
2
3
4
5
6
7
220
240
260
280
300
320
340
360
380
WAVELENGTH [NM] --->

TBS (LC 3930)

Constitution

3,5,3''''',5''''' -Tetra-t-butyl-p-sexiphenyl

$C_{52}H_{58}$ · MW: 683.03



Characteristics

Lambdachrome® number:	3930
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	320 nm
Molar absorptivity:	7.49 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

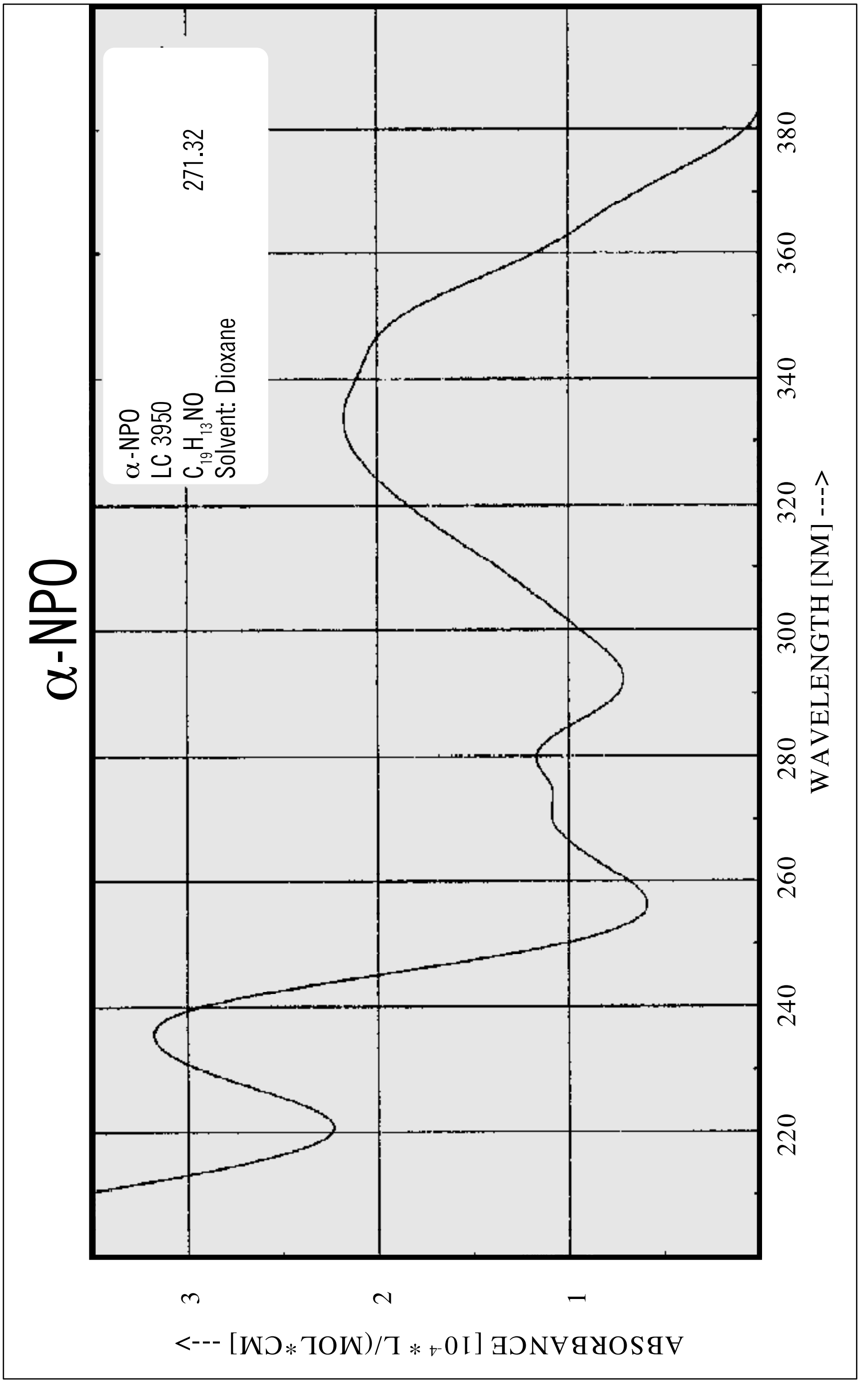
Lasing Performance

Very stable and efficient laser dye for pulsed operation; tunable around 390 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*393*	*365 - 410*	*11*	*0.16*	*Cyclohex*	*1*

References

1. Lambda Physik, *Data Sheet.*

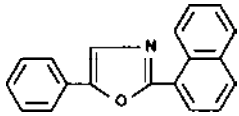

α-NPO
α-NPO
LC 3950
$C_{19}H_{13}NO$ 271.32
Solvent: Dioxane
ABSORBANCE [10-4 * L/(MOL*CM)] --->
WAVELENGTH [NM] --->
220
240
260
280
300
320
340
360
380
1
2
3

α-NPO (LC 3950)

Constitution

2-(1-Naphthyl)-5-phenyloxazol

$C_{19}H_{13}NO$ · MW: 271.32



Characteristics

Lambdachrome® number:	3950
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	333 nm
Molar absorptivity:	2.15 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in dioxane):	396 nm

For research and development purposes only.

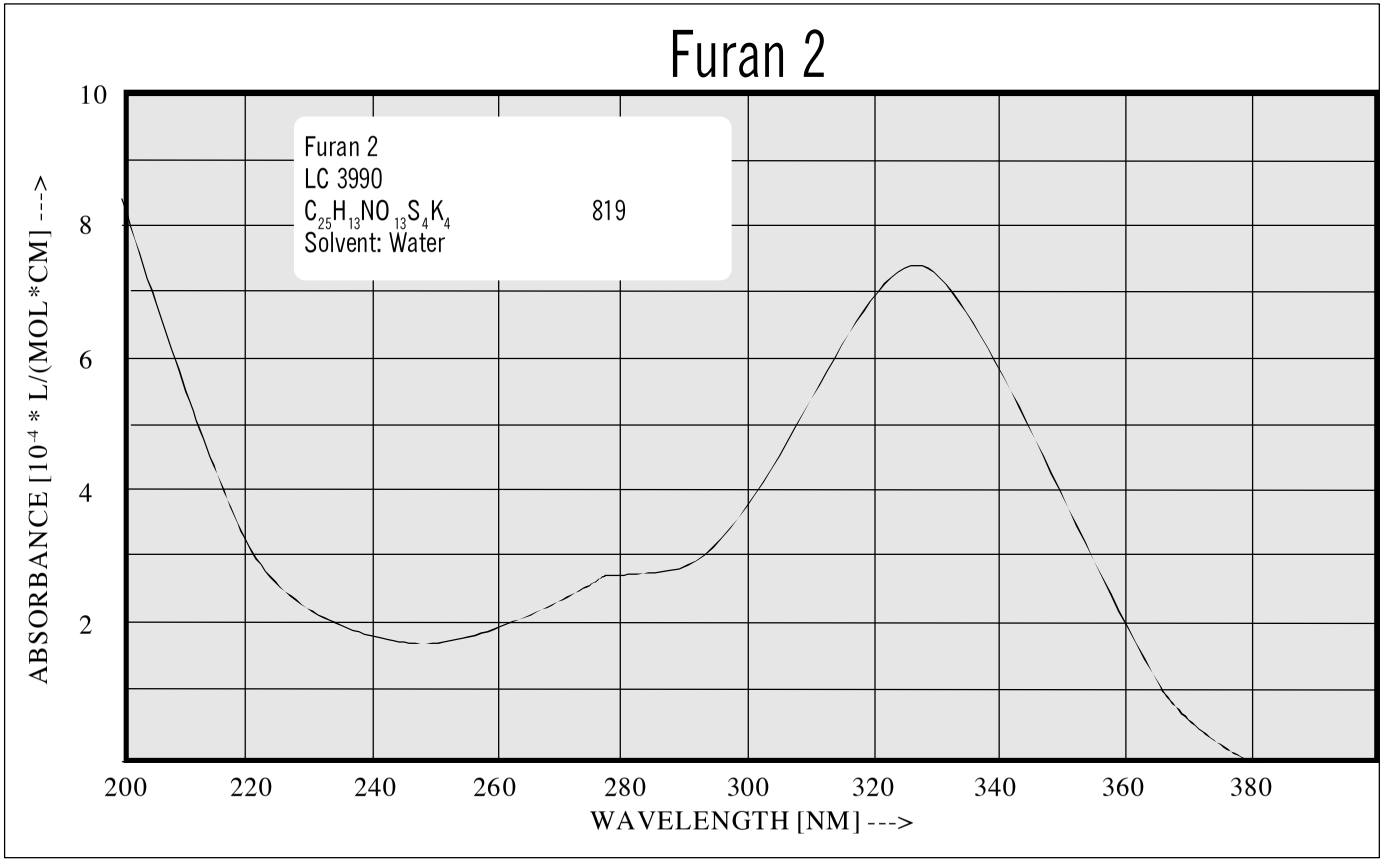
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 400 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*393*	*387 - 400*	*6*	*0.32*	*Cyclohex.*	*1*
Nitrogen	*337*	*400*	*391 - 425*	*rel.*	*0.67*	*Dioxane*	*2, 3*
Nd:YAG, 3rd	*355*	*400*	*-*	*6.5*	*1.00*	*Toluene*	*4*
Flashlamp	*-*	*400*	*-*	*-*	*0.07*	*Ethanol*	*5*

References

1. Lambda Physik, *Data Sheet.*
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. A. Dienes, *Appl. Phys.* 7, 135 (1975).
4. G. A. Abakumov et al. *JETP Letters* 9, 9 (1969).
5. H. W. Furumoto et al. *IEEE J. Quant. Electron.* QE-6(5), 262 (1970).

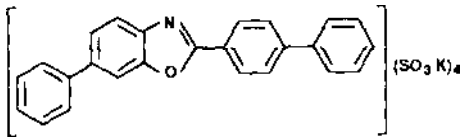

Furan 2
Furan 2
LC 3990
$C_{25}H_{13}NO_{13}S_4K_4$ 819
Solvent: Water
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
10
8
6
4
2
200
220
240
260
280
300
320
340
360
380
WAVELENGTH [NM] --->

Furan 2 (LC 3990)

Constitution

2-(4-Biphenylyl)-6-phenylbenzoxazotetrasulfonicacid Potassium Salt

$C_{25}H_{13}NO_{13}S_4K_4$ · MW: 819



Characteristics

Lambdachrome® number:	3990
CAS registry number:	-
Appearance:	light yellow, crystalline solid
Absorption maximum (in water):	330 nm
Molar absorptivity:	7.79 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in dioxane):	396 nm

For research and development purposes only.

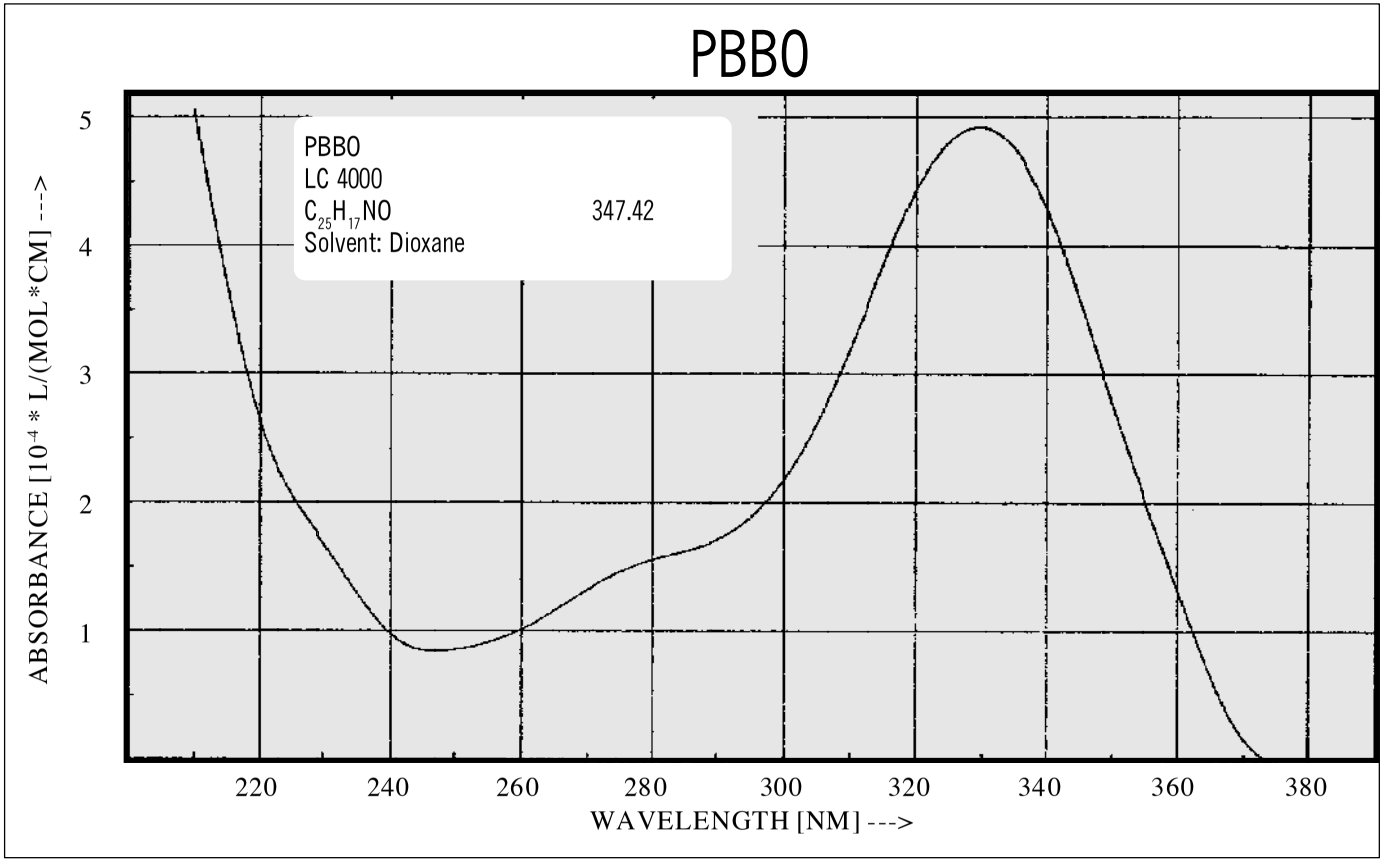
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 400 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*399*	*388 - 426*	*8*	*0.50*	*Methanol*	*1*
Nd:YAG, 3rd	*355*	*402*	*392 - 422*	*15*	*0.5*	*Methanol*	*1*

References

1. Lambda Physik, *Wall Chart* 1996.

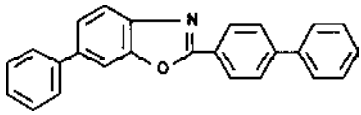

PBBO
PBBO
LC 4000
$C_{25}H_{17}NO$ 347.42
Solvent: Dioxane
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
5
4
3
2
1
220
240
260
280
300
320
340
360
380
WAVELENGTH [NM] --->

PBBO (LC 4000)

Constitution

2-(4-Biphenylyl)-6-phenylbenzoxazol-1,3

$C_{25}H_{17}NO$ · MW: 347.42



Characteristics

Lambdachrome® number:	4000
CAS registry number:	17064-47-0
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	327 nm
Molar absorptivity:	4.89 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	403 nm

For research and development purposes only.

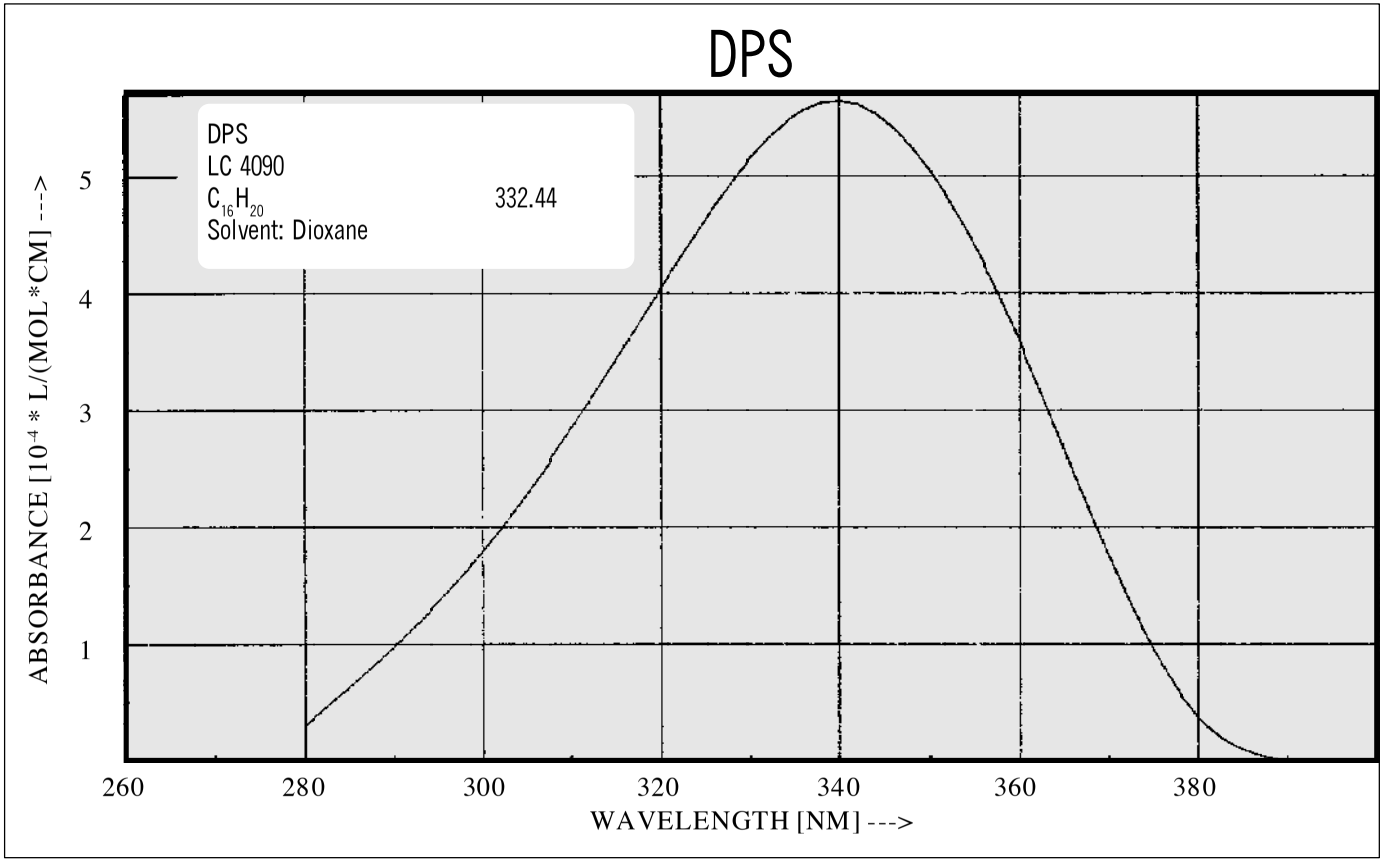
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 400 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*396*	*386 - 420*	*7*	*0.40*	*Dioxane*	*1, 2*
Nitrogen	*337*	*395*	*385 - 420*	*rel.*	*0.15*	*Dioxane*	*2, 3*

References

1. Lambda Physik, *Wall Chart* 1996.
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. Lambda Physik, *Data Sheet.*


DPS
DPS
LC 4090
$C_{16}H_{20}$ 332.44
Solvent: Dioxane
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
260
280
300
320
340
360
380
WAVELENGTH [NM] --->

DPS (LC 4090)

Constitution

4,4'-Diphenylstilbene
Pilot 409

$C_{16}H_{20}$ · MW: 332.44

Characteristics

Lambdachrome® number:	4090
CAS registry number:	26569-48-2
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	340 nm
Molar absorptivity:	5.65 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

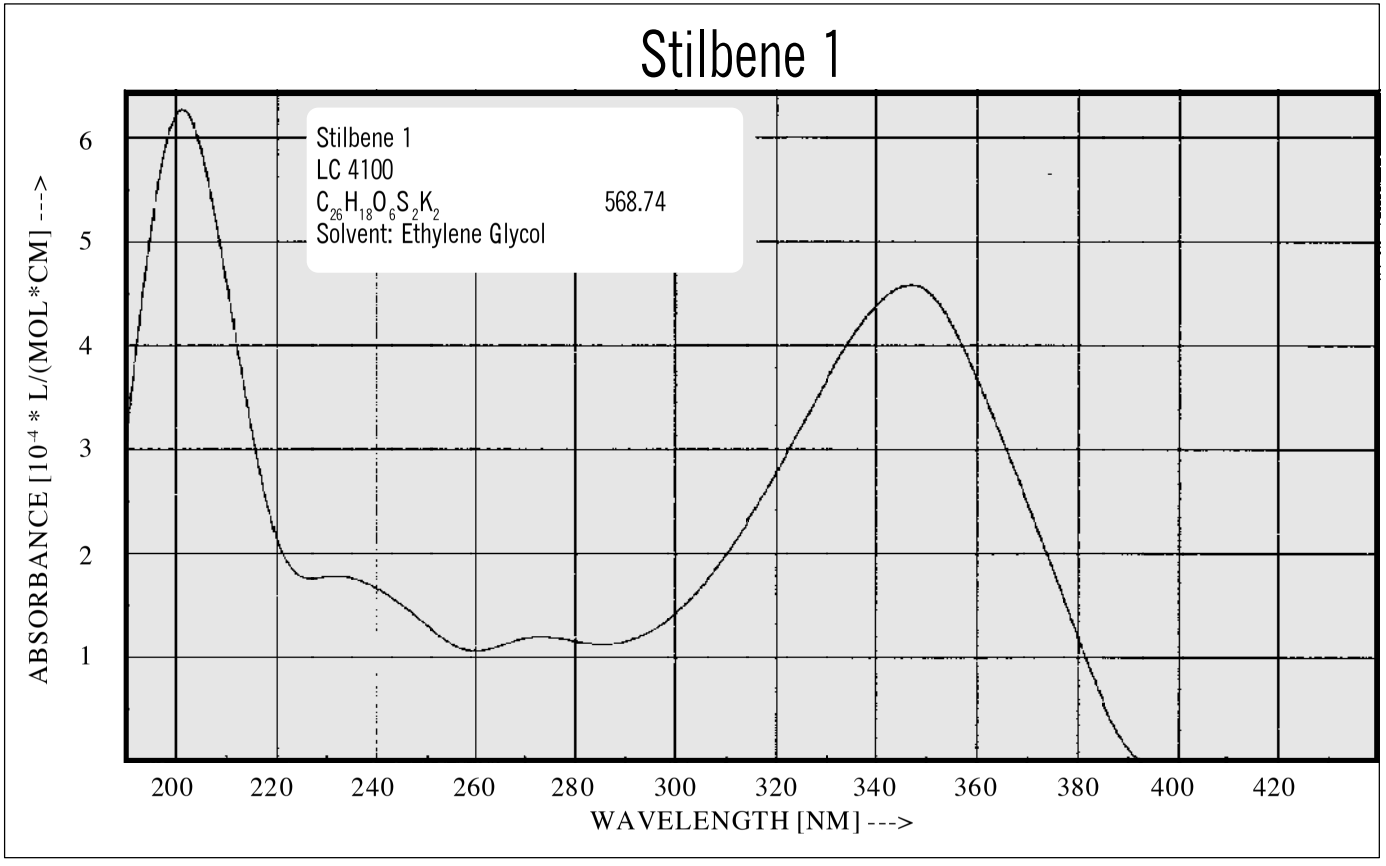
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 400 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*406*	*399 - 415*	*11*	*0.25*	*Dioxane*	*1, 2*
Nitrogen	*337*	*404*	*394 - 416*	*rel.*	*0.12*	*Dioxane*	*3, 4*
Nd:YAG, 3rd	*355*	*408*	*-*	*-*	*-*	*Tol.*	*5*
Flashlamp	*-*	*409*	*406 - 411*	*-*	*sat.*	*DMF*	*6, 7*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 402 (1981).
3. Lambda Physik, *Data Sheet.*
4. A. Dienes, *Appl. Phys.* 7, 135 (1975).
5. V. D. Kotzubanov et al., *Opt. Spectrosc.* 25, 406 (1968).
6. P. R. Hammond et al., *Appl. Phys.* 9, 67 (1976).
7. H. W. Furumoto et al., *IEEE J. Quant. Electron.* QE-6, 262 (1970).


Stilbene 1
Stilbene 1
LC 4100
$C_{26}H_{18}O_6S_2K_2$ 568.74
Solvent: Ethylene Glycol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
6
200
220
240
260
280
300
320
340
360
380
400
420
WAVELENGTH [NM] --->

Stilbene 1 (LC 4100)

Constitution

[1,1'-Biphenyl]-4-sulfonic acid, 4',4''-1,2-ethene-diylbis-, dipotassium salt

$C_{26}H_{18}O_6S_2K_2$ · MW: 568.74

Characteristics

Lambdachrome® number:	4100
CAS registry number:	74758-59-1
Appearance:	slightly yellow, crystalline solid
Absorption maximum (in Eg.):	350 nm
Molar absorptivity:	4.55×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

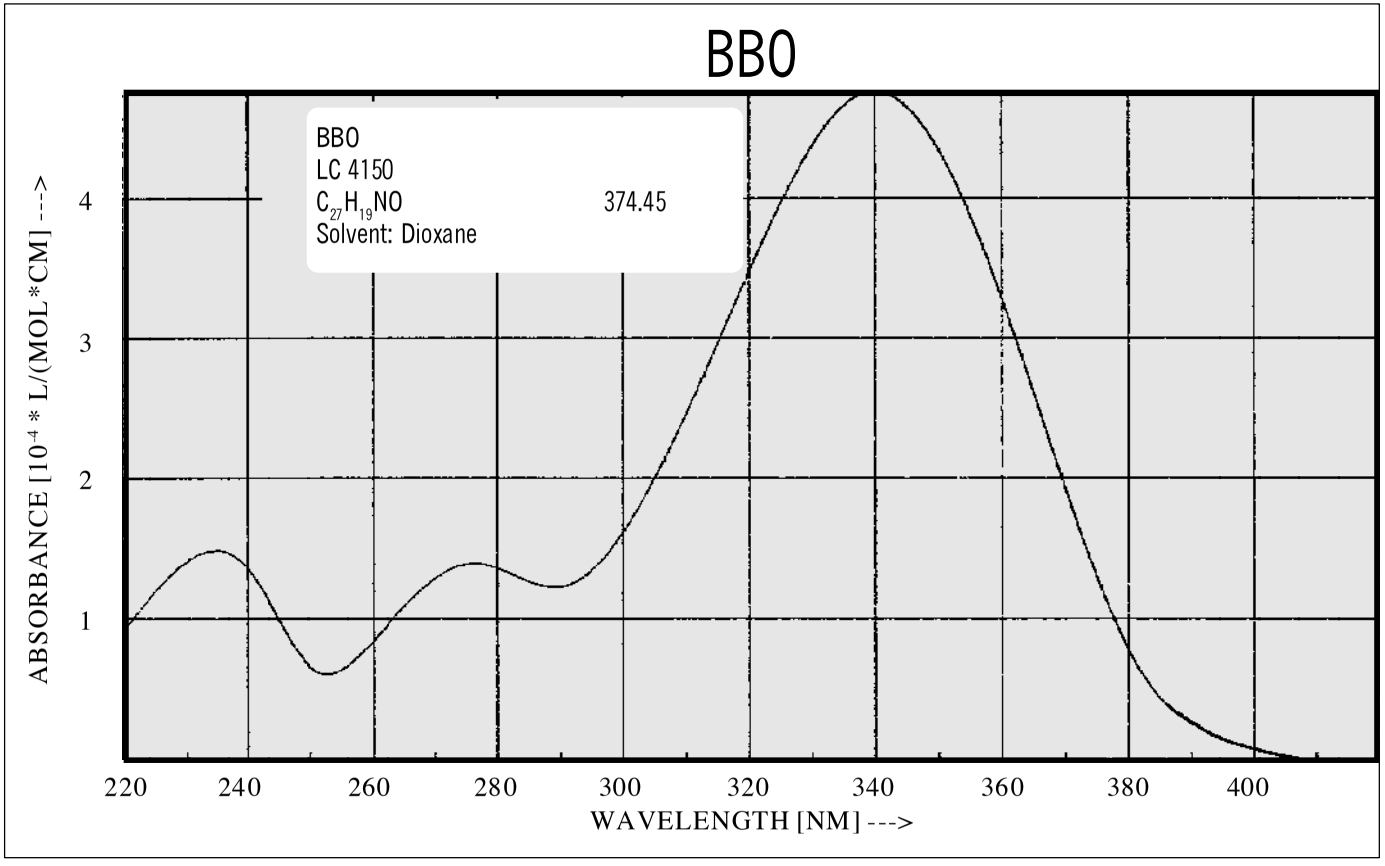
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 415 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*416*	*405 - 428*	*6*	*0.50*	*Eg.*	*1, 2, 3*
Nitrogen	*337*	*417*	*405 - 446*	*rel.*	*0.20*	*Eg.*	*4*
CW, Ar^+	*UV*	*415*	*403 - 428*	*-*	*0.75*	*Eg.*	*1, 4, 5, 6*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 402 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. T. F. Johnston, R. H. Brady, W. Proffitt, *Appl. Optics* 21(13), 2307 (1982).
6. W. Hüffer et al., *Opt. Commun.* 28(3), 353 (1979).

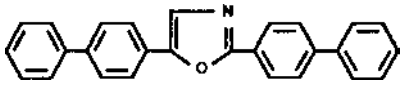

BBO
BBO
LC 4150
C27H19NO 374.45
Solvent: Dioxane
ABSORBANCE [10-4 * L/(MOL *CM] --->
1
2
3
4
220
240
260
280
300
320
340
360
380
400
WAVELENGTH [NM] --->

BBO (LC 4150)

Constitution

2,5-Bis-(4-biphenylyl)-oxazol

$C_{27}H_{19}NO$ · MW: 374.45



Characteristics

Lambdachrome® number:	4150
CAS registry number:	2083-09-2
Appearance:	white, crystalline solid
Absorption maximum (in dioxane):	340 nm
Molar absorptivity:	4.76×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in toluene):	412 nm

For research and development purposes only.

Lasing Performance

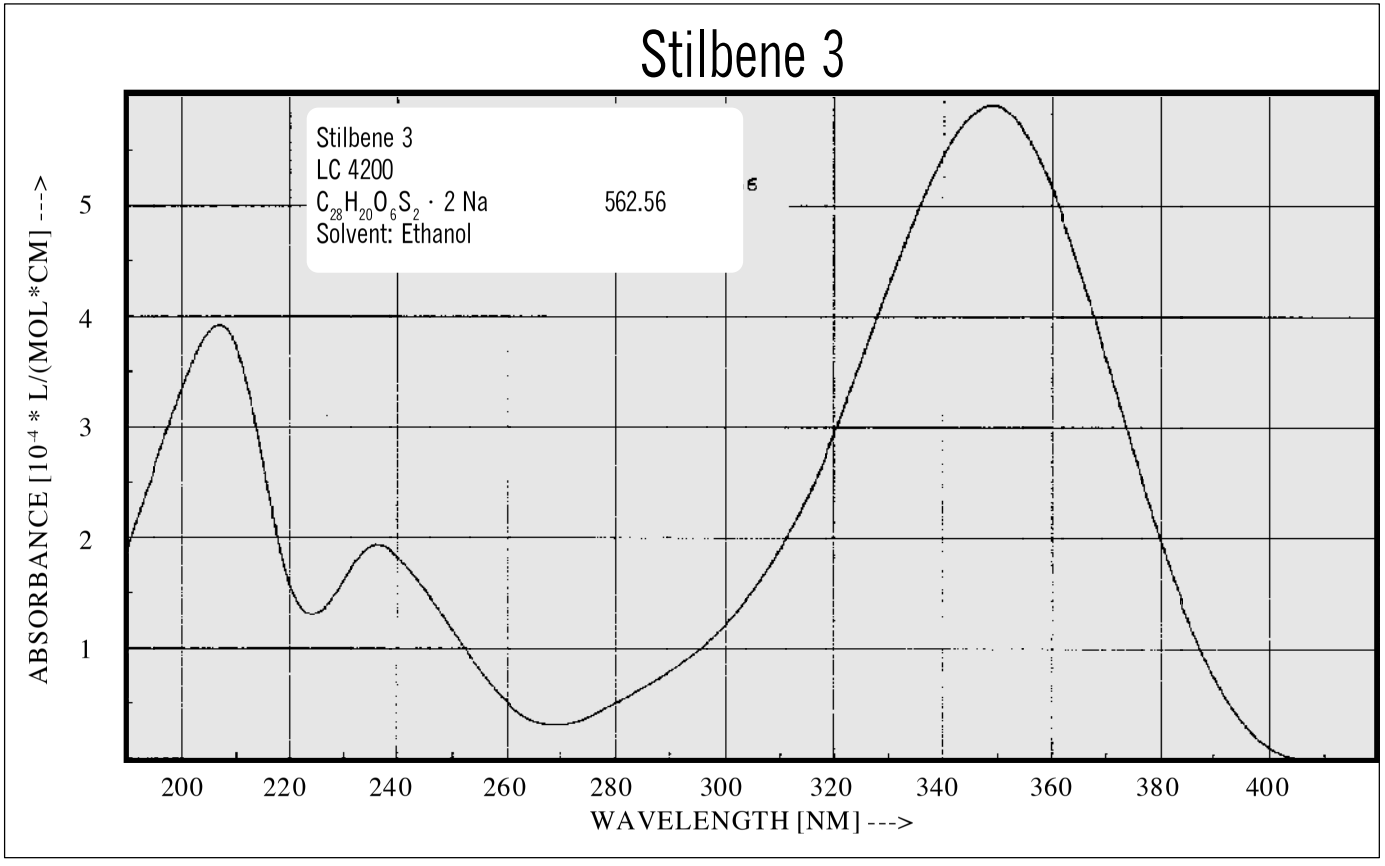
Laser dye for pulsed operation; tunable around 410 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nitrogen	*337*	*408*	*401 - 419*	*14*	*0.74*	*Dioxane*	*1, 2*
Nd:YAG, 3rd	*355*	*409*	*-*	*8*	*0.96*	*Tol.*	*3*
Flashlamp	*-*	*410*	*-*	*-*	*0.37*	*Dioxane*	*4, 5*

References

1. M. Maeda, Y. Miyazoe, *Jpn. J. Appl. Phys.* 13(5), 827 (1974).
2. H. P. Broida, S. C. Haydon, *Appl. Phys. Letters* 16(3), 142 (1970).
3. G. A. Abakumov et al., *JETP Letters* 9, 9 (1969).
4. H. W. Furumoto et al., *IEEE J. Quant. Electron.* QE-6(5), 262 (1970).
5. M. Maeda, Y. Miyazoe, *Jpn. J. Appl. Phys.* 11(5), 692 (1972).

Stilbene 3

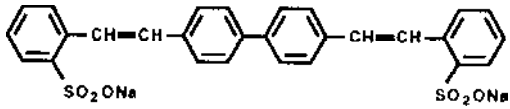

Stilbene 3
LC 4200
$C_{28}H_{20}O_6S_2 \cdot 2\,Na$ 562.56
Solvent: Ethanol
ε
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
200
220
240
260
280
300
320
340
360
380
400
WAVELENGTH [NM] --->

Stilbene 3 (LC 4200)

Constitution

2,2'-([1,1'-Biphenyl]-4,4'-diyldi-2,1-ethenediyl)-bis-benzenesulfonic acid
Disodium Salt
Stilbene 420

$C_{28}H_{20}O_6S_2 \cdot 2\ Na \cdot$ MW: 562.56



Characteristics

Lambdachrome® number:	4200
CAS registry number:	27344-41-8
Appearance:	yellow, crystalline solid
Absorption maximum (in Ethanol.):	350 nm
Molar absorptivity:	5.89 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

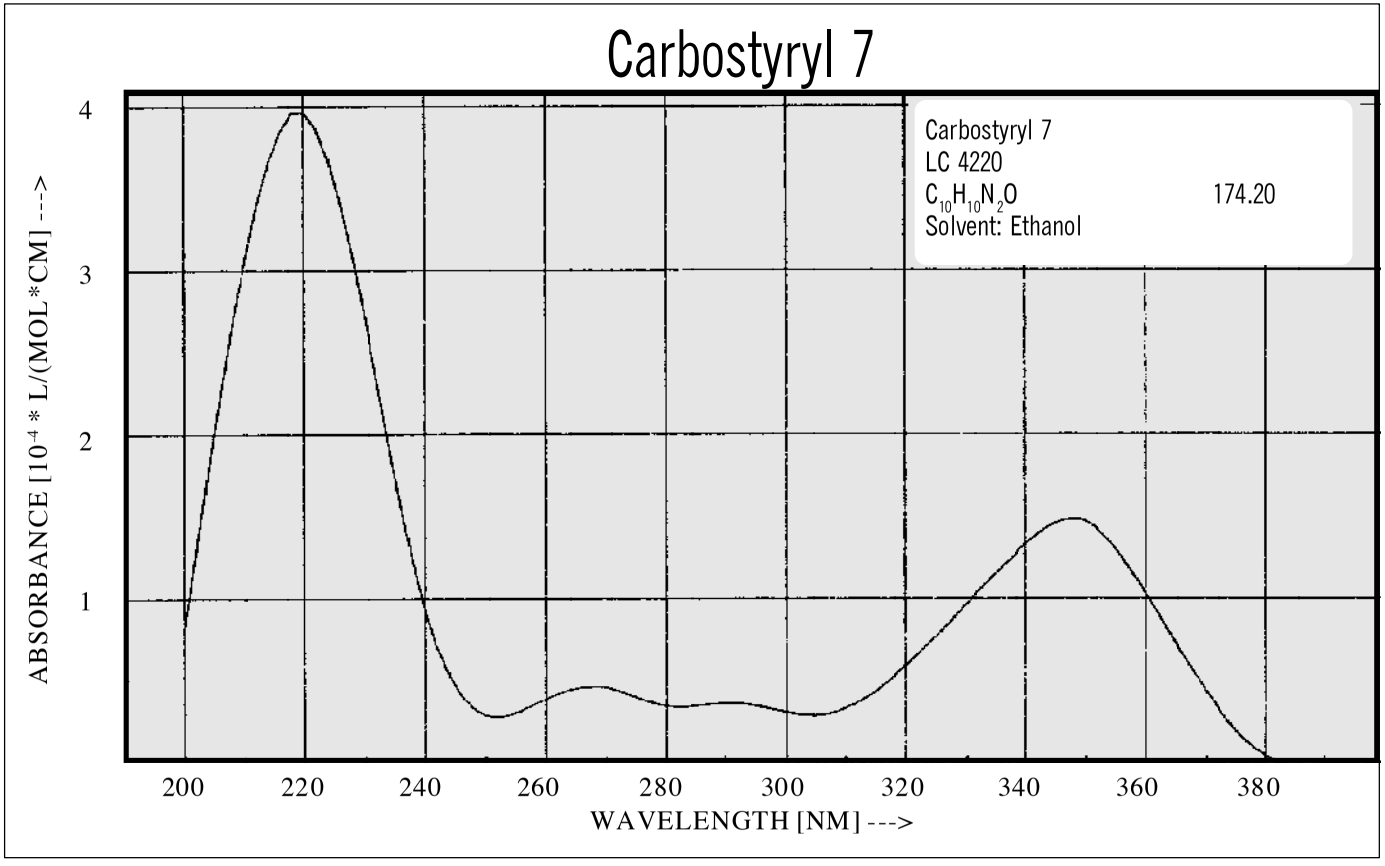
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 425 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*425*	*412 - 443*	*9*	*0.65*	*Methanol*	*1, 2, 3*
Nitrogen	*337*	*424*	*408 - 457*	*rel.*	*0.22*	*Methanol*	*3, 4*
Nd:YAG, 3rd	*355*	*428*	*415 - 439*	*15*	*0.25*	*Methanol*	*1, 5*
CW, Ar^+	*UV*	*435*	*410 - 485*	*-*	*1.0*	*Eg.*	*1, 4, 6, 7*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 402 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. D. M. Guthals, J. W. Nibler, *Opt. Commun.* 29(3), 322 (1979).
6. T. F. Johnston, R. H. Brady, W. Proffitt, *Appl. Optics* 21(13), 2307 (1982).
7. J. Kuhl et al., *Opt. Commun.* 24(3), 251 (1978).

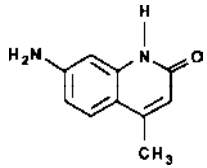

Carbostyryl 7
Carbostyryl 7
LC 4220
$C_{10}H_{10}N_2O$ 174.20
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
4
3
2
1
200
220
240
260
280
300
320
340
360
380
WAVELENGTH [NM] --->

Carbostyryl 7 (LC 4220)

Constitution

7-Amino-4-methylcarbostyryl
Carbostyryl 124

$C_{10}H_{10}N_2O$ · MW: 174.20



Characteristics

Lambdachrome® number:	4220
CAS registry number:	-
Appearance:	white, crystalline solid
Absorption maximum (in ethanol):	350 nm
Molar absorptivity:	1.46 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	400 nm

For research and development purposes only.

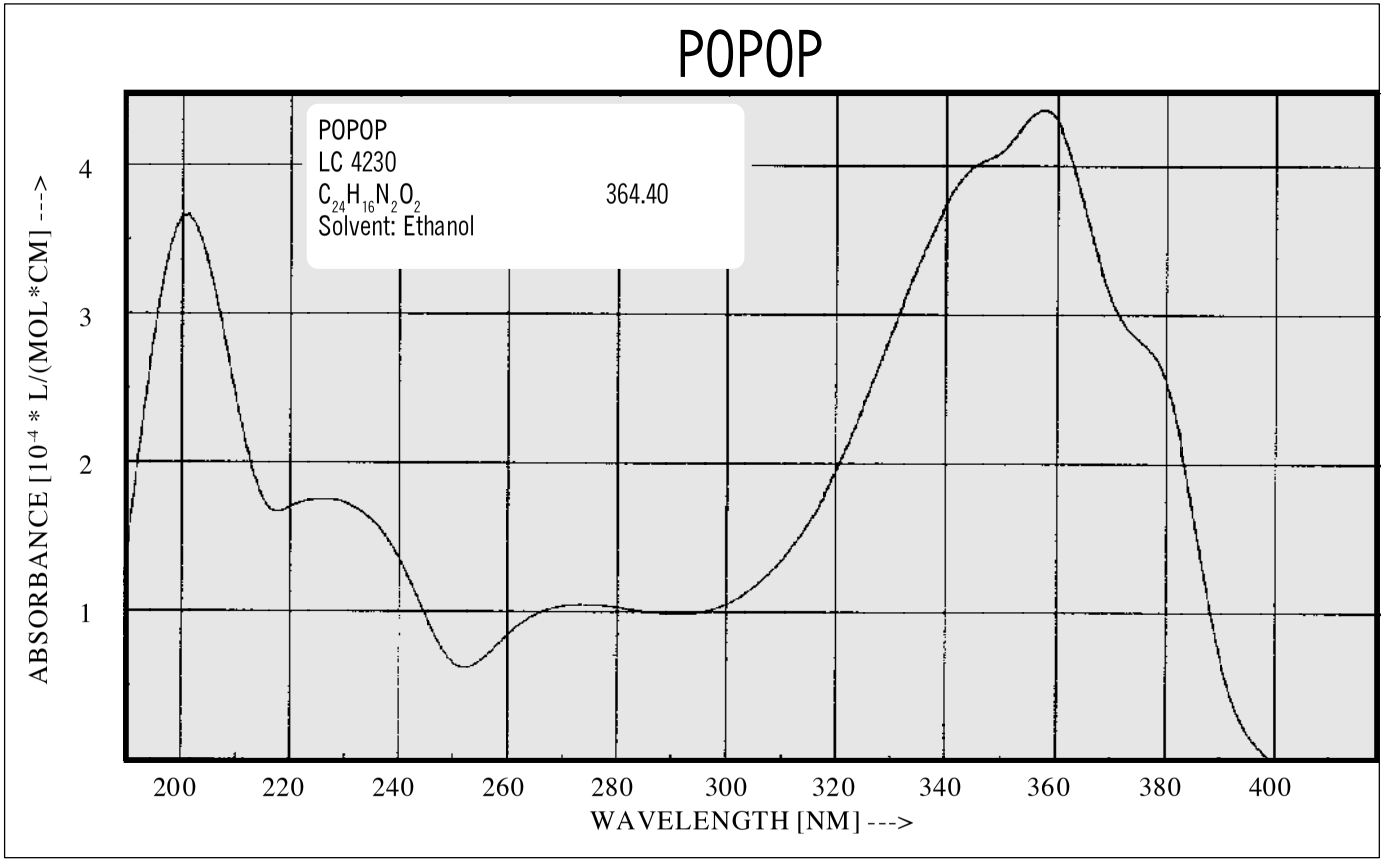
Lasing Performance

Laser dye for pulsed operation; tunable around 410 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*413*	*408 - 420*	-	-	*Ethanol*	*1, 3*

References

1. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).
2. R. Srinivasan, *IEEE J. Quant. Electron.* QE-5, 552 (1969).

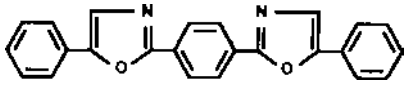

POPOP
POPOP
LC 4230
$C_{24}H_{16}N_2O_2$ 364.40
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
200
220
240
260
280
300
320
340
360
380
400
WAVELENGTH [NM] --->

POPOP (LC 4230)

Constitution

1,4-Di[2-(5-phenyloxazolyl)]benzene
Pilot 423

$C_{24}H_{16}N_2O_2$ · MW: 364.40



Characteristics

Lambdachrome® number:	4230
CAS registry number:	1806-34-4
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	358 nm
Molar absorptivity:	4.43×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	425 nm

For research and development purposes only.

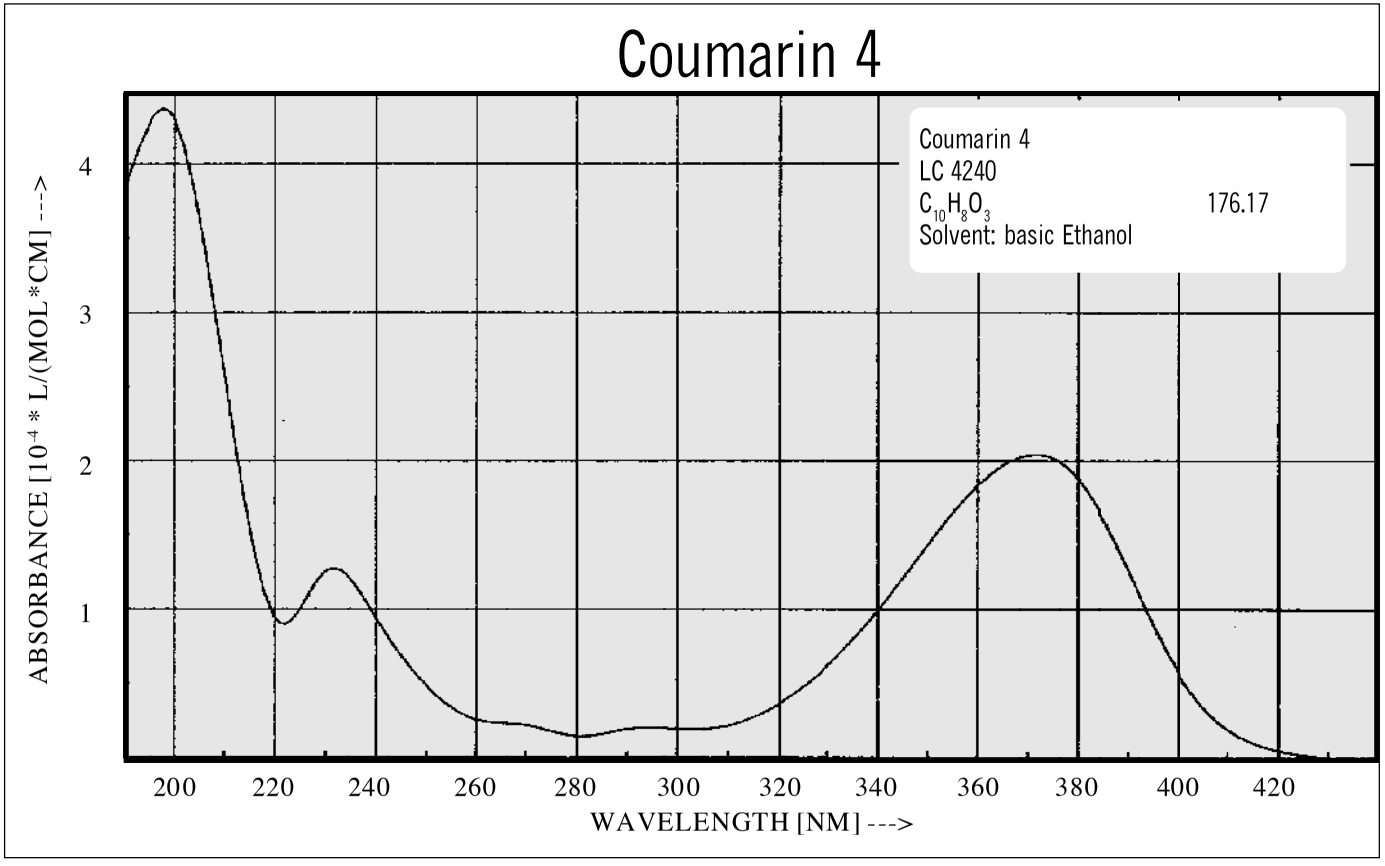
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 420 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*421*	*411 - 446*	*6.5*	*0.42*	*Dioxane*	*1*
Nitrogen	*337*	*421*	*412 - 454*	*rel.*	*0.39*	*EtOH/Tol.*	*1,2*
Nd:YAG, 3rd	*355*	*417*	*-*	*-*	*-*	*Tol.*	*3*
Flashlamp	*-*	*419*	*-*	*-*	*0.12*	*Ethanol*	*4, 5*

References

1. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
2. A. Dienes, *Appl. Phys.* 7, 135 (1975).
3. V. D. Kotzubanov et al., *Opt. Spectrosc.* 25, 406 (1968).
4. H. W. Furumoto, H. L. Ceccon, *J Appl Phys.* 40, 4204 (1969).
5. P. R. Hammond et al., *Appl. Phys.* 9, 67 (1976).

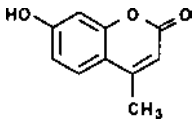

Coumarin 4
Coumarin 4
LC 4240
$C_{10}H_8O_3$ 176.17
Solvent: basic Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
4
3
2
1
200
220
240
260
280
300
320
340
360
380
400
420
WAVELENGTH [NM] --->

Coumarin 4 (LC 4240)

Constitution

7-Hydroxy-4-methylcoumarin
Umbelliferon 47

$C_{10}H_8O_3$ · MW: 176.17



Characteristics

Lambdachrome® number:	4240
CAS registry number:	90-33-5
Appearance:	colorless, crystalline solid
Absorption maximum (in bas. ethanol):	372 nm
Molar absorptivity:	2.10 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	445 nm

For research and development purposes only.

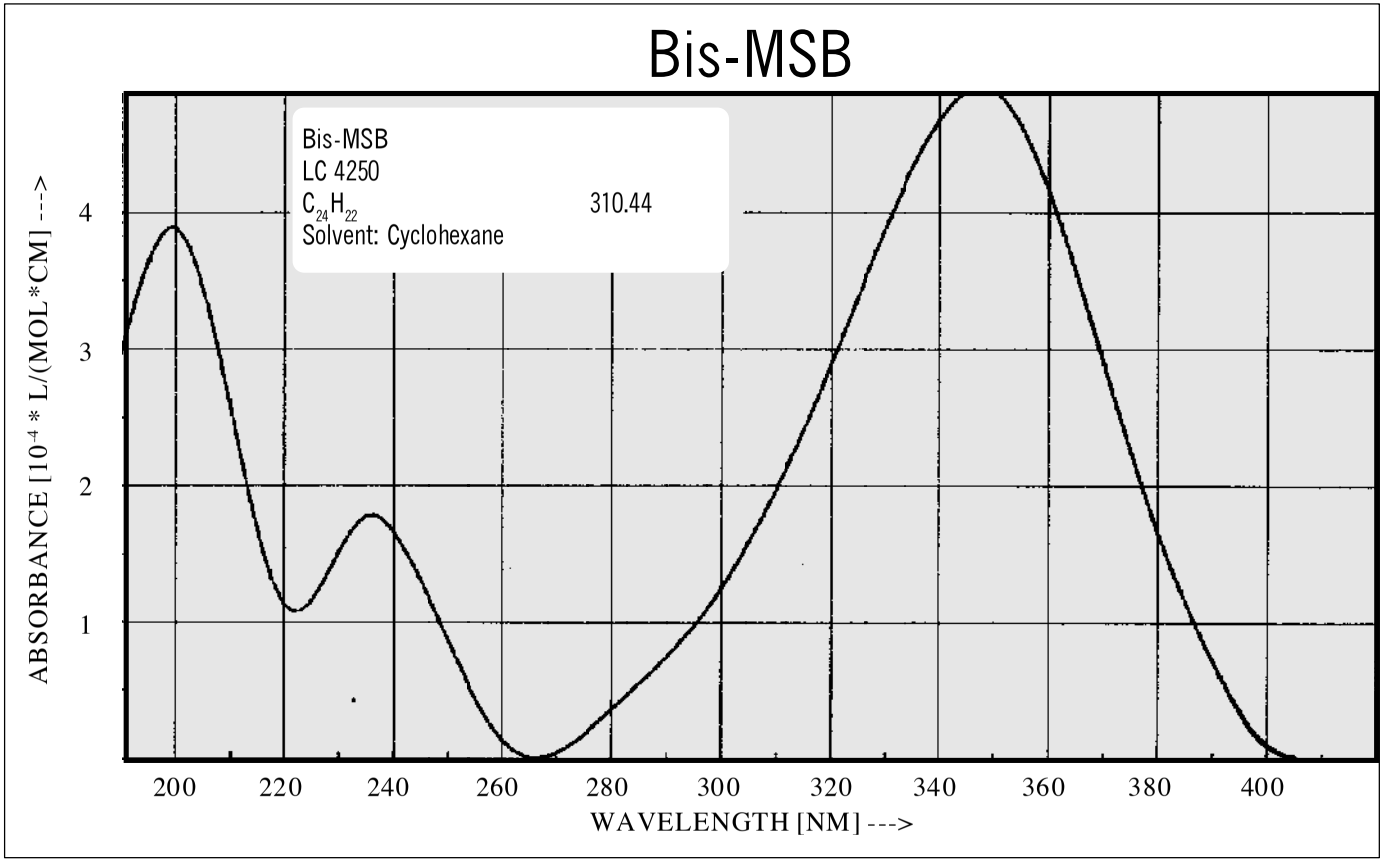
Lasing Performance

Laser dye for pulsed and CW operation; tunable around 450 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nitrogen	*337*	*-*	*370 - 580*	*-*		*various*	*1,2, 3*
Flashlamp	*-*	*454*	*-*	*-*	*0.51*	*Ethanol*	*4, 5*
CW, Ar^+	*UV*	*460*	*460 - 560*	*-*	*0.51*	*Eg.*	*6*

References

1. A. Dienes, *Appl. Phys.* 7, 135 (1975).
2. C. V. Shank et al., *Appl. Phys. Letters* 16(10), 405 (1970).
3. A. Dienes et al., *IEEE J. Quant. Electr.* QE-9, 833 (1973).
4. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).
5. B. B. Snavely et al., *Appl. Phys. Letters* 11(9), 275 (1967).
6. J. M. Yarborough, *Appl. Phys. Letters* 24(12), 629 (1974).

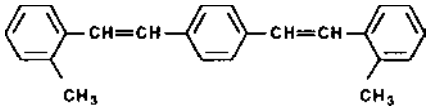

Bis-MSB
Bis-MSB
LC 4250
$C_{24}H_{22}$ 310.44
Solvent: Cyclohexane
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
200
220
240
260
280
300
320
340
360
380
400
WAVELENGTH [NM] --->

Bis-MSB (LC 4250)

Constitution

p-Bis(o-methylstyryl)-benzene

$C_{24}H_{22}$ · MW: 310.44



Characteristics

Lambdachrome® number:	4250
CAS registry number:	13280-61-0
Appearance:	yellow, crystalline solid
Absorption maximum (in cyclohexane):	350 nm
Molar absorptivity:	4.88 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	418 nm

For research and development purposes only.

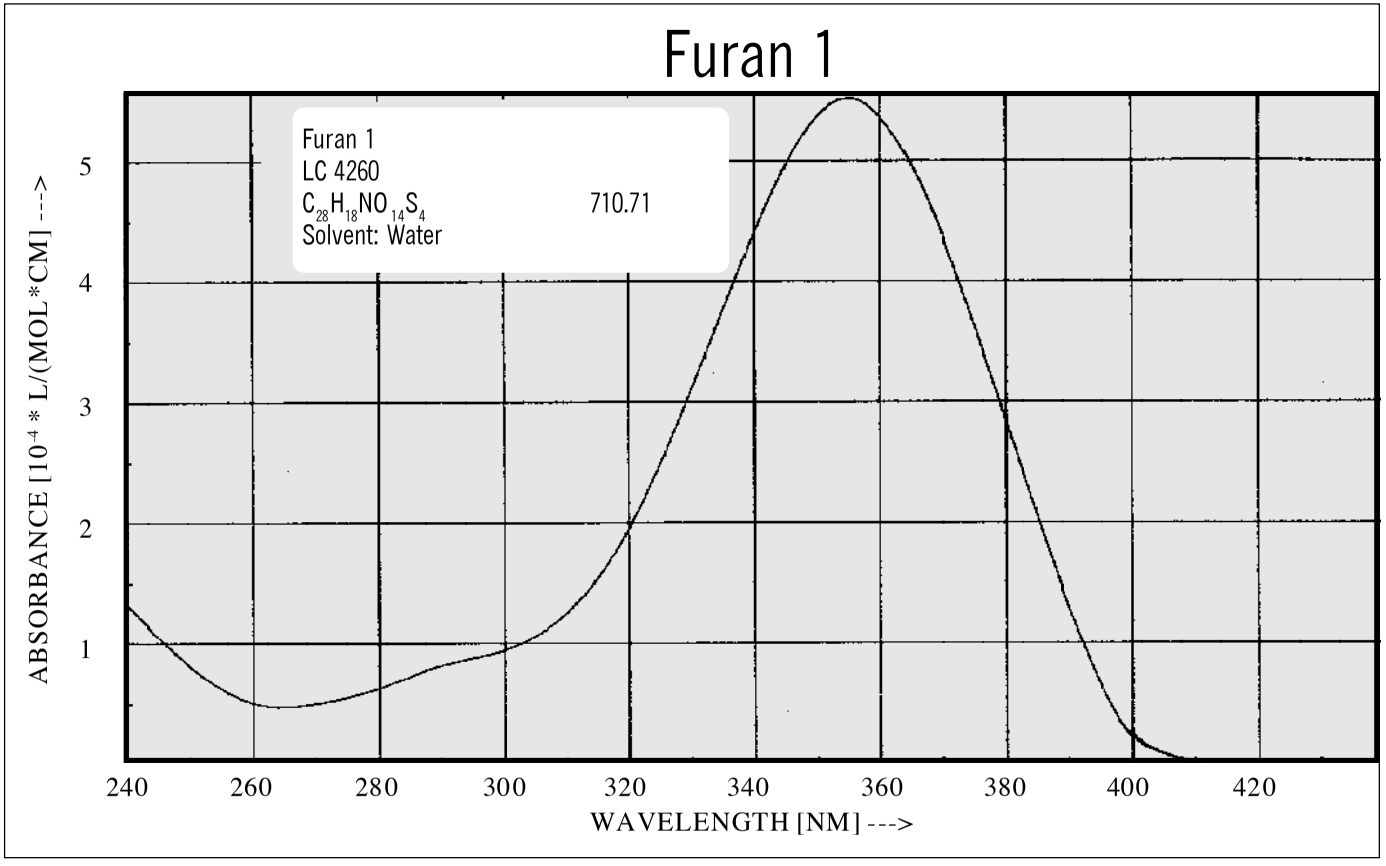
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 400 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*423*	*414 - 428*	*8.3*	*0.24*	*Dioxane*	*1*
Nitrogen	*337*	*421*	*412 - 435*	*rel.*	*0.14*	*Dioxane*	*2, 3*
Nd:YAG, 3rd	*355*	*-*	*-*	*-*	*1.08*	*Dioxane*	*4*
Flashlamp	*-*	*420*	*-*	*-*	*0.12*	*Toluene*	*5*

References

1. Lambda Physik, *Wall Chart* 6/83.
2. O. Uchino et al., *Appl. Phys.* 19, 35 (1979).
3. Lambda Physik, *Data Sheet.*
4. A. J. Cox et al., *Appl. Phys. Letters* 31(6), 389 (1977).
5. H. W. Furumoto et al. *J. Appl. Phys.* 40, 4204 (1969).

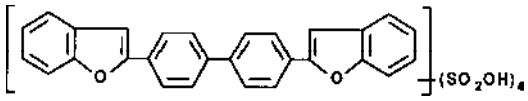

Furan 1
Furan 1
LC 4260
$C_{28}H_{18}NO_{14}S_4$ 710.71
Solvent: Water
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
5
240
260
280
300
320
340
360
380
400
420
WAVELENGTH [NM] --->

Furan 1 (LC 4260)

Constitution

Benzofuran,2,2'-[1,1'-biphenyl]-4,4'-diyl-bis-tetrasulfonic acid (tetrasodium salt)

$C_{28}H_{18}NO_{14}S_4 \cdot$ MW: 710.71



Characteristics

Lambdachrome® number:	4260
CAS registry number:	-
Appearance:	colorless, crystalline solid
Absorption maximum (in water):	355 nm
Molar absorptivity:	5.51 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

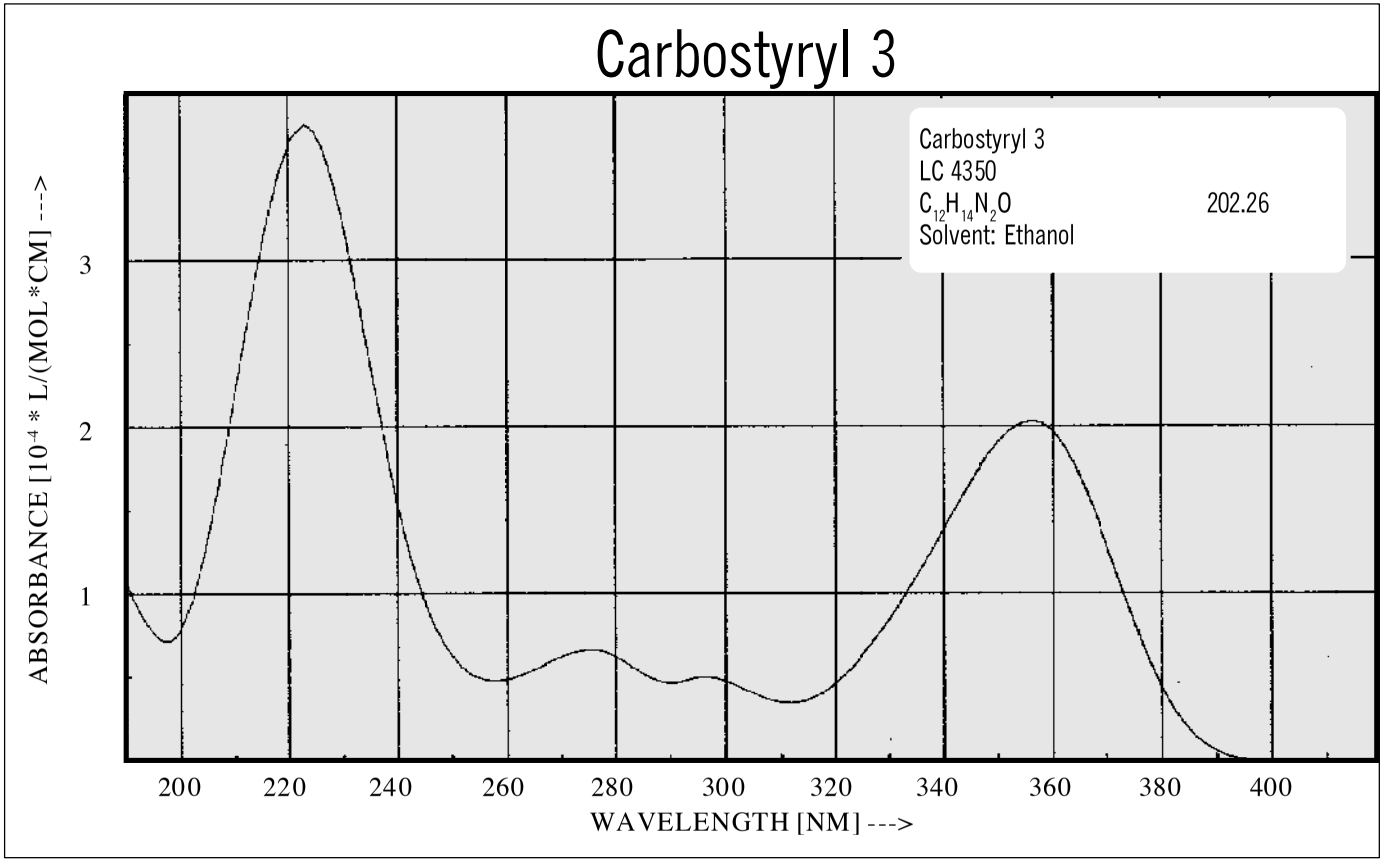
Lasing Performance

Laser dye for pulsed operation; tunable around 420 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*421*	*410 - 435*	*10*	*0.60*	*Methanol*	*1*
Nitrogen	*337*	*425*	*414 - 445*	*3.5*	*1.35*	*Methanol*	*1*
Nd:YAG, 3rd	*355*	*421*	*410 - 435*	*10*	*0.26*	*Methanol*	*2*

References

1. Lambda Physik, *Data Sheet.*
2. Lambda Physik, *Wall Chart* 1996.

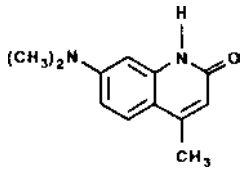

Carbostyryl 3
Carbostyryl 3
LC 4350
$C_{12}H_{14}N_2O$ 202.26
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
200
220
240
260
280
300
320
340
360
380
400
WAVELENGTH [NM] --->

Carbostyryl 3 (LC 4350)

Constitution

7-Dimethylamino-4-methylquinolon-2

$C_{12}H_{14}N_2O$ · MW: 202.26



Characteristics

Lambdachrome® number:	4350
CAS registry number:	-
Appearance:	colorless, crystalline solid
Absorption maximum (in ethanol):	360 nm
Molar absorptivity:	2.03×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	425 nm

For research and development purposes only.

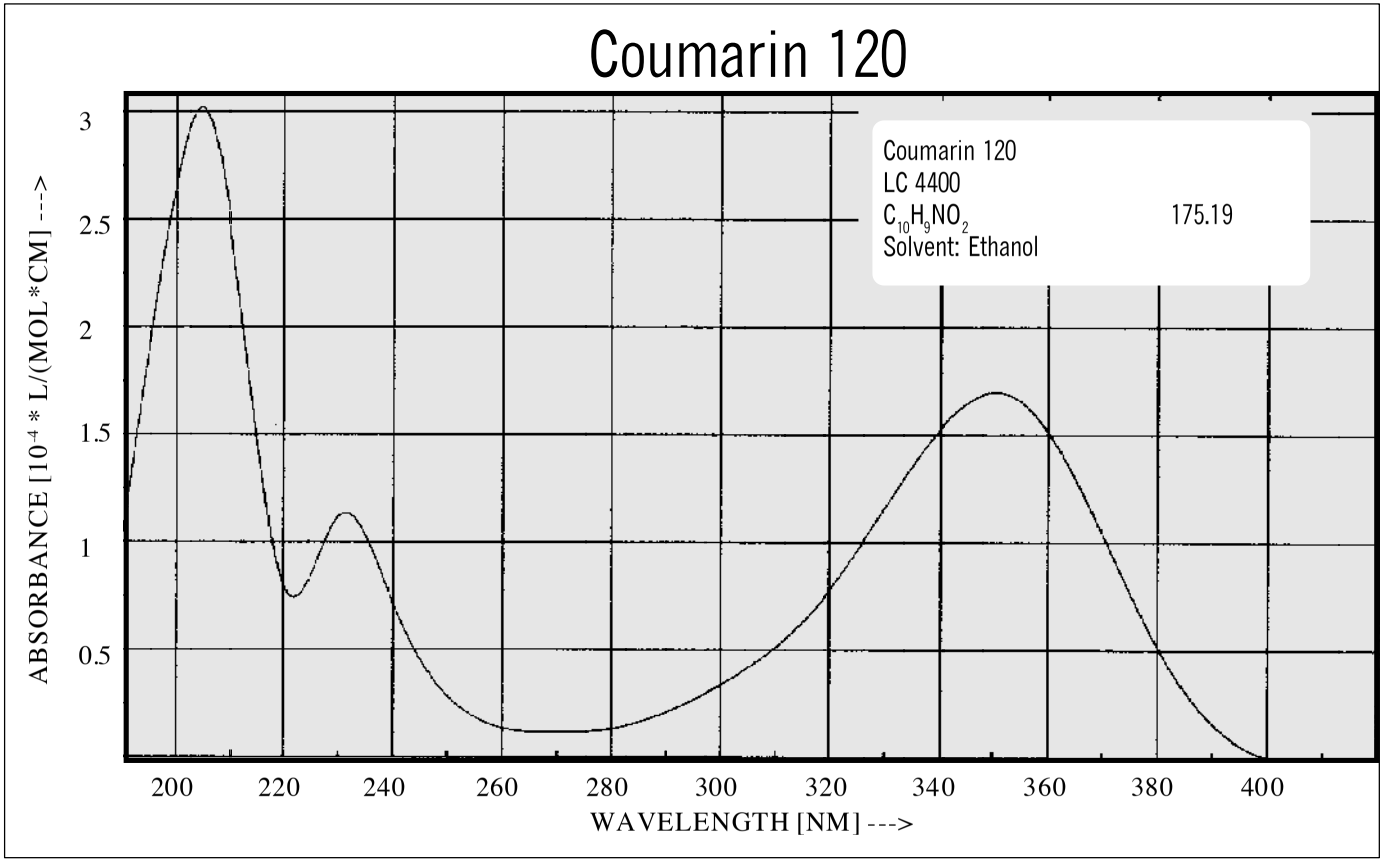
Lasing Performance

Laser dye for pulsed and CW operation; tunable around 440 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*430*	*420 - 440*	*poor*	*0.04*	*Methanol*	*1, 2*
CW, Ar^+	*UV*	*440*	*415 - 490*	*3*	*0.6*	*Eg.*	*3*

References

1. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).
2. J. B. Marling et al., *Appl. Optics* 13(10), 2317 (1974).
3. J. M. Yarborough, *Appl. Phys. Letters* 24(12), 629 (1974).

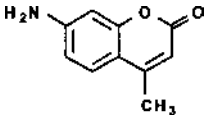

Coumarin 120
Coumarin 120
LC 4400
$C_{10}H_9NO_2$ 175.19
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
3
2.5
2
1.5
1
0.5
200
220
240
260
280
300
320
340
360
380
400
WAVELENGTH [NM] --->

Coumarin 120 (LC 4400)

Constitution

7-Amino-4-methylcoumarin
Coumarin 440

$C_{10}H_9NO_2$ · MW: 175.19



Characteristics

Lambdachrome® number:	4400
CAS registry number:	26093-31-2
Appearance:	slightly yellow, crystalline solid
Absorption maximum (in ethanol):	354 nm
Molar absorptivity:	1.81 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	435 nm

For research and development purposes only.

Lasing Performance

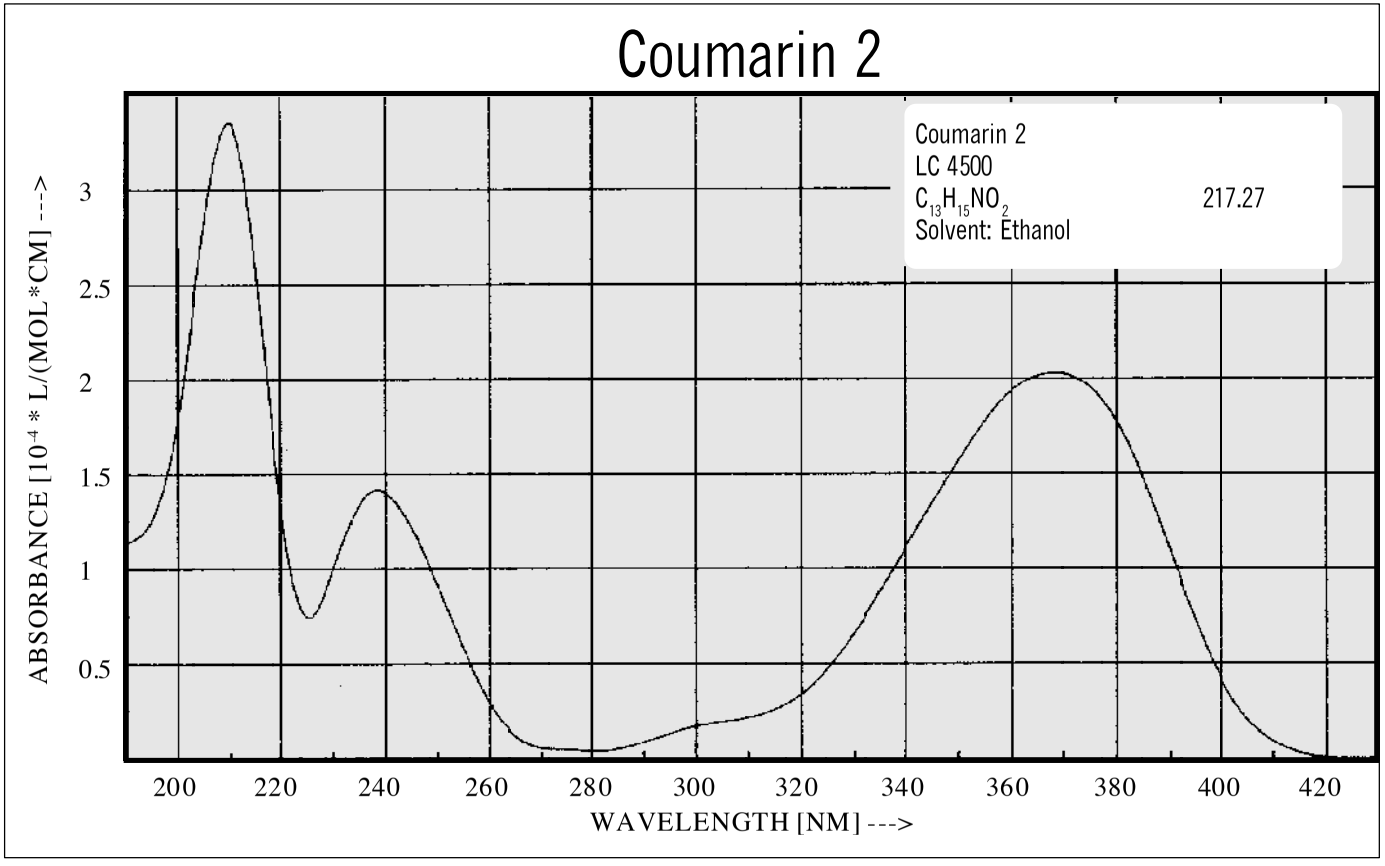
Efficient laser dye for pulsed and CW operation; tunable around 440 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*441*	*423 - 462*	*15*	*0.82*	*Methanol*	*1,2*
Nitrogen	*337*	*438*	*418 - 465*	*rel.*	*0.25*	*Methanol*	*2, 3*
Nd:YAG, 3rd	*355*	*440*	*420 - 470*	*16*	*0.25*	*Methanol*	*1, 4*
Flashlamp	*-*	*440*	*420 - 470*	*-*	*0.04*	*Methanol*	*5*
CW, Ar^+	*UV*	*450*	*425 - 475*	*-*	*0.52*	*Eg.*	*6*

References

1. Lambda Physik, *Wall Chart* 1996.
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. Lambda Physik, *Data Sheet.*
4. K. Kato, *IEEE J. Quantum Electr.* QE-11, 373 (1975).
5. J. B. Marling et al., *Appl. Optics* 13(10), 2317 (1974).
6. J. M. Yarborough, *Appl. Phys. Letters* 24(12), 629 (1974).

Coumarin 2

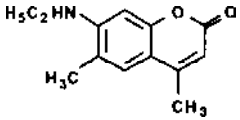

Coumarin 2
LC 4500
$C_{13}H_{15}NO_2$ 217.27
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
3
2.5
2
1.5
1
0.5
200
220
240
260
280
300
320
340
360
380
400
420
WAVELENGTH [NM] --->

Coumarin 2 (LC 4500)

Constitution

7-Amino-4-methylcoumarin
Coumarin 450

$C_{13}H_{15}NO_2$ · MW: 217.27



Characteristics

Lambdachrome® number:	4500
CAS registry number:	26078-25-1
Appearance:	slightly yellow, crystalline solid
Absorption maximum (in ethanol):	366 nm
Molar absorptivity:	2.02 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	443 nm

For research and development purposes only.

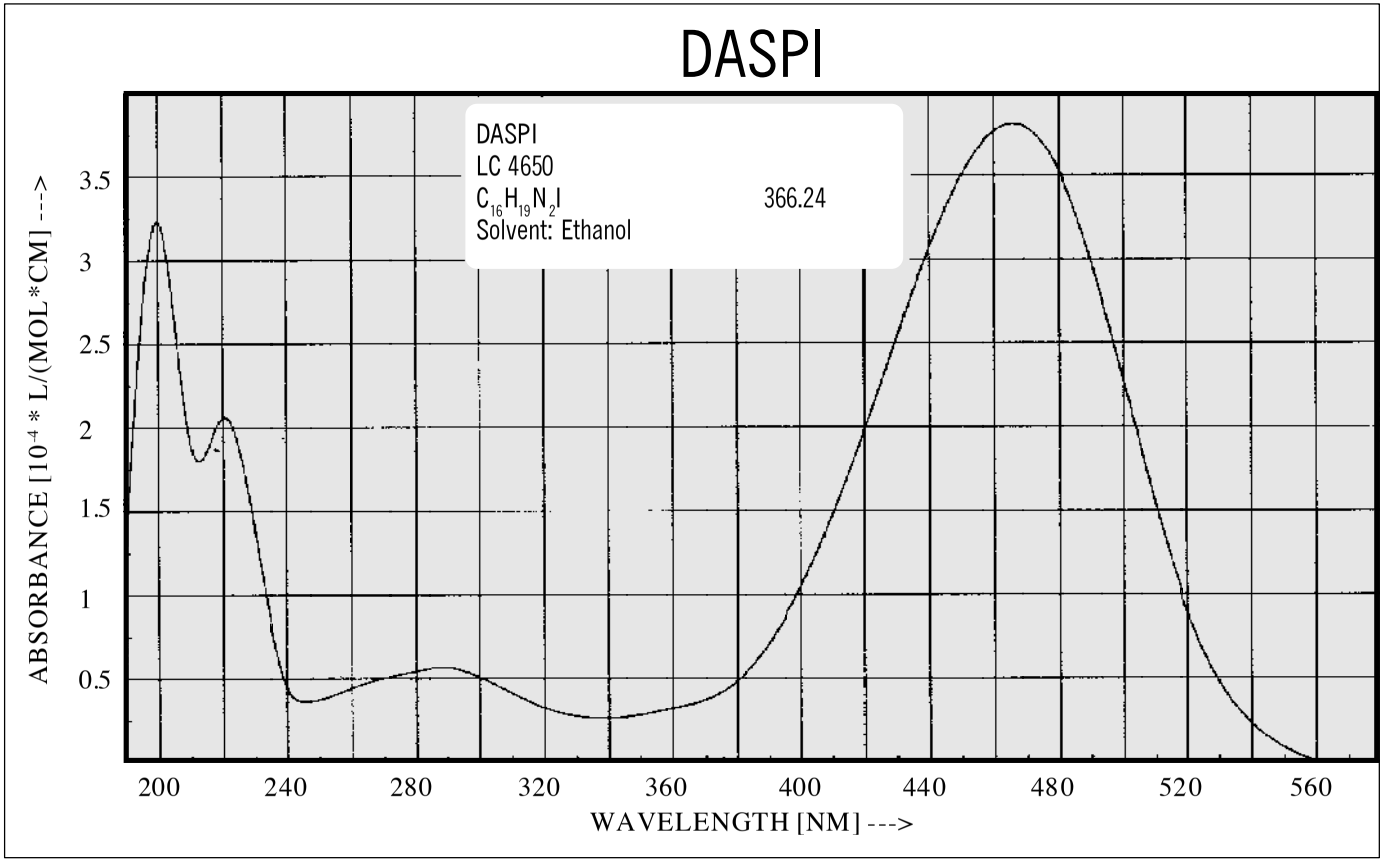
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 450 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*448*	*432- 475*	*15*	*1.50*	*Methanol*	*1, 2*
Nitrogen	*337*	*444*	*426 - 475*	*rel.*	*0.40*	*Methanol*	*3, 4*
Nd:YAG, 3rd	*355*	*450*	*435 - 467*	*10*	*0.30*	*Methanol*	*3, 5*
Flashlamp	*-*	*450*	*440 - 458*	*-*	*-*	*Ethanol*	*6*
CW, Ar^+	*UV*	*450*	*430 - 480*	*-*	*0.59*	*Bz./Eg.*	*7*

References

1. Lambda Physik, *Wall Chart* 1996.
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. Lambda Physik, *Data Sheet.*
4. R. J. von Gutfeld et al., *IEEE J. Quantum Electron.* QE-6, 332 (1970).
5. D. M. Guthals, J. W. Nibler, Opt. Commun. 29(3), 322 (1979).
6. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).
7. Coherent, *CW Dye Laser Fact Sheets.*

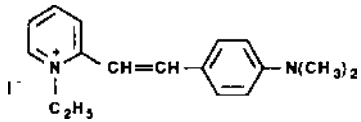

DASPI
DASPI
LC 4650
$C_{16}H_{19}N_2I$ 366.24
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
3.5
3
2.5
2
1.5
1
0.5
200
240
280
320
360
400
440
480
520
560
WAVELENGTH [NM] --->

DASPI (LC 4650)

Constitution

2-(p-Dimethylaminostyryl)-pyridylmethyl Iodide

$C_{16}H_{19}N_2I$ · MW: 366.24



Characteristics

Lambdachrome® number:	4650
CAS registry number:	-
Appearance:	orange, crystalline solid
Absorption maximum (in ethanol):	472 nm
Molar absorptivity:	3.83×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

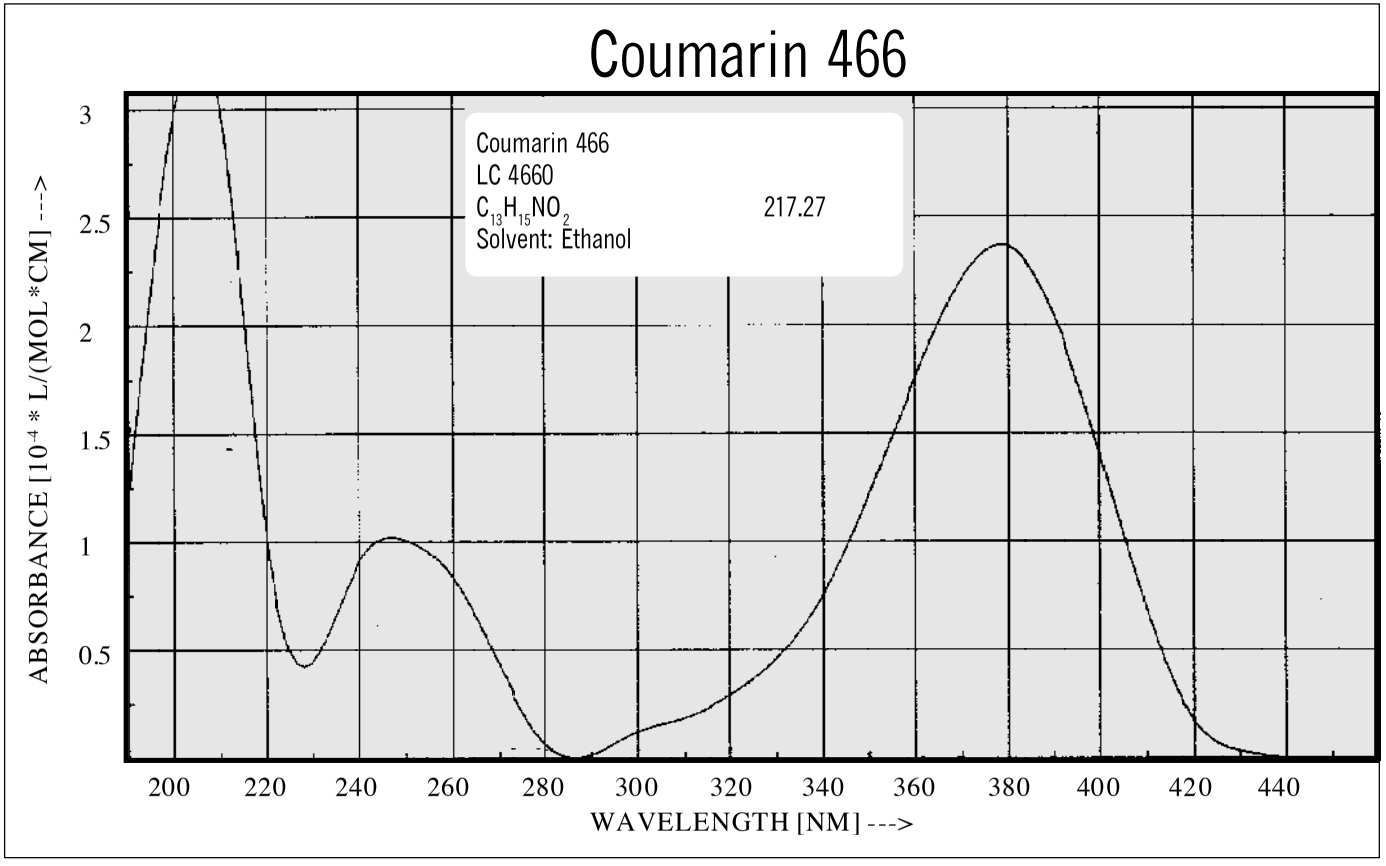
Lasing Performance

Saturable absorber for flashlamp pumped Coumarin 1, 102, 466, and 6H dye lasers[1.].

References

1. W. Sibbett, J. R. Taylor, *Opt. Commun.* 46(1), 32 (1983).

Coumarin 466

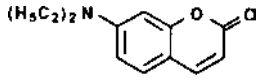


Coumarin 466 (LC 4660)

Constitution

7-Diethylaminocoumarin
LD 466 · C1H

$C_{13}H_{15}NO_2$ · MW: 217.27



Characteristics

Lambdachrome® number:	4660
CAS registry number:	-
Appearance:	yellow, crystalline solid
Absorption maximum (ethanol):	380 nm
Molar absorptivity:	2.38 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

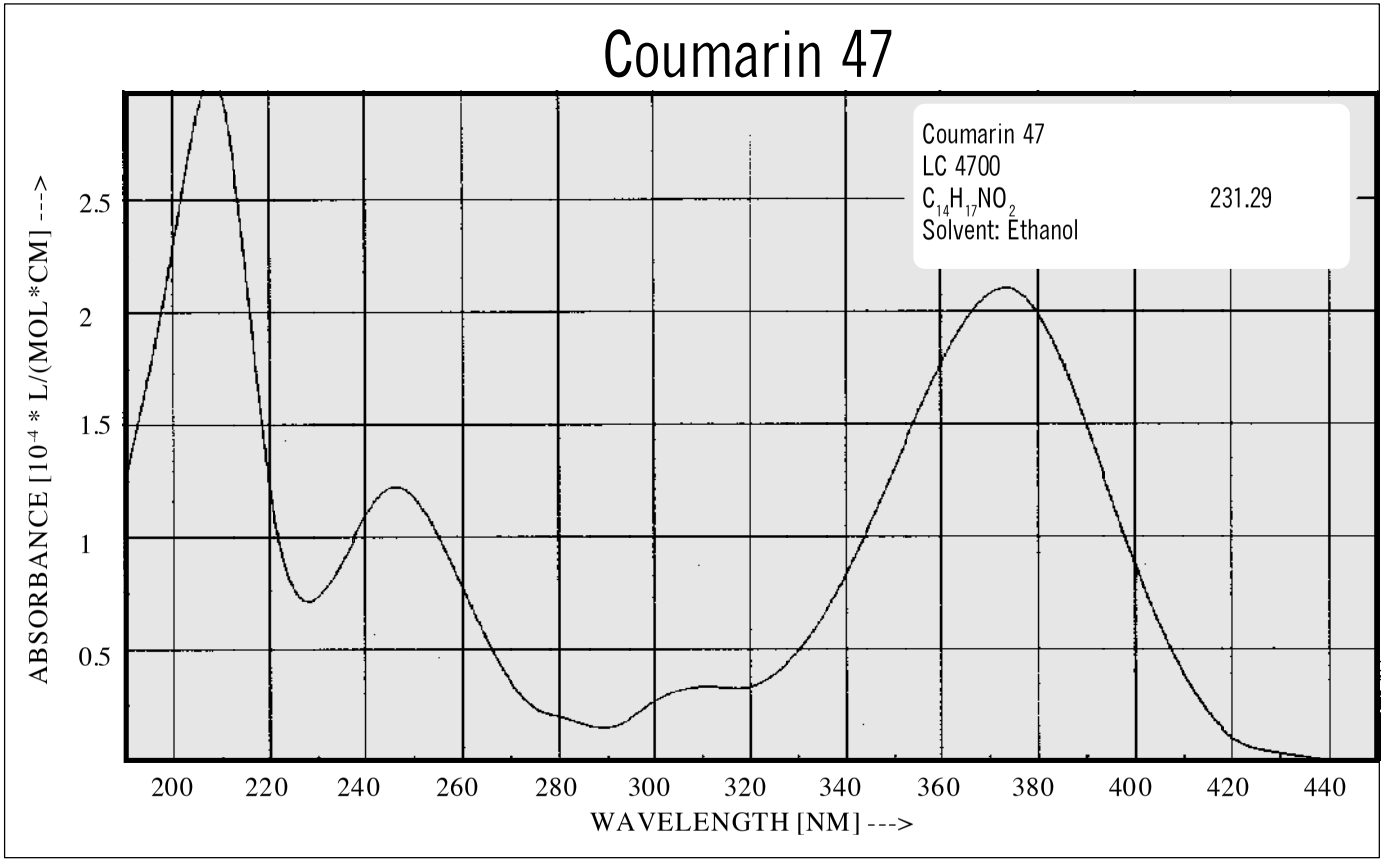
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 465 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*466*	-	-	*0.16*	*Ethanol*	*1, 2*

References

1. E. J. Schimitschek et al., *Opt. Commun.* 16(3), 313 (1976).
2. E. A. Stappaerts, *Appl. Optics* 16(12), 3079 (1977).

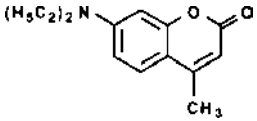

Coumarin 47
Coumarin 47
LC 4700
$C_{14}H_{17}NO_2$ 231.29
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440
WAVELENGTH [NM] --->

Coumarin 47 (LC 4700)

Constitution

7-Diethylamino-4-methylcoumarin
Coumarin 460 · Coumarin 1

$C_{14}H_{17}NO_2$ · MW: 231.29



Characteristics

Lambdachrome® number:	4700
CAS registry number:	99-44-1
Appearance:	slightly yellow, crystalline solid
Absorption maximum (in ethanol):	373 nm
Molar absorptivity:	2.10 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	450 nm

For research and development purposes only.

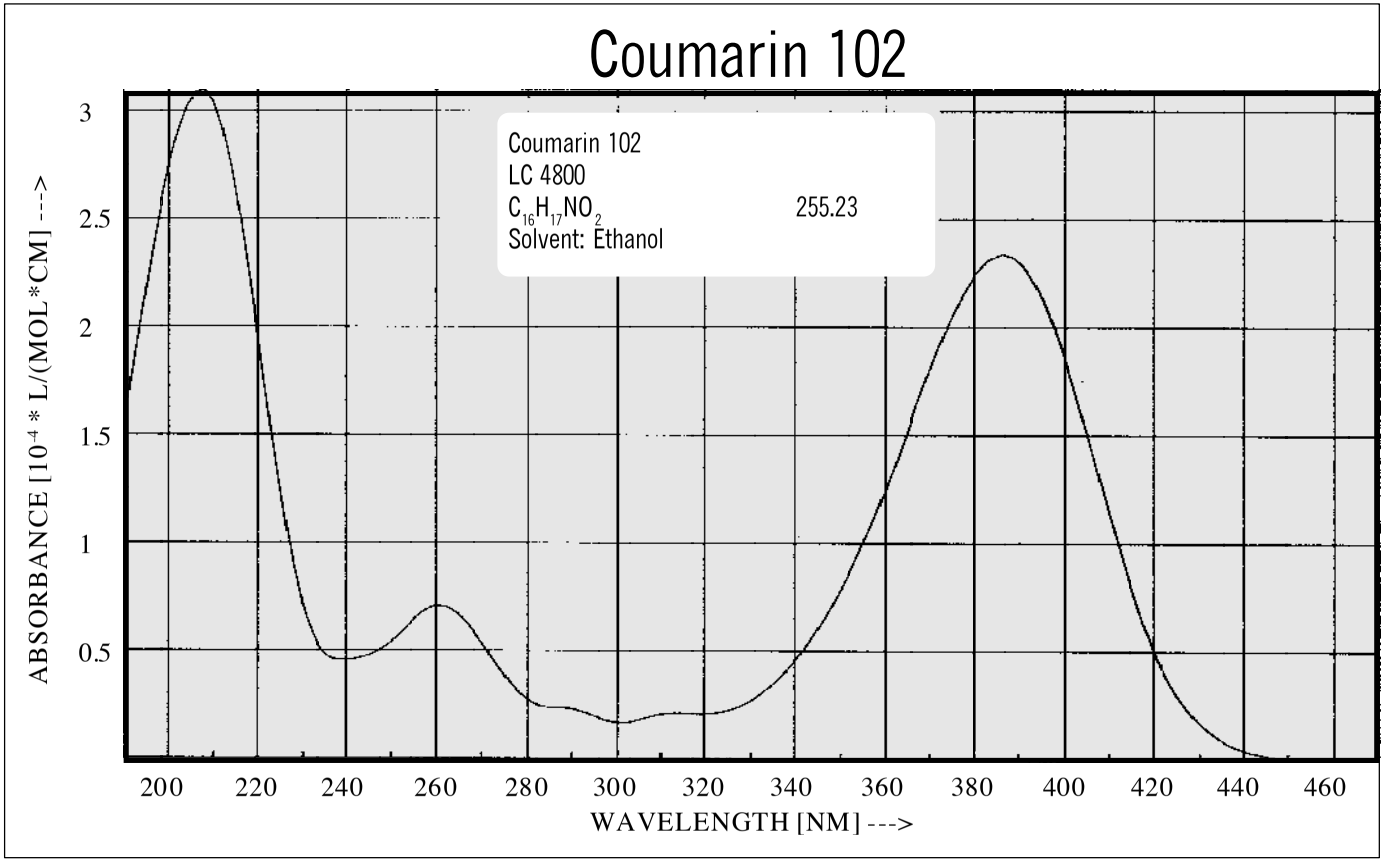
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 450 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*456*	*440 - 484*	*18*	*1.60*	*Methanol*	*1, 2, 3*
Nitrogen	*337*	*453*	*436 - 486*	*rel.*	*0.66*	*Methanol*	*3, 4*
Nd:YAG, 3rd	*355*	*460*	*444 - 476*	*15*	*0.3*	*Methanol*	*1, 5*
Flashlamp	*-*	*460*	*435 - 490*	*-*	*0.02*	*Ethanol*	*6, 7*
CW, Ar^+	*UV*	*470*	*450 - 500*	*-*	*1.76*	*MeOH/Eg.*	*8*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. D. M. Guthals, J. W. Nibbler, *Opt. Commun.* 29(3), 322 (1977).
6. J. B. Marling et al., *Appl. Optics* 13(10), 2317 (1974).
7. J. B. Marling et al., *Appl. Phys. Letters* 17(12), 527 (1970).
8. Coherent, *CW Dye Laser Fact Sheets.*

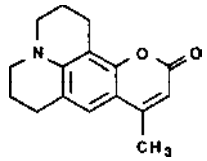

Coumarin 102
Coumarin 102
LC 4800
$C_{16}H_{17}NO_2$ 255.23
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
3
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460
WAVELENGTH [NM] --->

Coumarin 102 (LC 4800)

Constitution

2,3,5,6-1H,4H-Tetrahydro-8-methylquinolizino-[9,9a,1-gh]-coumarin
Coumarin 480

$C_{16}H_{17}NO_2$ · MW: 255.23



Characteristics

Lambdachrome® number:	4800
CAS registry number:	41267-76-9
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	389 nm
Molar absorptivity:	2.15 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	465 nm

For research and development purposes only.

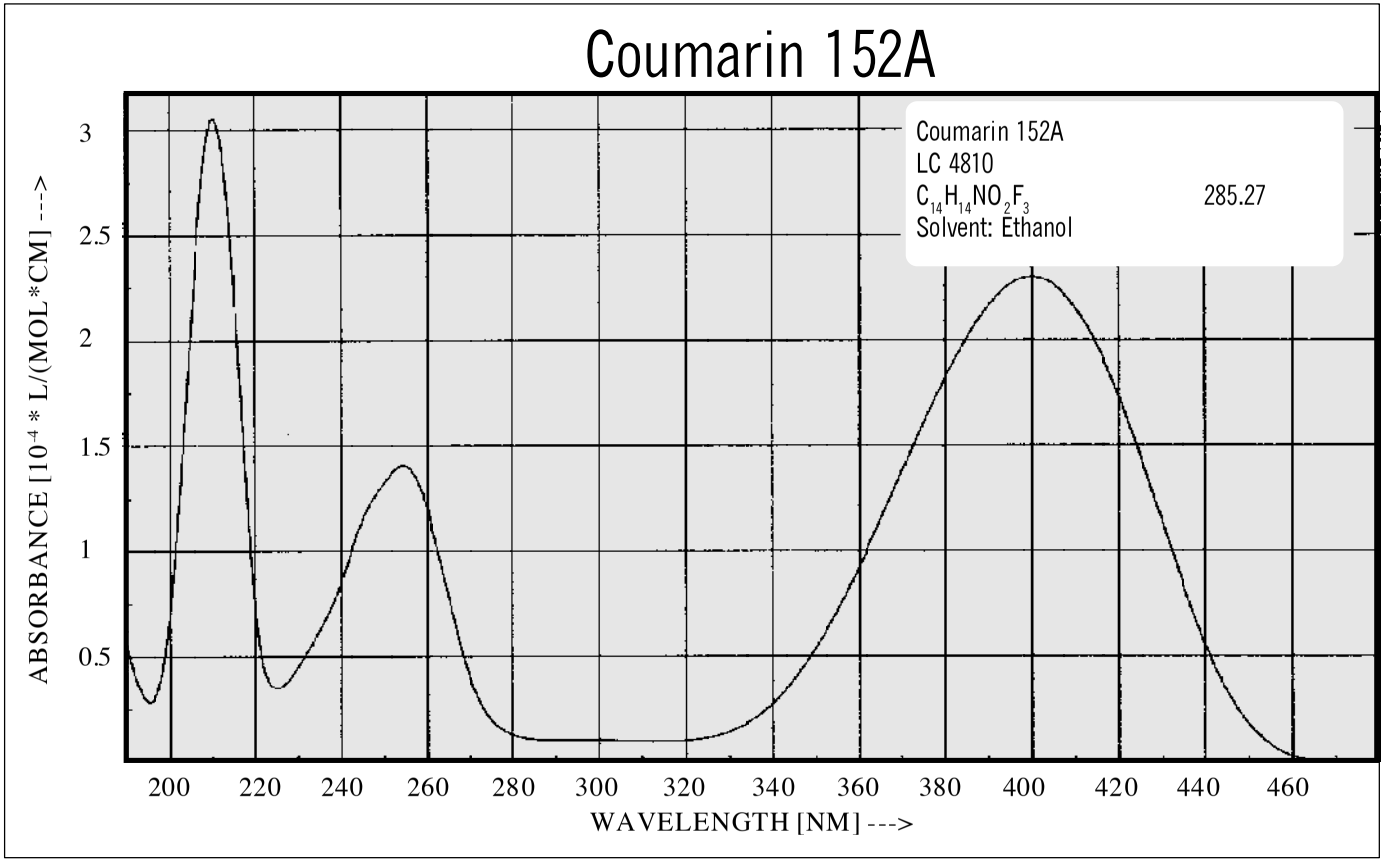
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 480 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*480*	*460 - 510*	*18*	*2.30*	*Methanol*	*1, 2*
Nitrogen	*337*	*470*	*454 - 506*	*rel.*	*1.44*	*Methanol*	*3*
Nd:YAG, 3rd	*355*	*480*	*462 - 497*	*15*	*0.40*	*Methanol*	*1, 4*
Flashlamp	*-*	*480*	*460 - 530*		*0.05*	*Methanol*	*5*
CW, Ar^+	*UV*	*482*	*463 - 515*	*-*	*2.0*	*Bz./Eg.*	*1, 6*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
3. Lambda Physik, *Data Sheet.*
4. K. Kato, *IEEE J. Quant. Electron.* QE-11, 373 (1975).
5. J. B. Marling et al., *Appl. Optics* 13(10), 2317 (1974).
6. Coherent, *CW Dye Laser Fact Sheets.*

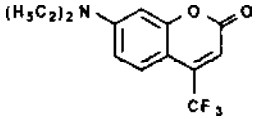

Coumarin 152A
Coumarin 152A
LC 4810
$C_{14}H_{14}NO_2F_3$ 285.27
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
3
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460
WAVELENGTH [NM] --->

Coumarin 152A (LC 4810)

Constitution

7-Diethylamino-4-trifluormethylcoumarin
Coumarin 481 · C1F

$C_{14}H_{14}NO_2F_3$ · MW: 285.27



Characteristics

Lambdachrome® number:	4810
CAS registry number:	41934-47-8
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	405 nm
Molar absorptivity:	2.16 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	510 nm

For research and development purposes only.

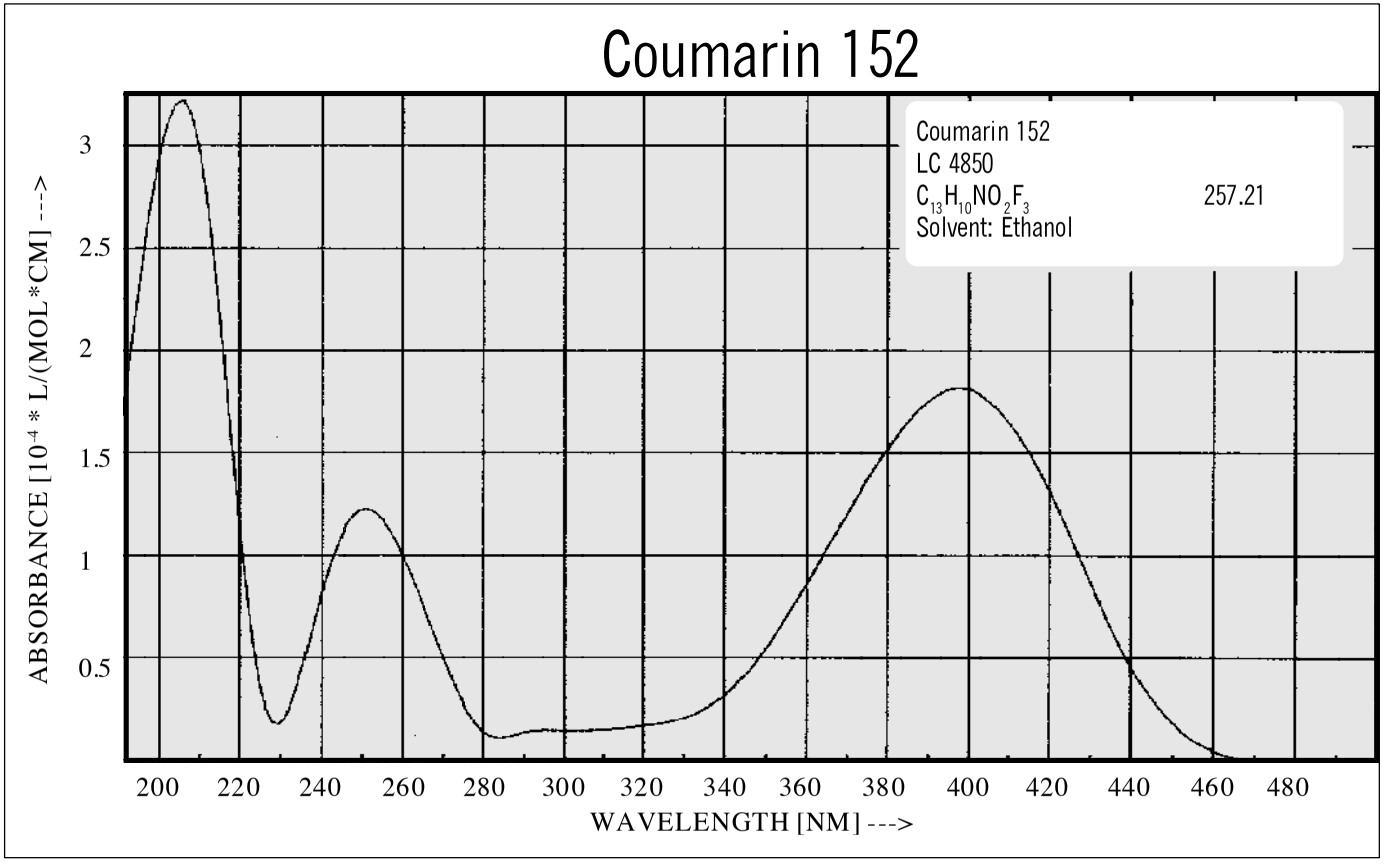
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 500 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*517*	*491 - 553*	*4*	*1.84*	*Ethanol*	*1, 2*
Nitrogen	*337*	*490*	*461 - 549*	*rel.*	*1.71*	*Dioxane*	*2, 3*
Nd:YAG, 3rd	*355*	*520*	*500 - 540*	*-*	*2.85*	*Ethanol*	*4*
Flashlamp	*-*	*481*	*-*	*-*	*0.21*	*Dioxane*	*5*

References

1. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. J. A. Halstead, R. R. Reeves, *Opt. Commun.* 27(2), 273 (1978).
4. D. M. Guthals, J. W. Nibbler, *Opt. Commun.* 29(3), 322 (1977).
5. E. J. Schimitschek et al., *IEEE J. Quantum Electron.* QE-9, 781 (1973).

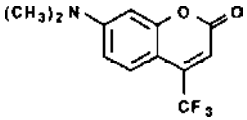

Coumarin 152
Coumarin 152
LC 4850
$C_{13}H_{10}NO_2F_3$ 257.21
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
3
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480
WAVELENGTH [NM] --->

Coumarin 152 (LC 4850)

Constitution

7-Dimethylamino-4-trifluormethylcoumarin
Coumarin 485 · C2F

$C_{13}H_{10}NO_2F_3$ · MW: 257.21



Characteristics

Lambdachrome® number:	4850
CAS registry number:	53518-14-2
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	397 nm
Molar absorptivity:	1.97 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	510 nm

For research and development purposes only.

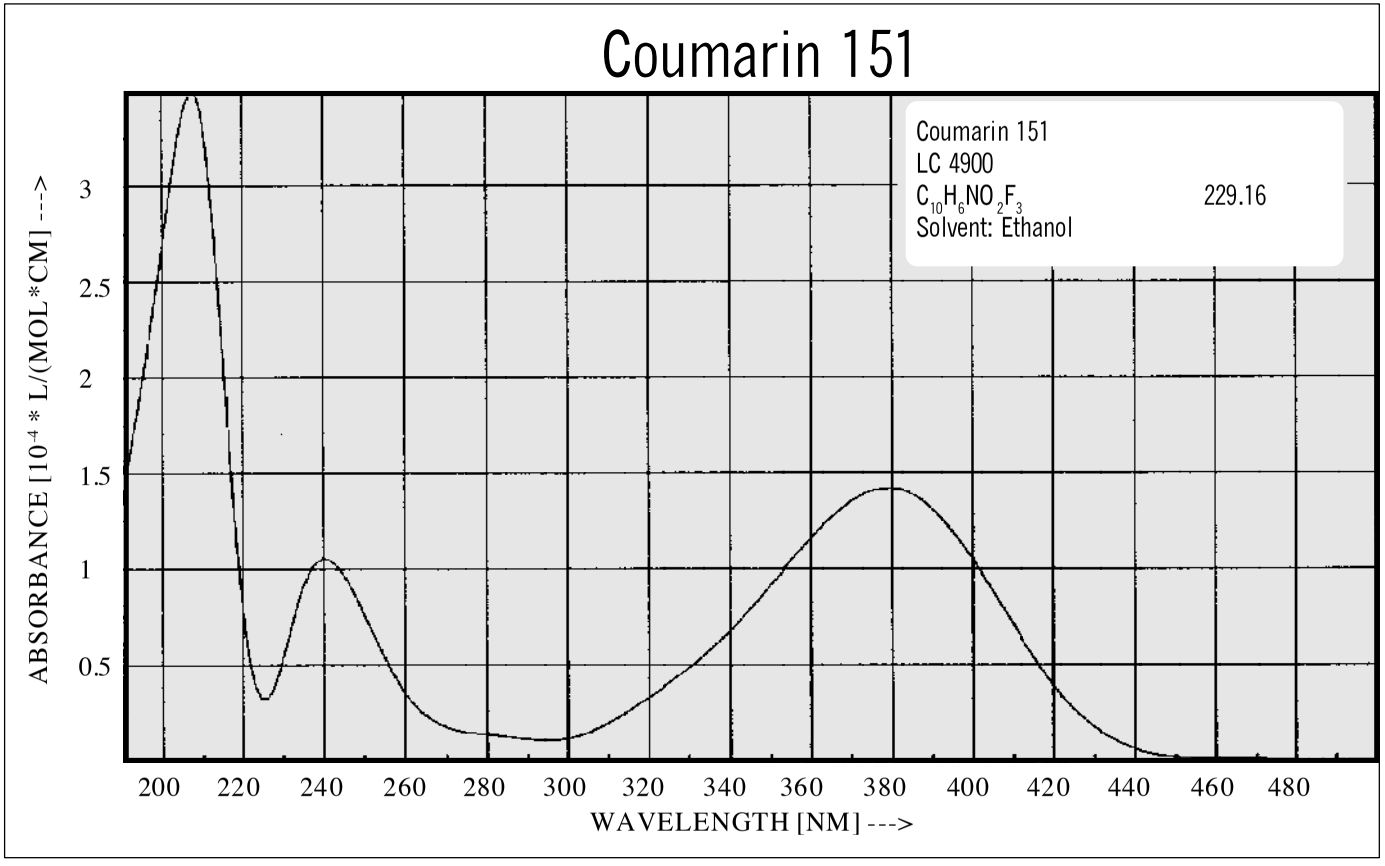
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 520 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*520*	*490 - 570*	*5.5*	*2.00*	*Ethanol*	*1*
Nitrogen	*337*	*532*	*495 - 560*	-	-	*Ethanol*	*2*
Flashlamp	-	-	*518 - 531*	-	-	*Ethanol*	*3*

References

1. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
2. Lambda Physik, *Data Sheet.*
3. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).

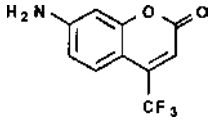

Coumarin 151
Coumarin 151
LC 4900
$C_{10}H_6NO_2F_3$ 229.16
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
3
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480
WAVELENGTH [NM] --->

Coumarin 151 (LC 4900)

Constitution

7-Amino-4-trifluormethylcoumarin
Coumarin 490 · C3F

$C_{10}H_6NO_2F_3$ · MW: 229.16



Characteristics

Lambdachrome® number:	4900
CAS registry number:	53518-13-3
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	382 nm
Molar absorptivity:	1.70 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	480 nm

For research and development purposes only.

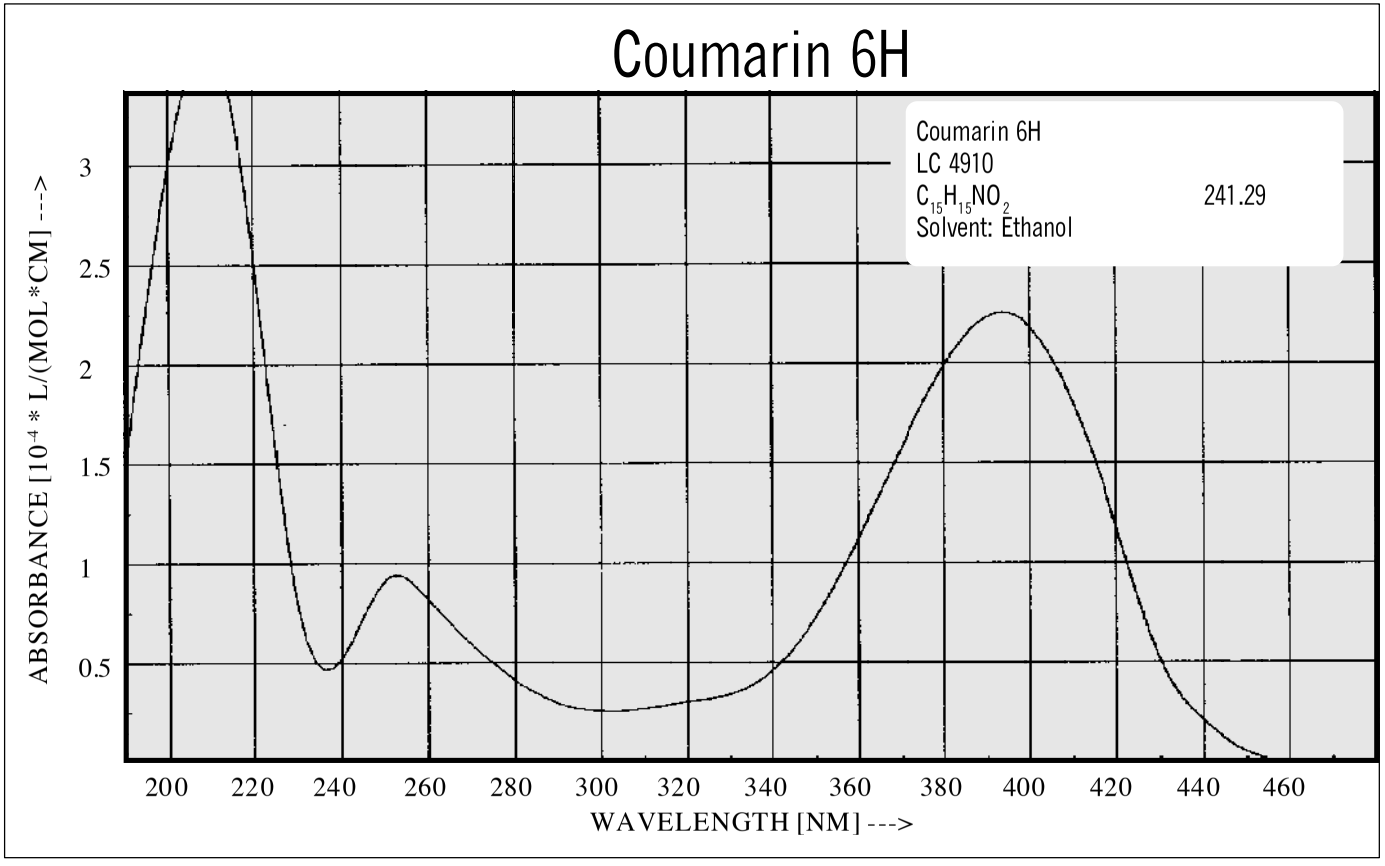
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 490 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*490*	*481 - 493*	-	-	*Ethanol*	*1, 2*

References

1. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).
2. G. A. Reynolds, K. H. Drexhage, *Opt. Commun.* 13(3), 222 (1975).

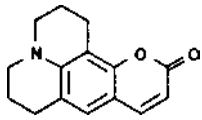

Coumarin 6H
Coumarin 6H
LC 4910
$C_{15}H_{15}NO_2$ 241.29
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
3
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460
WAVELENGTH [NM] --->

Coumarin 6H (LC 4910)

Constitution

2,3,5,6-1H,4H-Tetrahydroquinolizino-[9,9a,1-gh]coumarin
LD 490 · C6H

$C_{15}H_{15}NO_2$ · MW: 241.29



Characteristics

Lambdachrome® number:	4910
CAS registry number:	58336-35-9
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	396 nm
Molar absorptivity:	2.50 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

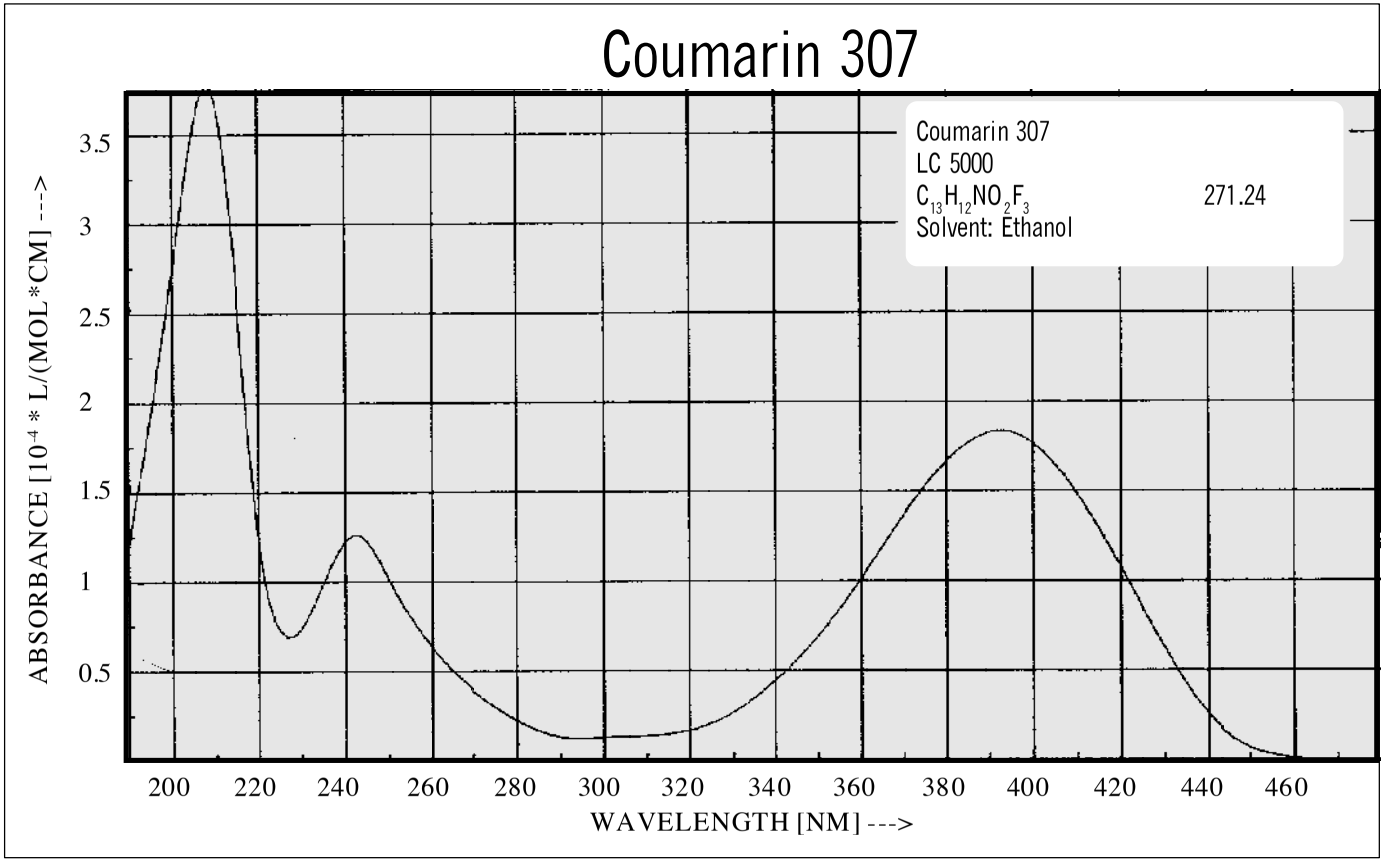
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 490 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*491*	*463 - 522*	*5.7*	*1.33*	*Etahnol*	*1*
Flashlamp	-	-	*477 - 493*	-	-	*Ethanol*	*2*
CW, Kr^+	*VIO*	*490*	*476 - 515*	-	*1.20*	*Eg./Bz.*	*3*

References

1. Lambda Physik.
2. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).
3. Lambda Physik, *Data Sheet.*

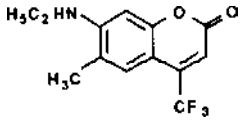

Coumarin 307
Coumarin 307
LC 5000
$C_{13}H_{12}NO_2F_3$ 271.24
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
3.5
3
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460
WAVELENGTH [NM] --->

Coumarin 307 (LC 5000)

Constitution

7-Ethylamino-6-methyl-4-trifluormethylcoumarin
Coumarin 503

$C_{13}H_{12}NO_2F_3$ · MW: 271.24



Characteristics

Lambdachrome® number:	5000
CAS registry number:	55804-66-5
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	395 nm
Molar absorptivity:	1.85 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	490 nm

For research and development purposes only.

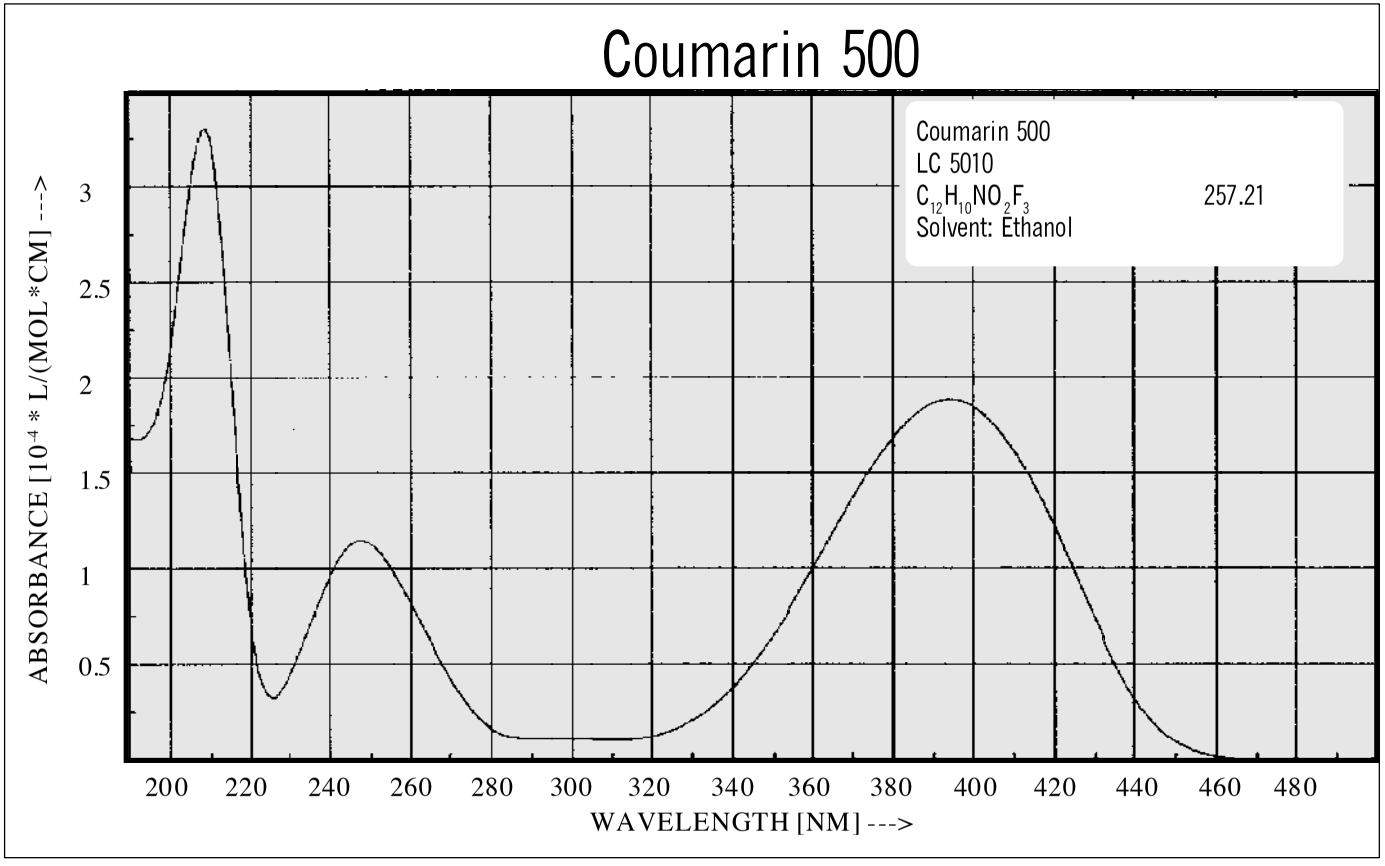
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 500 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*500*	*479 - 553*	*16*	*3.40*	*Methanol*	*1, 2*
Nitrogen	*337*	*504*	*478 - 547*	*rel.*	*1.60*	*Methanol*	*3, 4*
Nd:YAG, 3rd	*355*	*508*	*485 - 546*	*15*	*0.70*	*Methanol*	*1*
Flashlamp	*-*	*-*	*490 - 510*	*-*	*-*	*Ethanol*	*6*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. A. N. Fletcher, *Appl Phys.* 14, 295 (1977).

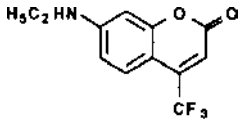

Coumarin 500
Coumarin 500
LC 5010
$C_{12}H_{10}NO_2F_3$ 257.21
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
3
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480
WAVELENGTH [NM] --->

Coumarin 500 (LC 5010)

Constitution

7-Ethylamino-4-trifluormethylcoumarin

$C_{12}H_{10}NO_2F_3$ · MW: 257.21



Characteristics

Lambdachrome® number:	5010
CAS registry number:	-
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	395 nm
Molar absorptivity:	1.85 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

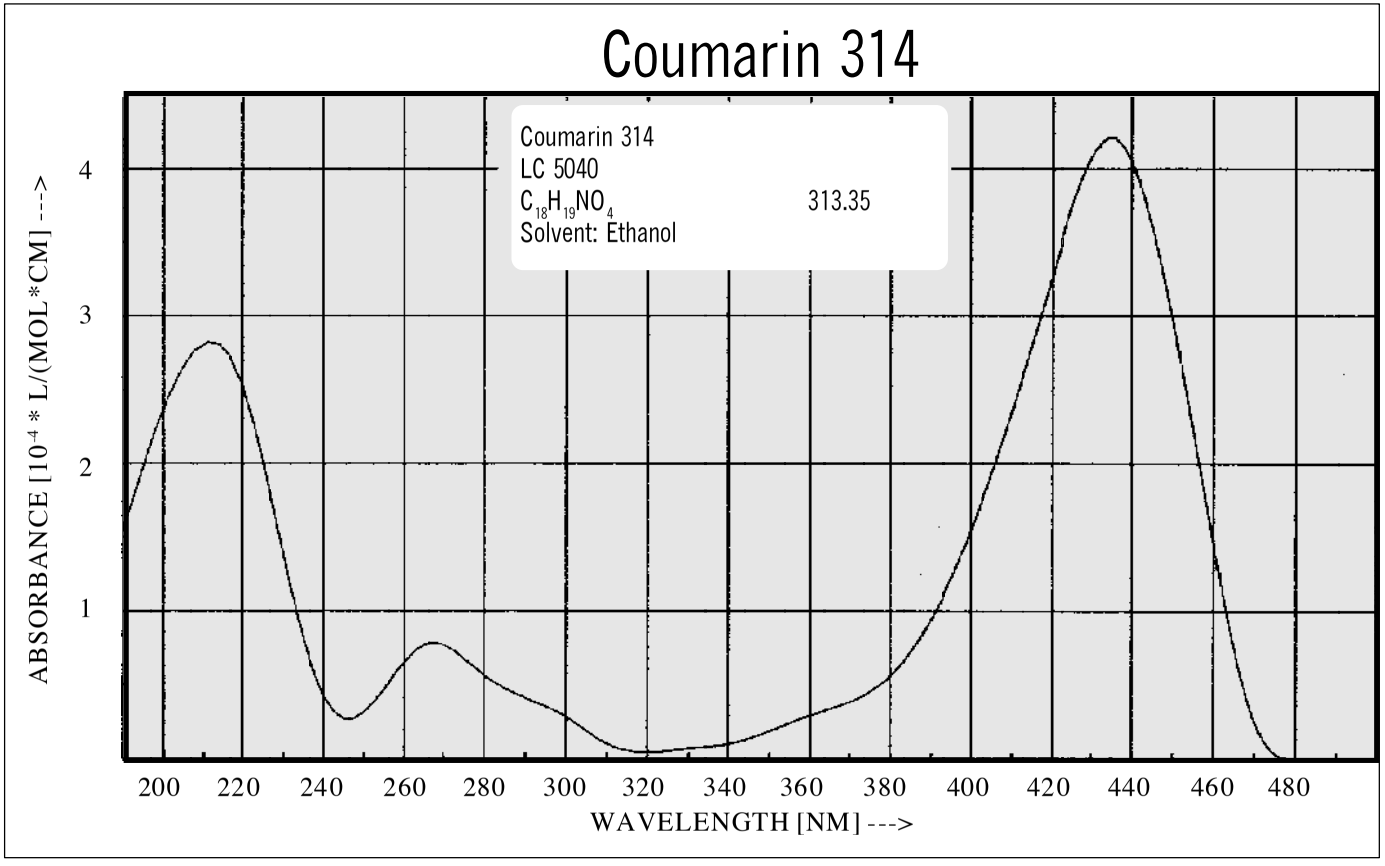
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 500 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*502*	*480 - 520*	*12*	*2.40*	*Methanol*	*1, 2*
Nitrogen	*337*	*503*	*473 - 562*	*rel.*	*1.40*	*Ethanol*	*2*
Nd:YAG, 3rd	*355*	*518*	*498 - 546*	*10*	*0.70*	*Methanol*	*3, 6*
Flashlamp	-	-	-	-	-	-	*4, 5*

References

1. Lambda Physik
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. D. M. Guthals, J. W. Nibler, *Opt. Commun.* 29(3), 322(1979).
4. Th. Varghese, *Opt. Commun.* 44(5), 353(1983).
5. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).
6. Lambda Physik, *Wall Chart* 1996.

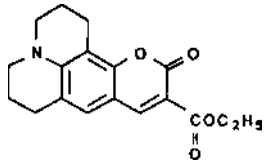

Coumarin 314
Coumarin 314
LC 5040
$C_{18}H_{19}NO_4$ 313.35
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480
WAVELENGTH [NM] --->

Coumarin 314 (LC 5040)

Constitution

2,3,5,6-1H,4H-Tetrahydro-9-carboethoxyquinolizino-[9,9a,1-gh]coumarin
Coumarin 504

$C_{18}H_{19}NO_4$ · MW: 313.35



Characteristics

Lambdachrome® number:	5040
CAS registry number:	55804-66-5
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	436 nm
Molar absorptivity:	4.70 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	480 nm

For research and development purposes only.

Lasing Performance

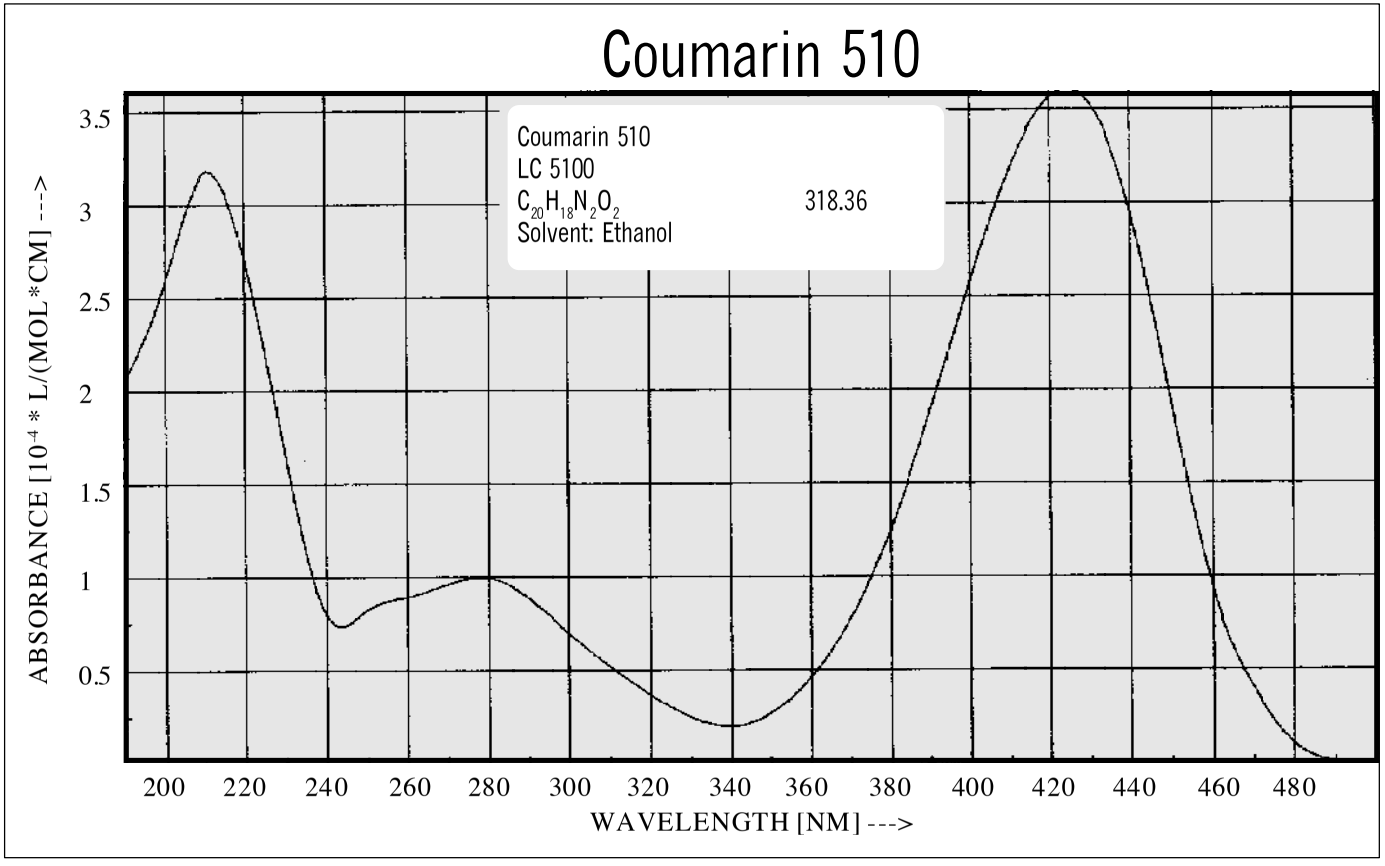
Efficient laser dye for pulsed operation; tunable around 505 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*506*	*490 - 504*	-	-	*Ethanol*	*1, 2*

References

1. K. H. Drexhage et al., *IEEE J. Quantum Electron.* QE-10, 695 (1974).
2. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).

Coumarin 510

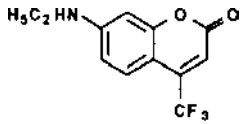


Coumarin 510 (LC 5100)

Constitution

2,3,5,6-1H,4H-Tetrahydro-9-(3-pyridyl)-quinolizino-[9,9a,1-gh]coumarin

$C_{20}H_{18}N_2O_2$ · MW: 318.36



Characteristics

Lambdachrome® number:	5100
CAS registry number:	-
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	425 nm
Molar absorptivity:	3.70 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

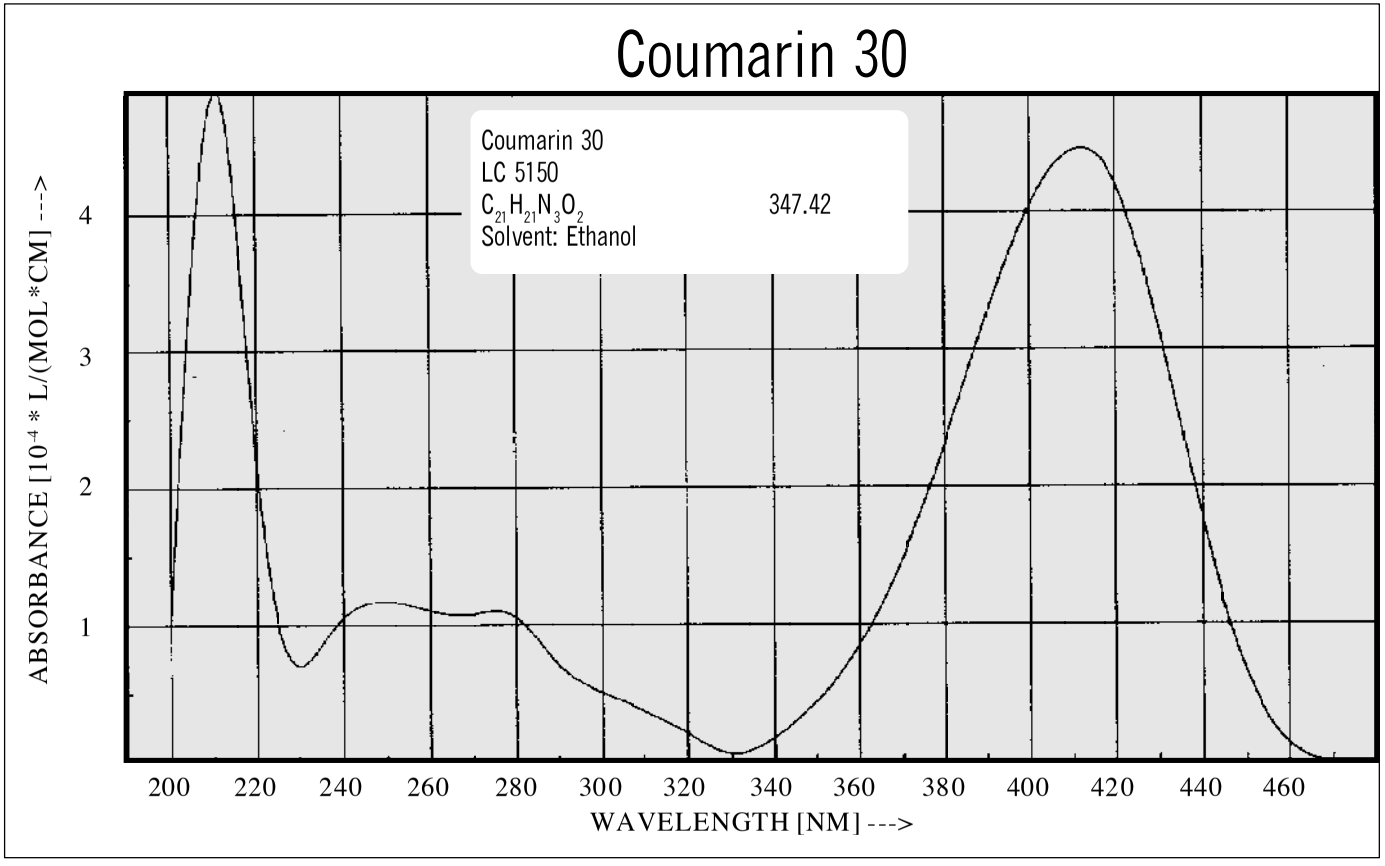
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 510 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*511*	*504 - 511*	-	-	*Ethanol*	*1*
CW, Ar^+	*VIO*	*525*	*495 - 565*	-	*1.0*	*Bz./Eg*	*2*

References

1. A. N. Fletcher et al., *Opt. Commun.* 47(1), 57 (1983).
2. Lambda Physik.

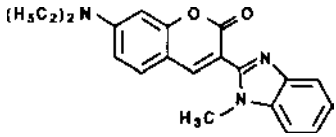

Coumarin 30
Coumarin 30
LC 5150
$C_{21}H_{21}N_3O_2$ 347.42
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
200
220
240
260
280
300
320
340
360
380
400
420
440
460
WAVELENGTH [NM] --->

Coumarin 30 (LC 5150)

Constitution

3-(2'-N-Methylbenzimidazolyl)-7-N,N-diethylaminocoumarin
Coumarin 515

$C_{21}H_{21}N_3O_2$ · MW: 347.42



Characteristics

Lambdachrome® number:	5150
CAS registry number:	41044-12-6
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	412 nm
Molar absorptivity:	4.45×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	488 nm

For research and development purposes only.

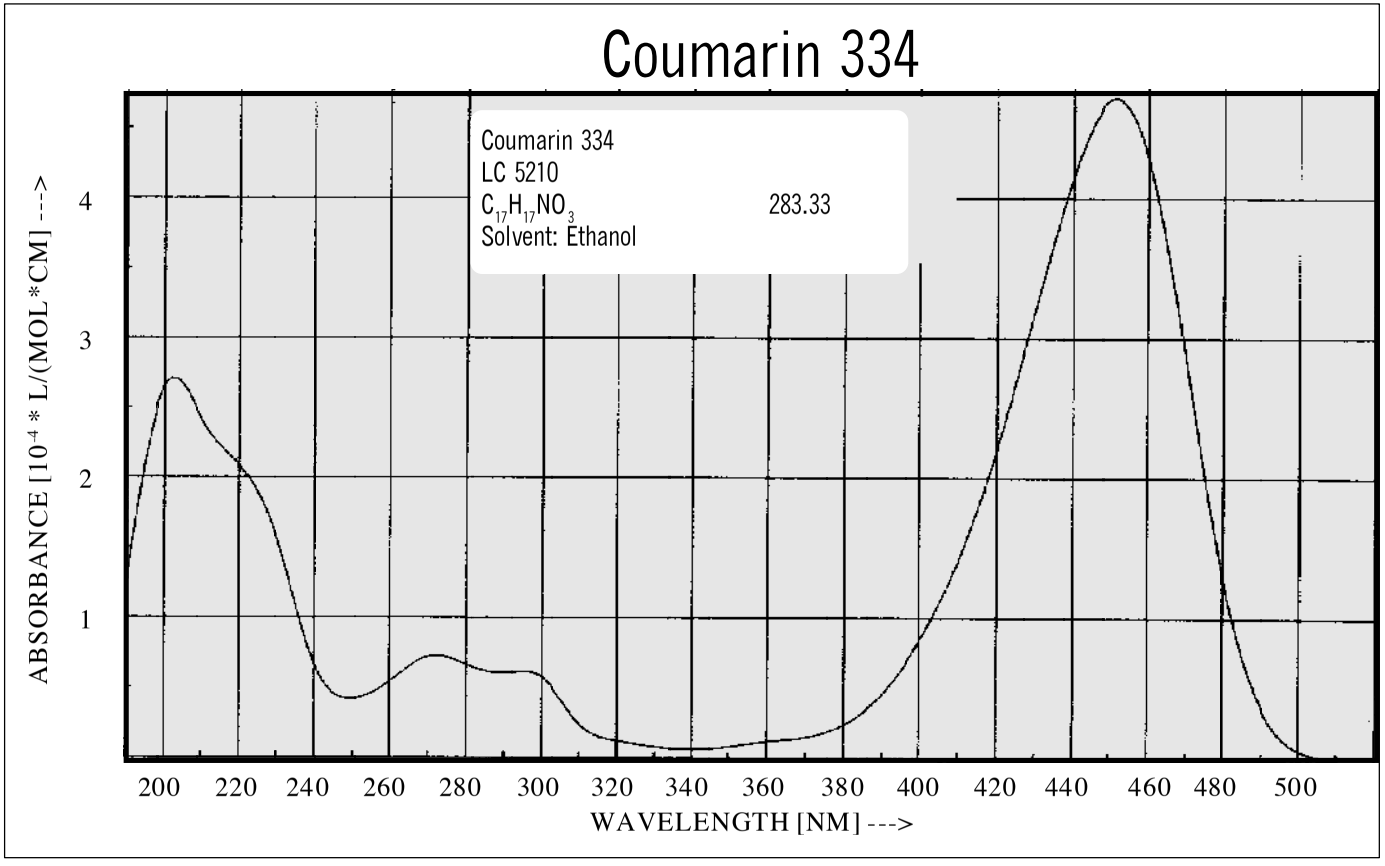
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 510 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*508*	*480 - 540*	-	*0.07*	*Methanol*	*1, 2*
CW, Kr^+	*VIO*	*510*	*480 - 555*	*12*	*0.26*	*MeOH/Eg*	*3*

References

1. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).
2. J. B. Marling et al., *Appl. Optics.* 13(10), 2317 (1974).
3. Coherent, *CW Dye Laser Fact Sheets.*

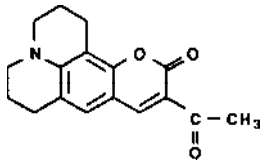

Coumarin 334
Coumarin 334
LC 5210
$C_{17}H_{17}NO_3$ 283.33
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500
WAVELENGTH [NM] --->

Coumarin 334 (LC 5210)

Constitution

2,3,5,6-1H,4H-Tetrahydro-9-acetylquinolizino-[9,9a,1-gh]-coumarin
Coumarin 521

$C_{17}H_{17}NO_3$ · MW: 283.33



Characteristics

Lambdachrome® number:	5210
CAS registry number:	55804-67-6
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	450 nm
Molar absorptivity:	4.73 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	495 nm

For research and development purposes only.

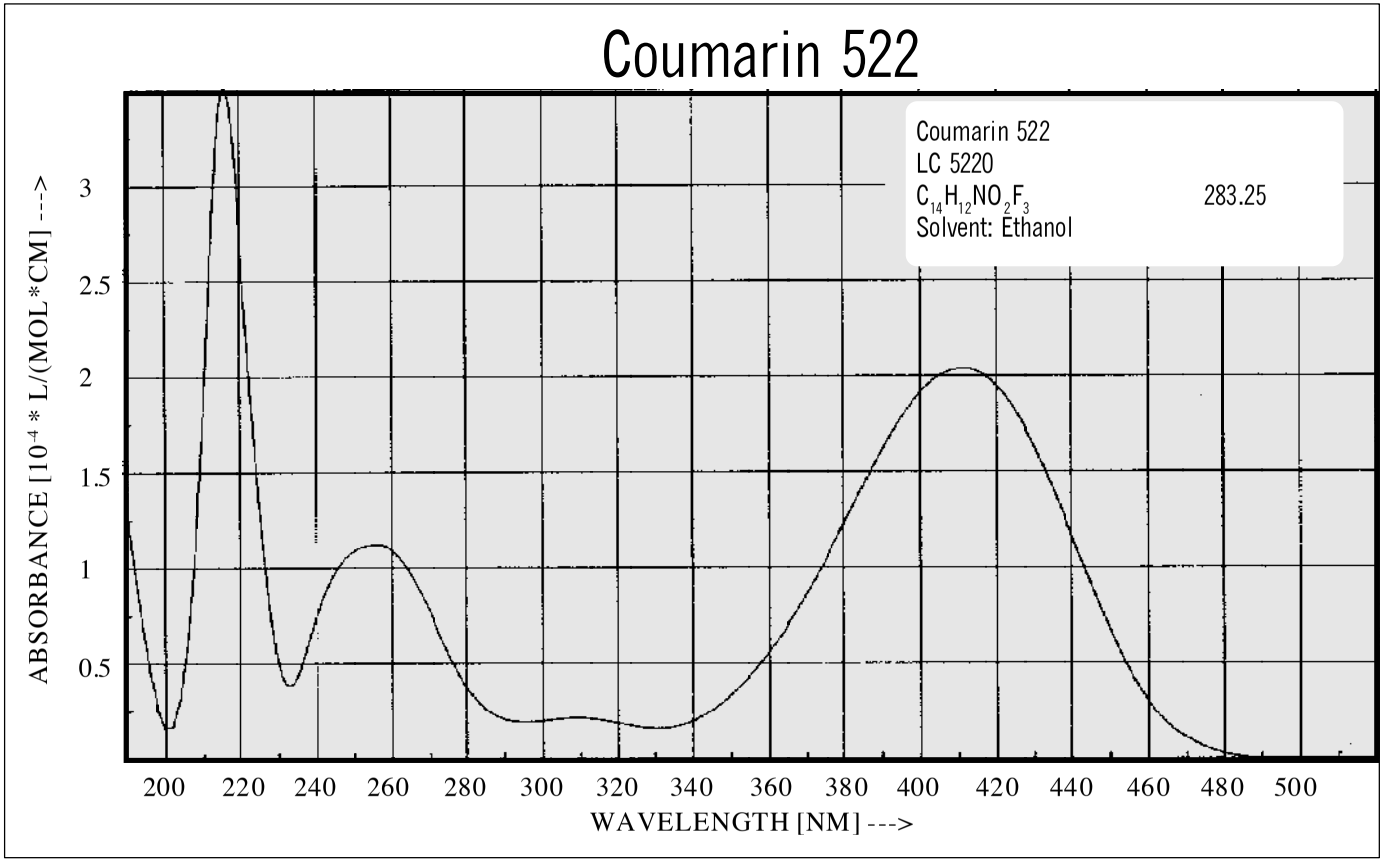
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 480 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*520*	*506 - 537*	*12*	*1.50*	*Methanol*	*1, 2*
Flashlamp	-	-	*507 - 512*		-	*Methanol*	*3, 4*

References

1. Lambda Physik, *Wall Chart* 6/83.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9(1983).
3. A. N. Fletcher *Appl. Phys.* 14, 295 (1977).
4. G. A. Reynolds, K. H. Drexhage, *Opt. Commun.* 13(3), 222(1975).

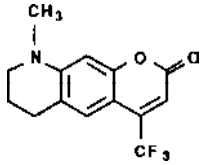

Coumarin 522
Coumarin 522
LC 5220
$C_{14}H_{12}NO_2F_3$ 283.25
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
3
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500
WAVELENGTH [NM] --->

Coumarin 522 (LC 5220)

Constitution

N-Methyl-4-trifluormethylpiperidino-[3,2-g]-coumarin
C8F

$C_{14}H_{12}NO_2F_3$ · MW: 283.25



Characteristics

Lambdachrome® number:	5220
CAS registry number:	55318-19-7
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	410 nm
Molar absorptivity:	2.06 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	516 nm

For research and development purposes only.

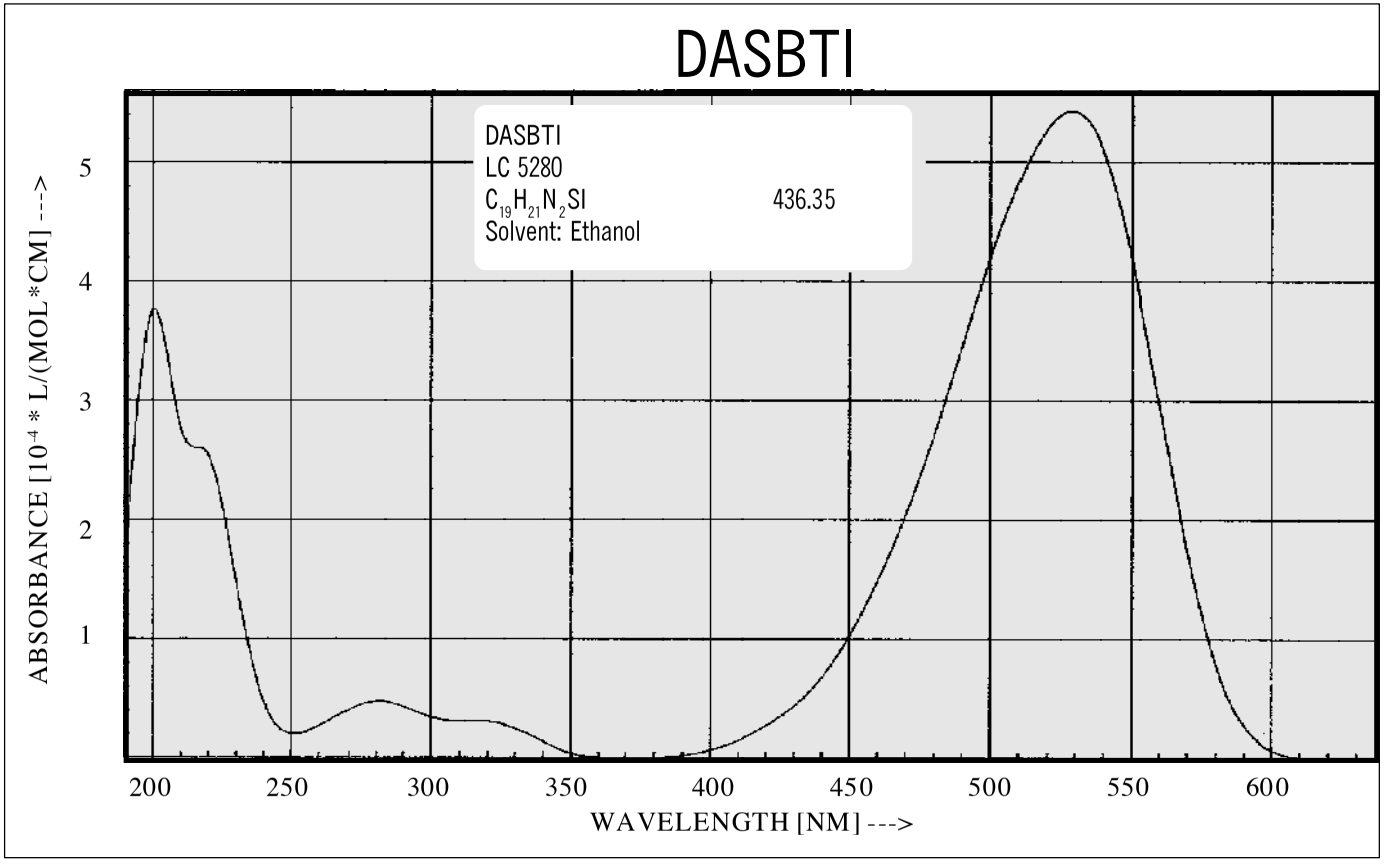
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 520 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nitrogen	*337*	*520*	*495 - 575*	*14*	*0.04*	*DMF*	*1*
Nd:YAG, 3rd	*355*	*525*	*505 - 550*	*-*	*1.41*	*Ethanol*	*2*
Flashlamp	*-*	*-*	*518 - 528*	*-*	*-*	*Ethanol*	*3*

References

1. P. R. Hammond, *IEEE J. Quantum Electron.* QE-15(7), 624(1979).
2. D. M. Guthals, J. W. Nibler, *Opt. Commun.* 29(3), 322(1979).
3. A. N. Fletcher, *Appl. Phys.* 14, 295 (1977).

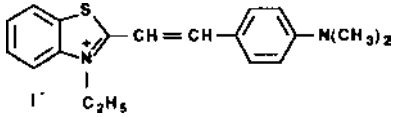

DASBTI
DASBTI
LC 5280
$C_{19}H_{21}N_2SI$ 436.35
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
200
250
300
350
400
450
500
550
600
WAVELENGTH [NM] --->

DASBTI (LC 5280)

Constitution

2-(p-Dimethylaminostyryl)-benzothiazolylethyl Iodide

$C_{19}H_{21}N_2SI$ · MW: 436.35



Characteristics

Lambdachrome® number:	5280
CAS registry number:	-
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	530nm
Molar absorptivity:	5.49×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

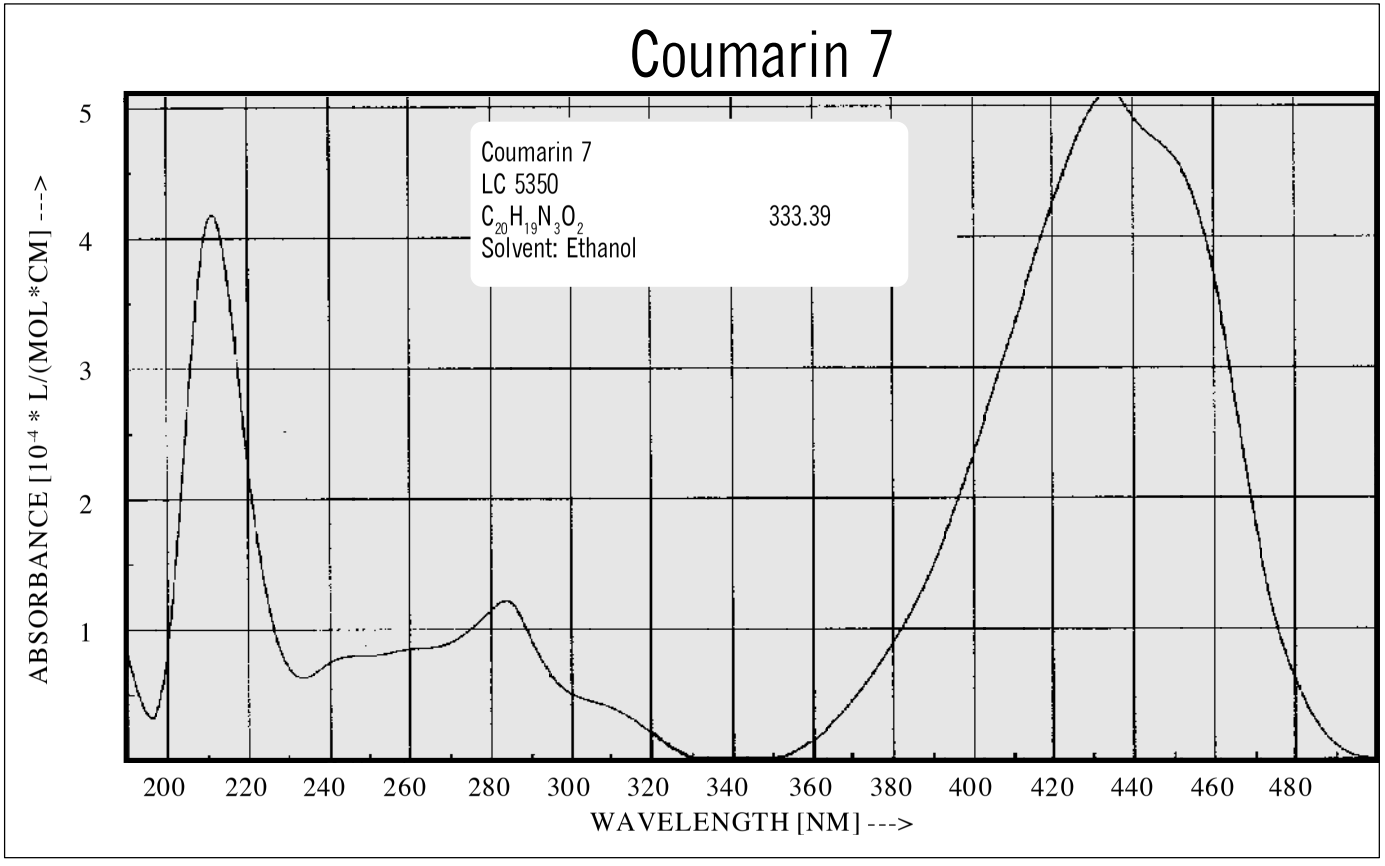
For research and development purposes only.

Lasing Performance

Saturable absorber for flashlamp pumped Coumarin 6, 153, 522, ands Rhodamine 110 dye lasers [1.,2.]. Applicable around 530 nm.

References

1. W. Sibbett, J. R. Taylor, *Appl. Phys.* B29, 191(1982).
2. W. Sibbett, J. R. Taylor, *IEEE J. Quantum Electron.* QE-19(4), 558(1983).

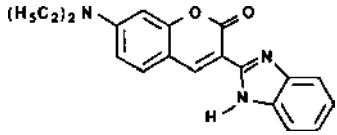

Coumarin 7
Coumarin 7
LC 5350
$C_{20}H_{19}N_3O_2$ 333.39
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
WAVELENGTH [NM] --->

Coumarin 7 (LC 5350)

Constitution

3-(2'-Benzimidazolyl)-7-N,N-diethylaminocoumarin
Coumarin 535

$C_{20}H_{19}N_3O_2$ · MW: 333.39



Characteristics

Lambdachrome® number:	5350
CAS registry number:	27425-55-4
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	433 nm
Molar absorptivity:	5.05 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	493 nm

For research and development purposes only.

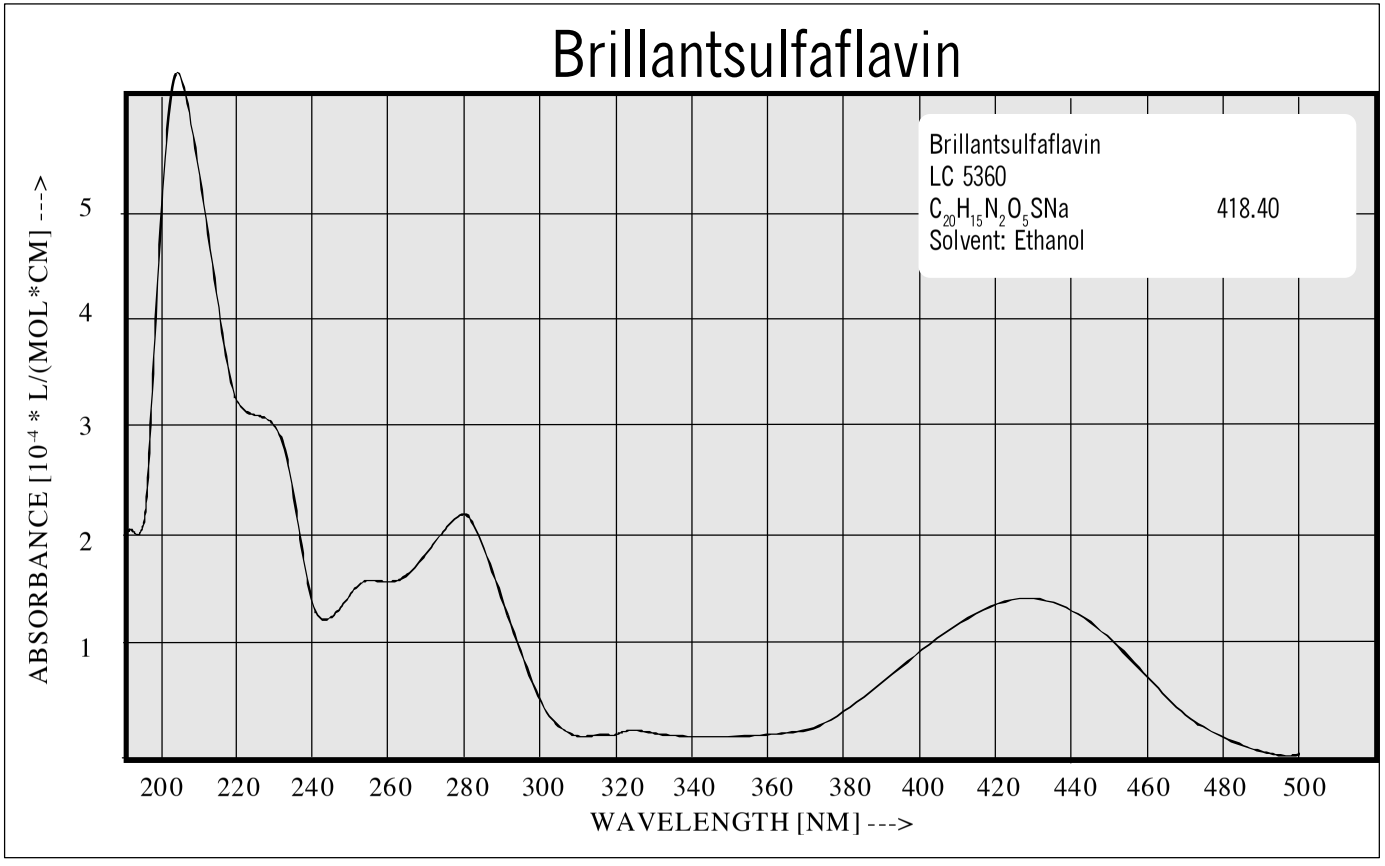
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 530 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	-	*517 - 527*	-	-	*Ethanol*	*1*
CW, Ar^+	*VIO*	*530*	*495 - 570*	*9*	*1.00*	*Bz.*	*2*

References

1. A. N. Fletcher *Appl. Phys.* 14, 295 (1977).
2. J. M. Yarborough, *Appl. Phys. Lett.* 24(12), 629 (1974).

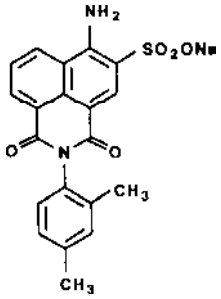

Brillantsulfaflavin
Brillantsulfaflavin
LC 5360
$C_{20}H_{15}N_2O_5SNa$ 418.40
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500
WAVELENGTH [NM] --->

Brillantsulfaflavin (LC 5360)

Constitution

Pilot 512

$C_{20}H_{15}N_2O_5SNa$ · MW: 418.40



Characteristics

Lambdachrome® number:	5360
CAS registry number:	2391-30-2
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	423 nm
Molar absorptivity:	1.41 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	517 nm

For research and development purposes only.

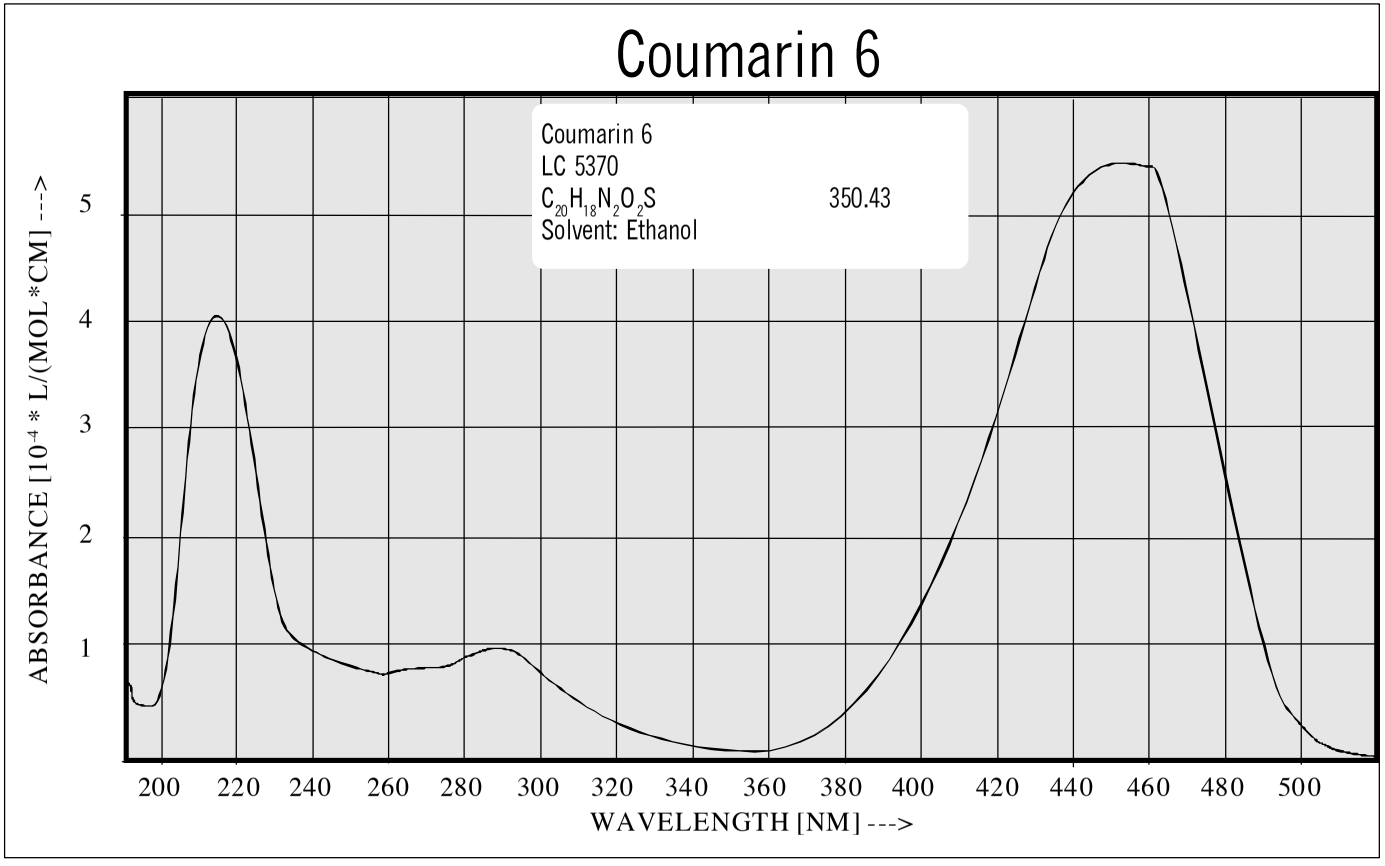
Lasing Performance

Laser dye for pulsed operation; tunable around 540 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*540*	*508 - 574*	-	*0.21*	*Ethanol*	*1, 2*

References

1. M. Maeda, Y. Miyazoe, *Jap. J. Appl. Phys.* 11(5), 692 (1972).
2. J. B. Marling et al., *IEEE J. Quantum Electr.* QE-7, 498 (1971).

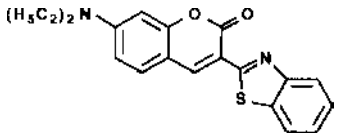

Coumarin 6
Coumarin 6
LC 5370
$C_{20}H_{18}N_2O_2S$ 350.43
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500
WAVELENGTH [NM] --->

Coumarin 6 (LC 5370)

Constitution

3-(2'-Benzothiazolyl)-7-diethylaminocoumarin
Coumarin 540

$C_{20}H_{18}N_2O_2S$ · MW: 350.43



Characteristics

Lambdachrome® number:	5370
CAS registry number:	38215-35-0
Appearance:	orange, crystalline solid
Absorption maximum (in ethanol):	458 nm
Molar absorptivity:	5.4 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	505 nm

For research and development purposes only.

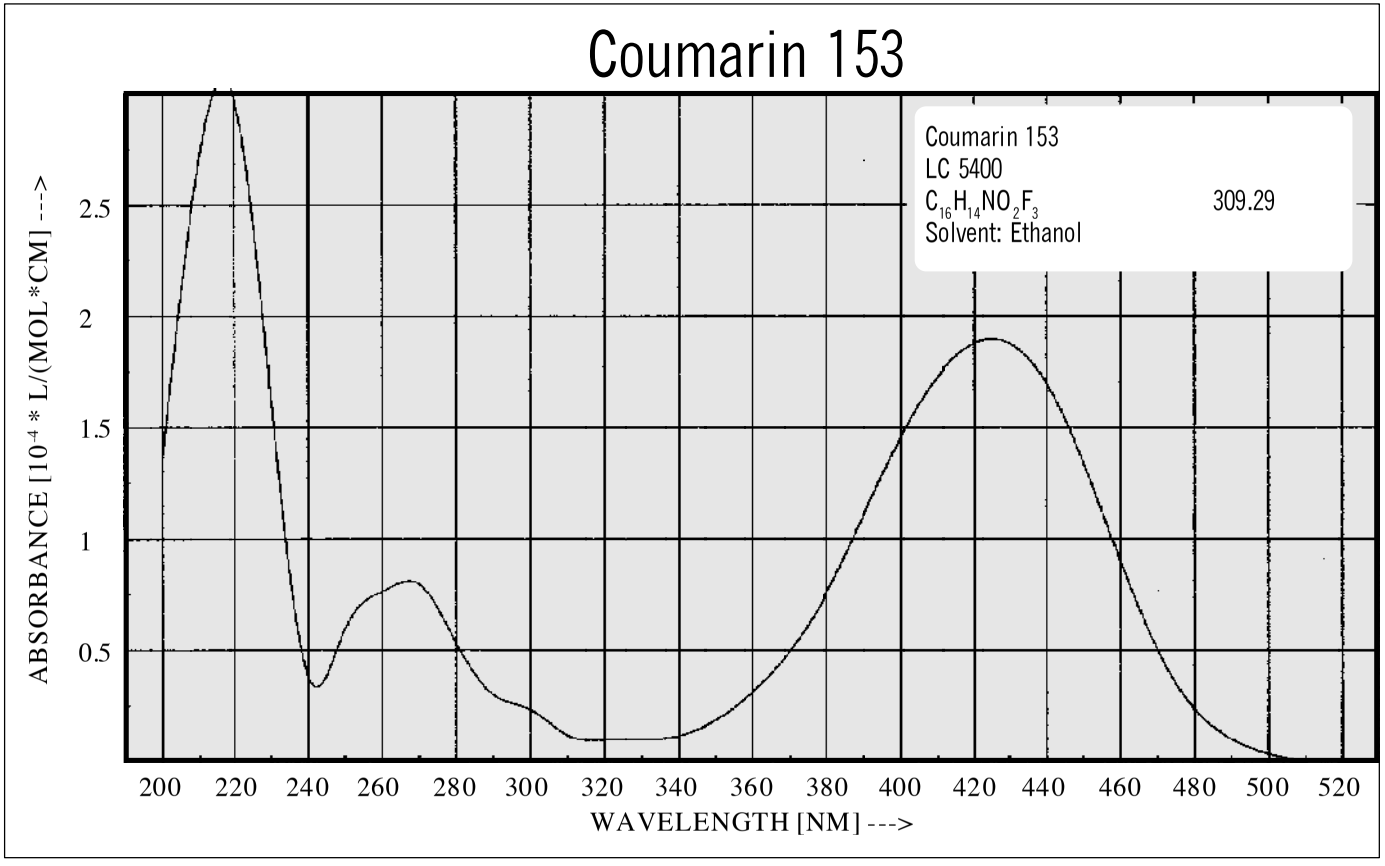
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 540 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*534*	*515 - 558*	*9*	*0.84*	*DMSO*	*1, 2*
Flashlamp	-	-	*530 - 539*	-	-	*Ethanol*	*3*
CW, Ar^+	*488*	*535*	*510 - 550*	-	*2.0*	*Bz./Eg.*	*4, 5*

References

1. Lambda Physik.
2. O. Uchino et al., *Appl. Phys.* 19, 35(1979).
3. A. N. Fletcher, *Appl. Phys.* 14, 295(1977).
4. Lambda Physik, *Wall Chart* 1996.
5. T. F. Johnston at al., *Appl. Optics* 21(13), 2307(1982).

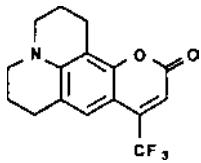

Coumarin 153
Coumarin 153
LC 5400
$C_{16}H_{14}NO_2F_3$ 309.29
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520
WAVELENGTH [NM] --->

Coumarin 153 (LC 5400)

Constitution

2,3,5,6-1H,4H-Tetrahydro-8-trifluormethylquinolizino-[9,9a,1-gh]coumarin
Coumarin 540A, C6F

$C_{16}H_{14}NO_2F_3$ · MW: 309.29



Characteristics

Lambdachrome® number:	5400
CAS registry number:	53518-18-6
Appearance:	yellow, crystalline solid
Absorption maximum (in ethanol):	423 nm
Molar absorptivity:	1.89 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	530 nm

For research and development purposes only.

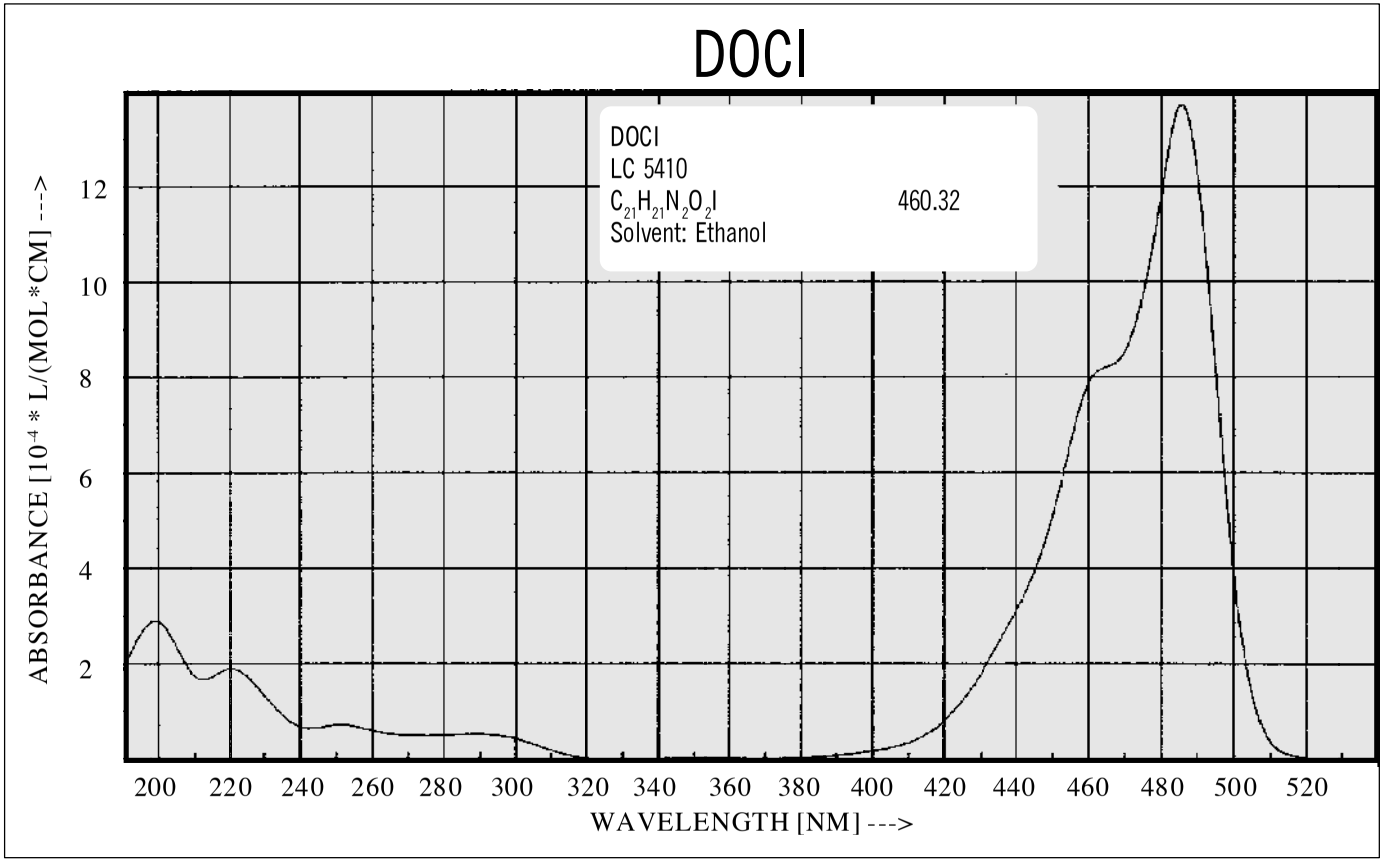
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 500 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*540*	*522 - 600*	*15*	*4.20*	*Methanol*	*1, 2, 3*
Nd:YAG, 3rd	*355*	*540*	*516 - 575*	*18*	*2.36*	*Methanol*	*1*
Nitrogen	*337*	*540*	*517 - 590*	*rel.*	*3.10*	*Methanol*	*4, 5*
Flashlamp	-	-	*528 - 547*	-	-	*Methanol*	*6*

References

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3552 (1981).
4. Lambda Physik, *Data Sheet.*
5. R. E. Drullinger, *Opt. Commun.* 39(4), 263 (1981).
6. A. N. Fletcher *Appl. Phys.* 14, 295 (1977).

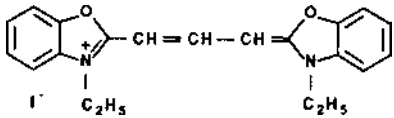

DOCI
DOCI
LC 5410
$C_{21}H_{21}N_2O_2I$ 460.32
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
2
4
6
8
10
12
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520
WAVELENGTH [NM] --->

DOCI (LC 5410)

Constitution

3,3'-Diethyloxacarbocyanine Iodide

$C_{21}H_{21}N_2O_2I$ · MW: 460.32



Characteristics

Lambdachrome® number:	5410
CAS registry number:	-
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	485 nm
Molar absorptivity:	12.6 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

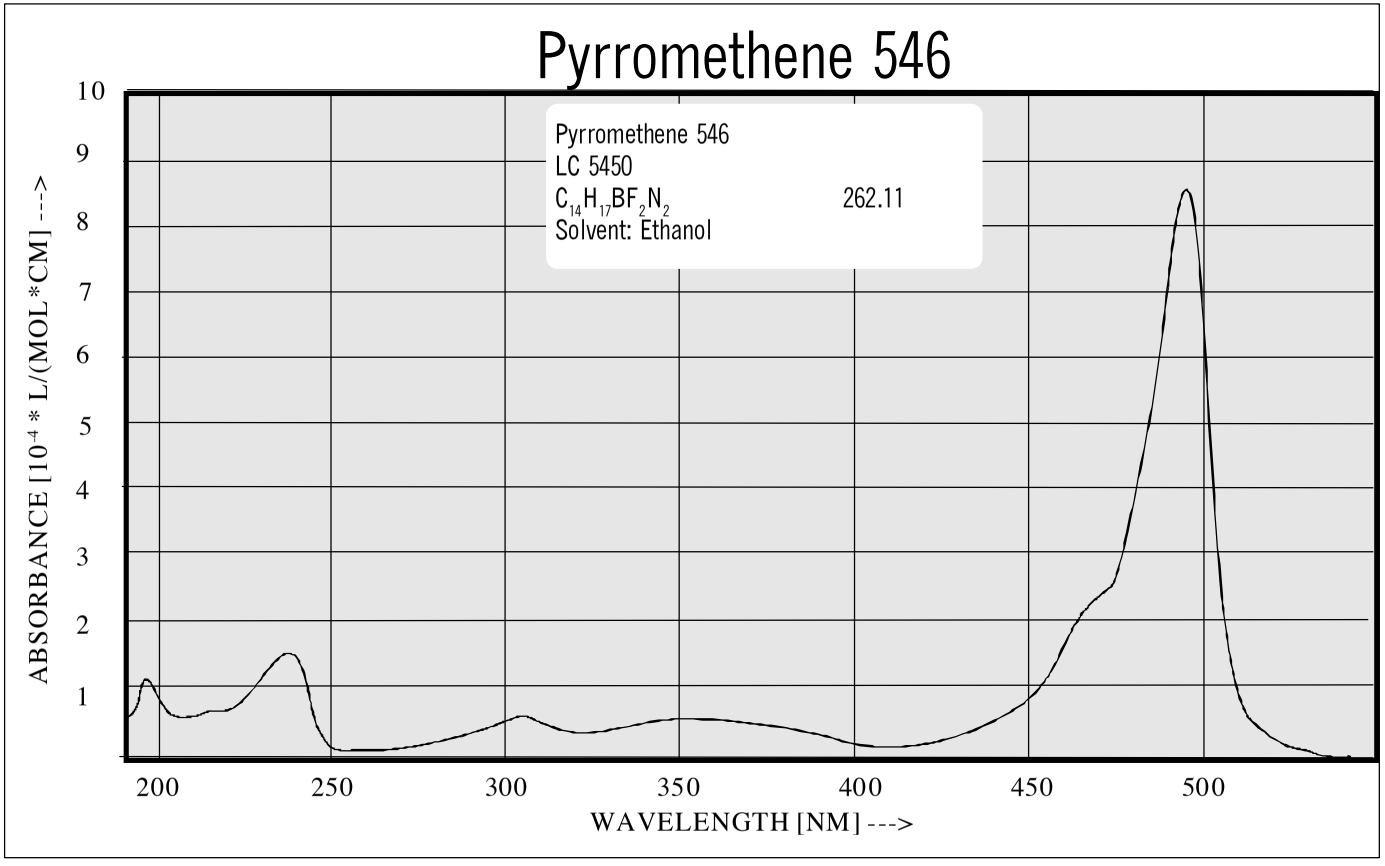
Lasing Performance

Laser dye for pulsed operation; tunable around 540 nm. Saturable absorber for Coumarin 102 dye lasers; applicalbel around 480 nm [2.,3.].

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*541*	-	-	*0.09*	*Glyzerine*	*1*

References

1. M Maeda, Y. Miyazoe, *Jap. J. Appl. Phys.* 11(5), 692 (1972).
2. J. C. Mialocq, P. Goujon, *Appl. Phys. Letters* 33(9), 819 (1978).
3. R. Wyatt, *Opt. Commun.* 38(1), 64 (1981).

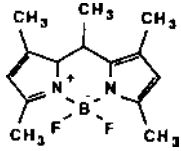

Pyrromethene 546
Pyrromethene 546
LC 5450
$C_{14}H_{17}BF_2N_2$ 262.11
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
10
9
8
7
6
5
4
3
2
1
200
250
300
350
400
450
500
WAVELENGTH [NM] --->

Pyrromethene 546 (LC 5450)

Constitution

4,4-Difluoro-1,3,5,7,8-pentamethyl-4-bora-3a,4a-diaza-s-indacene
1,3,5,7,8-Pentamethylpyrromethenedifluoroborate Complex

$C_{14}H_{17}BF_2N_2$ · MW: 262.11



Characteristics

Lambdachrome® number:	5450
CAS registry number:	121207-31-6
Appearance:	orange, crystalline solid
Absorption maximum (in ethanol):	494 nm
Molar absorptivity:	8.58 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in methanol):	519 nm

For research and development purposes only.

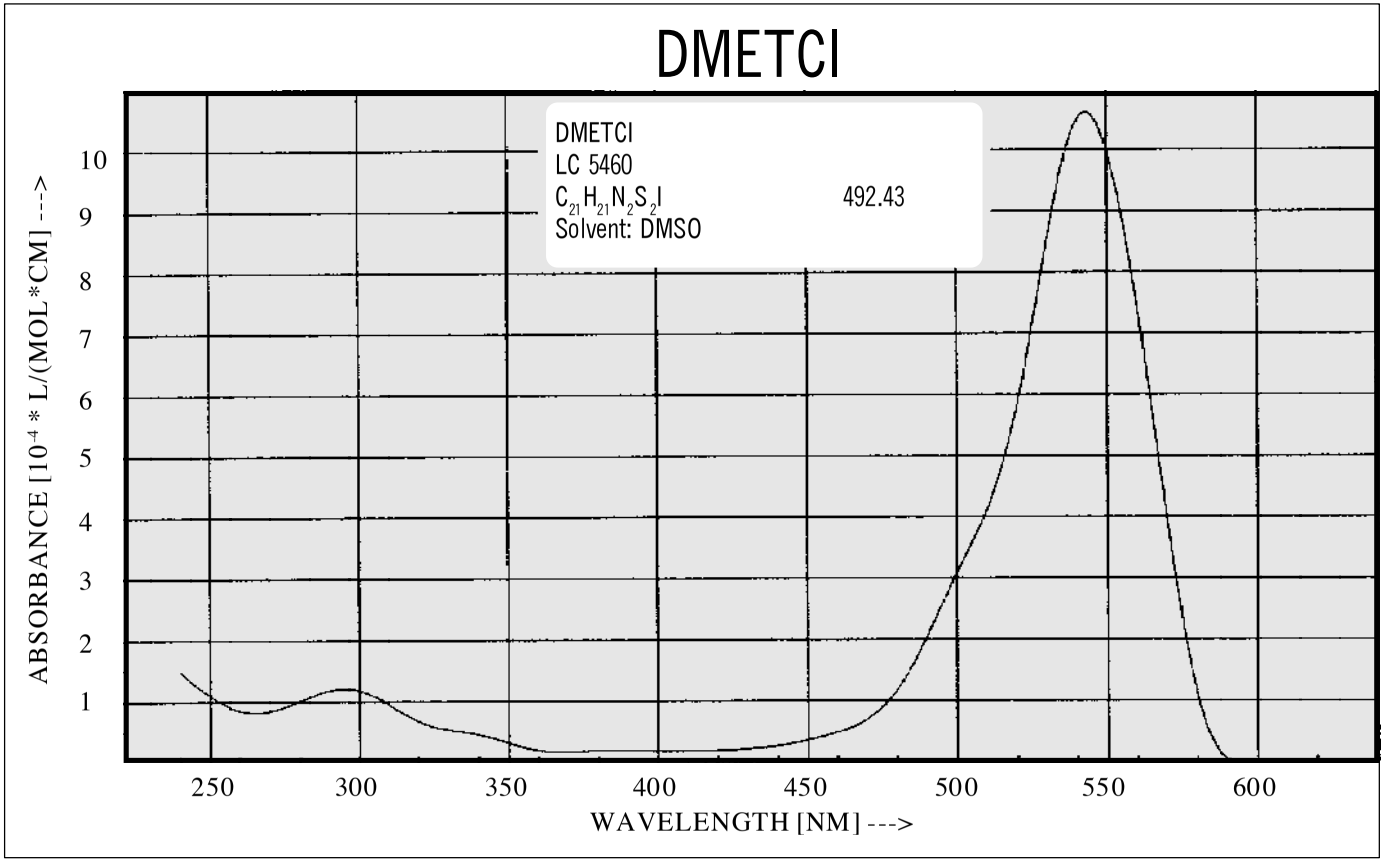
Lasing Performance

Laser dye for flashlamp pumped dye lasers; tunable around 542 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*542*	*523-580*	-	*0.066*	*Methanol*	*1*
Flashlamp	-	*546*	-	-	*0.039*	*Ethanol*	*2*

References

1. M. Shah et al., *Heteroatom Chem.* 1(5), 389(1990).
2. Th. G. Pavlopoulos, M. Shah, J. H. Boyer, *Opt. Commun.* 70(5), 425 (1989).

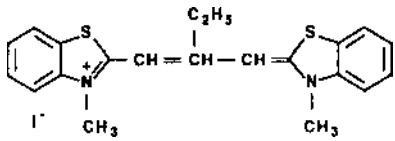

DMETCI
DMETCI
LC 5460
$C_{21}H_{21}N_2S_2I$ 492.43
Solvent: DMSO
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
8
9
10
250
300
350
400
450
500
550
600
WAVELENGTH [NM] --->

DMETCI (LC 5460)

Constitution

3,3'-Dimethyl-9-ethylthiacarbocyanine Iodide

$C_{21}H_{21}N_2S_2I$ · MW: 492.43



Characteristics

Lambdachrome® number:	5460
CAS registry number:	-
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	540 nm
Molar absorptivity:	10.6 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

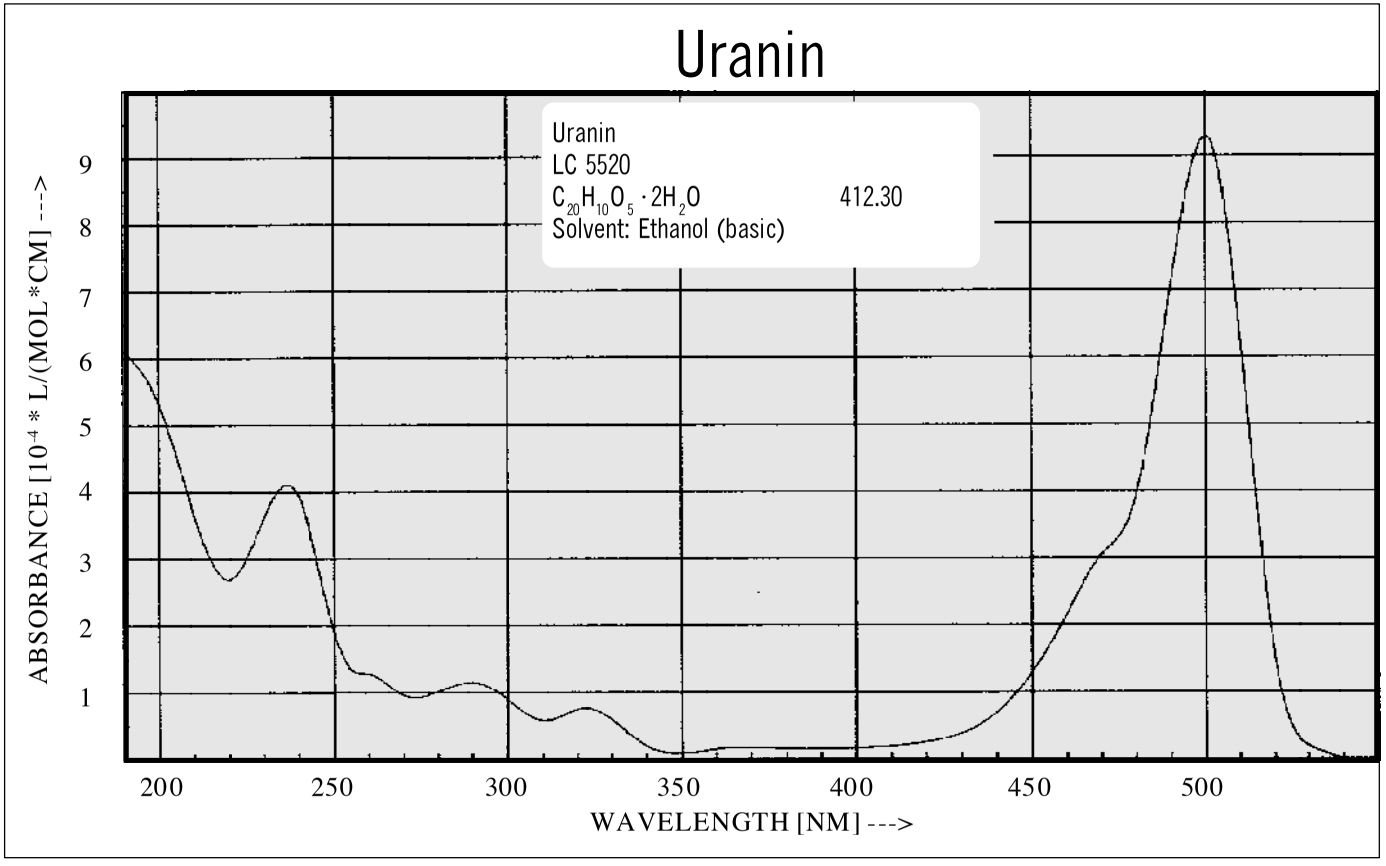
Lasing Performance

Saturable absorber for Coumarin 153 dye lasers; applicable around 540 nm [1.].

References

1. W. Sibbett, J. R. Taylor, *Opt. Commun.* 43(1), 50 (1982).

Uranin

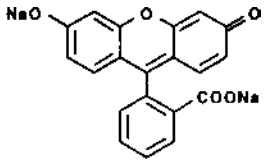

Uranin
LC 5520
$C_{20}H_{10}O_5 \cdot 2H_2O$ 412.30
Solvent: Ethanol (basic)
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
5
6
7
8
9
200
250
300
350
400
450
500
WAVELENGTH [NM] --->

Uranin (LC 5520)

Constitution

Disodium Fluorescein

$C_{20}H_{10}O_5 \cdot 2H_2O$ · MW: 412.30



Characteristics

Lambdachrome® number:	5520
CAS registry number:	518-47-8
Appearance:	red, crystalline solid
Absorption maximum (in basic ethanol):	500 nm
Molar absorptivity:	9.92 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in bas. ethanol):	521 nm

For research and development purposes only.

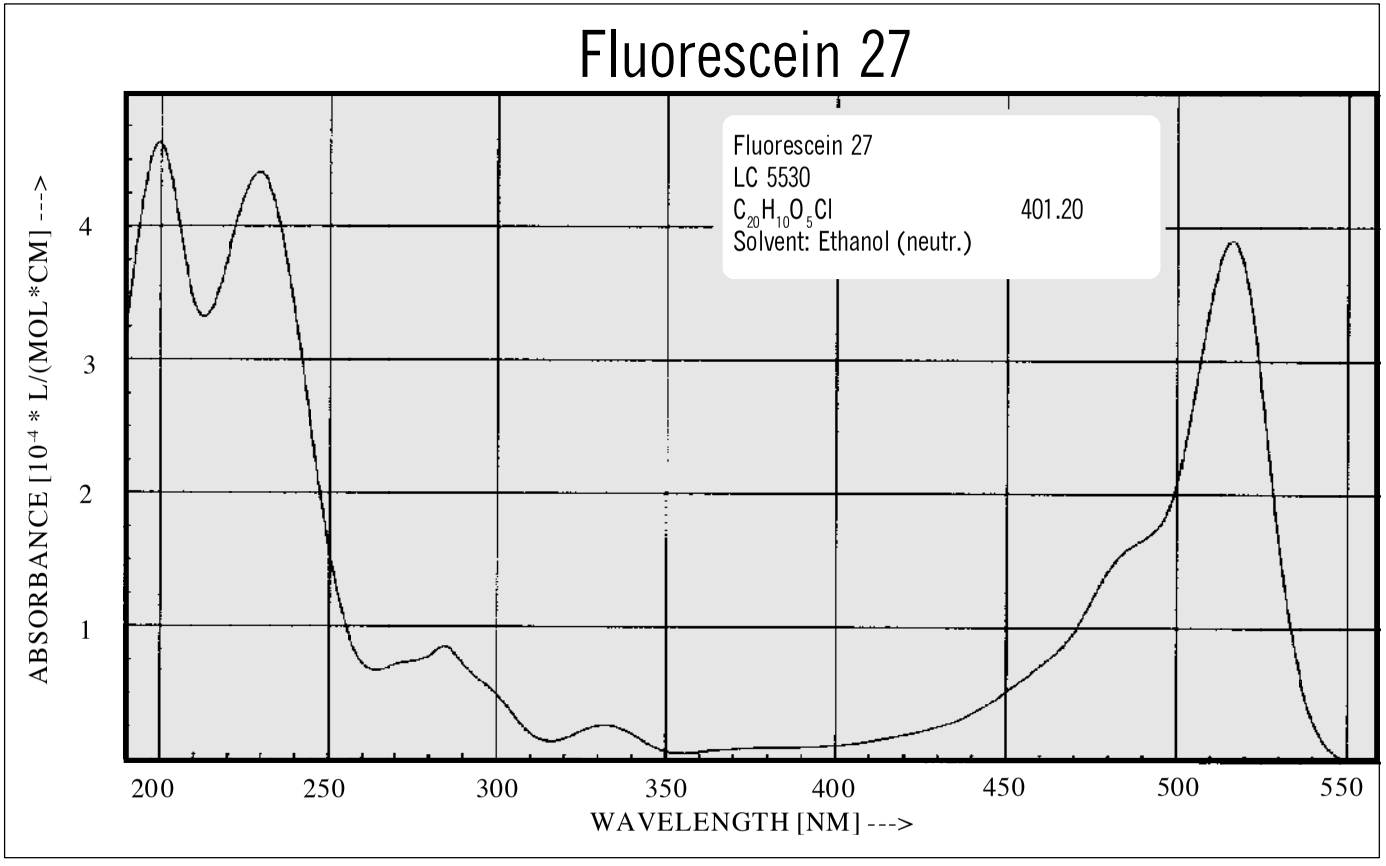
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 550 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*540*	*532 - 561*	*9*	*1.35*	*Methanol*	*1*
Nitrogen	*337*	*538*	*-*	*rel.*	*1.10*	*Methanol*	*2, 3*
Nd:YAG, 3rd	*355*	*550*	*536 - 568*	*-*	*2.06*	*Ethanol*	*4*
Cu-vapor	*510*	*528*	*-*	*-*	*0.42*	*Ethanol*	*5*
Flashlamp	*-*	*-*	*549 - 574*	*-*	*0.12*	*Methanol*	*6*
CW, Ar^+	*all*	*560*	*530 - 590*	*7*	*1.76*	*MeOh/Eg.*	*7*

References

1. Lambda Physik, *Wall Chart* 6/83.
2. A. Dienes, *Appl. Phys.* 7, 135 (1975).
3. G. Capelle, D. Phillips, *Appl. Optics* 9(12), 2742 (1970).
4. D, M. Guthals, J. W. Nibler, *Opt. Commun.* 29(3), 322 (1979).
5. L. Masarnovskii et al., *Sov. J. Quantum Electr.* 9(7), 900 (1979).
6. D. A. Jennings, A. J. Varga, *J. Appl. Phys.* 42(12), 5171 (1971).
7. Coherent, *CW Dye Laser Fact Sheets.*

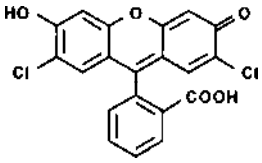

Fluorescein 27
Fluorescein 27
LC 5530
$C_{20}H_{10}O_5Cl$ 401.20
Solvent: Ethanol (neutr.)
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
200
250
300
350
400
450
500
550
WAVELENGTH [NM] --->

Fluorescein 27 (LC 5530)

Constitution

9-(o-Carboxyphenyl)-2,7-dichloro-6-hydroxy-3H-xanthen-3-on
2,7-Dichlorofluorescein · Fluorescein 548

$C_{20}H_{10}O_5Cl$ · MW: 401.20



Characteristics

Lambdachrome® number:	5530
CAS registry number:	76-54-0
Appearance:	red, crystalline solid
Absorption maximum (in basic ethanol):	512 nm
Molar absorptivity:	11.0 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in bas. ethanol):	530 nm

For research and development purposes only.

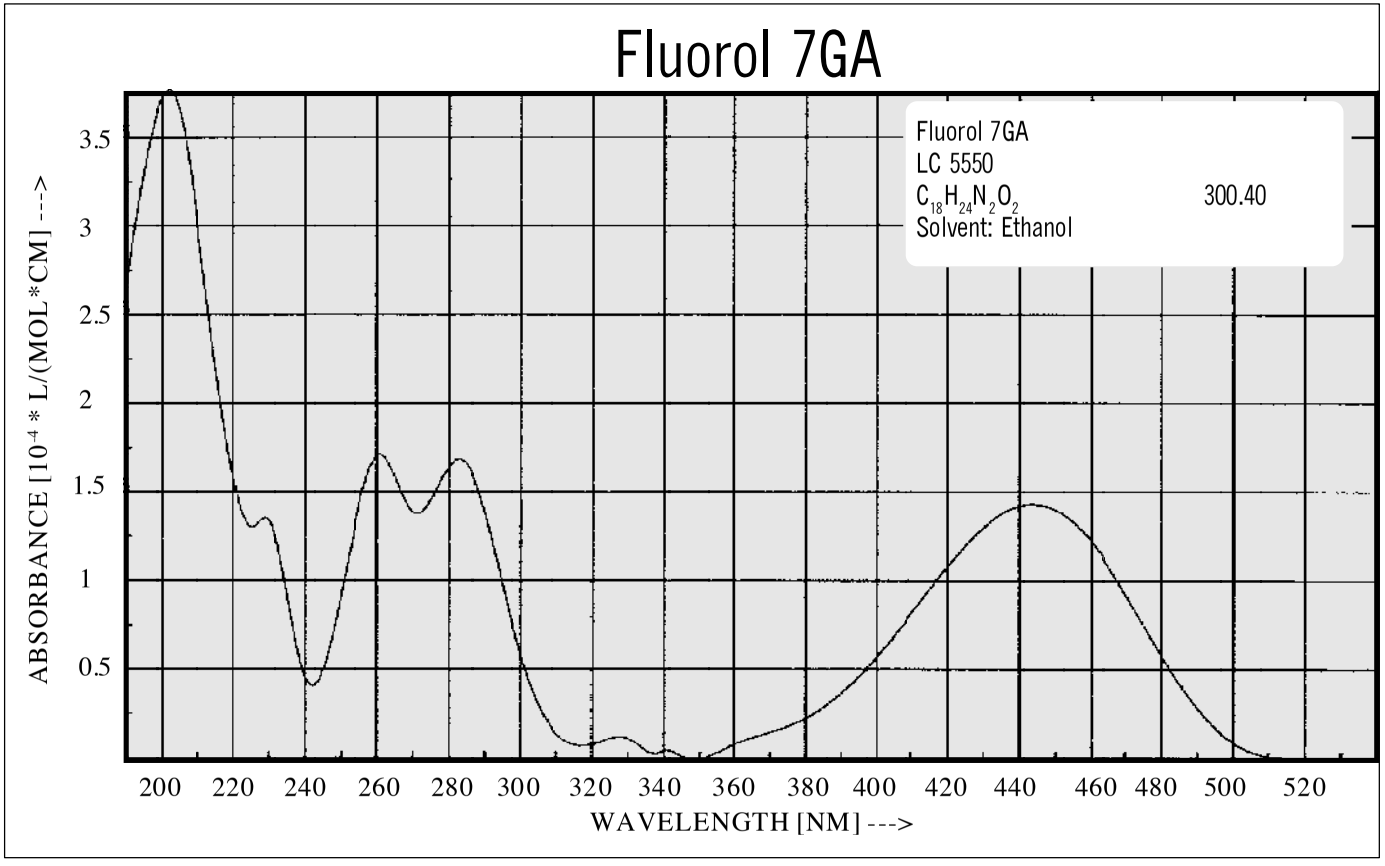
Lasing Performance

Laser dye for pulsed and CW operation; tunable around 550 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*553*	*540 - 587*	*12*	*1.40*	*Methanol*	*1*
Nitrogen	*337*	*558*	*546 - 589*	*rel.*	*1.00*	*Ethanol*	*1, 2*
Nd:YAG, 2nd	*532*	*550*	*540 - 575*	*28*	*0.64*	*Methanol*	*3*
Flashlamp	*-*	*-*	*557 - 581*	*-*	*0.20*	*Methanol*	*4*

References

1. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
2. E. D. Stokes et al., *Opt. Commun.* 5(4), 267 (1972).
3. Lambda Physik, *Wall Chart* 1996.
4. D. A. Jennings, A. J. Varga, *J. Appl. Phys.* 42(12), 5171 (1971).

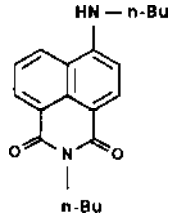

Fluorol 7GA
Fluorol 7GA
LC 5550
$C_{18}H_{24}N_2O_2$ 300.40
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
3.5
3
2.5
2
1.5
1
0.5
200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520
WAVELENGTH [NM] --->

Fluorol 7GA (LC 5550)

Constitution

Fluorol 555

$C_{20}H_{24}N_2O_2$ · MW: 324.40



Characteristics

Lambdachrome® number:	5550
CAS registry number:	-
Appearance:	red, crystalline solid
Absorption maximum (in methanol):	440 nm
Molar absorptivity:	1.40 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

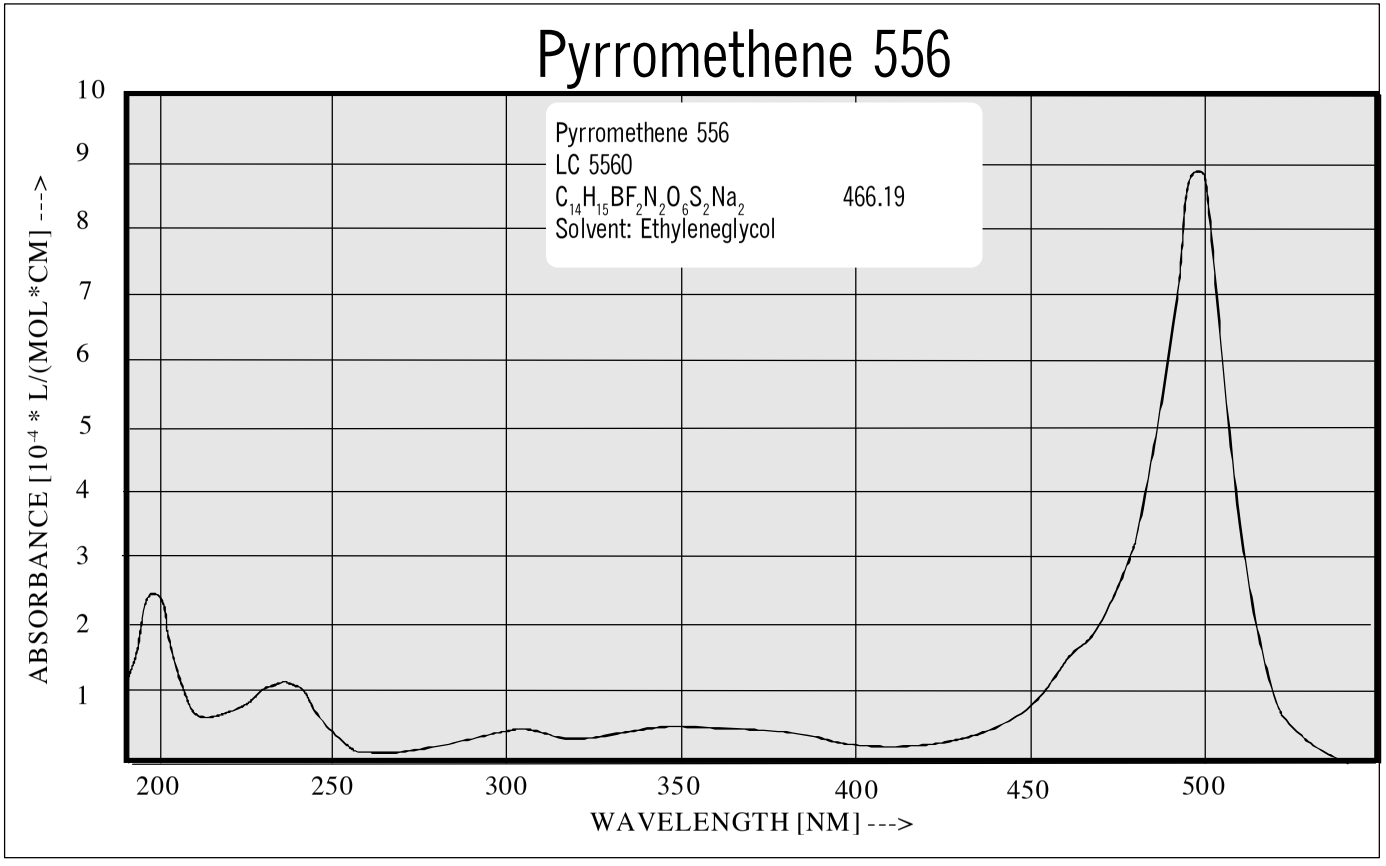
Lasing Performance

Efficient laser dye for pulsedoperation; tunable around 520 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*560*	*530 - 590*	*5*	*1.80*	*Methanol*	*1, 2*
Flashlamp	*-*	*-*	*530 - 600*	*-*	*0.10*	*Methanol*	*3*

References

1. Lambda Physik.
2. F. Bos, *Appl. Optics* 20(20), 3553, (1981).
3. M. Lambropoulos, *Opt. Commun.* 15(1), 35 (1975).

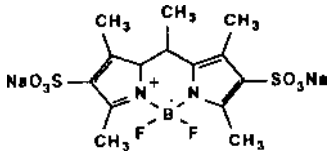

Pyrromethene 556
Pyrromethene 556
LC 5560
$C_{14}H_{15}BF_2N_2O_6S_2Na_2$ 466.19
Solvent: Ethyleneglycol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
8
9
10
200
250
300
350
400
450
500
WAVELENGTH [NM] --->

Pyrromethene 556 (LC 5560)

Constitution

Disodium-1,3,5,7,8-pentamethylpyrromethene-2,6-disulfonate-difluoroborate complex

$C_{14}H_{17}BF_2N_2O_6S_2Na_2$ · MW: 466.19



Characteristics

Lambdachrome® number:	5560
CAS registry number:	121461-69-6
Appearance:	yellow/orange, crystalline solid
Absorption maximum (in ethyleneglycol):	498 nm
Molar absorptivity:	8.88 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in methanol):	533 nm

For research and development purposes only.

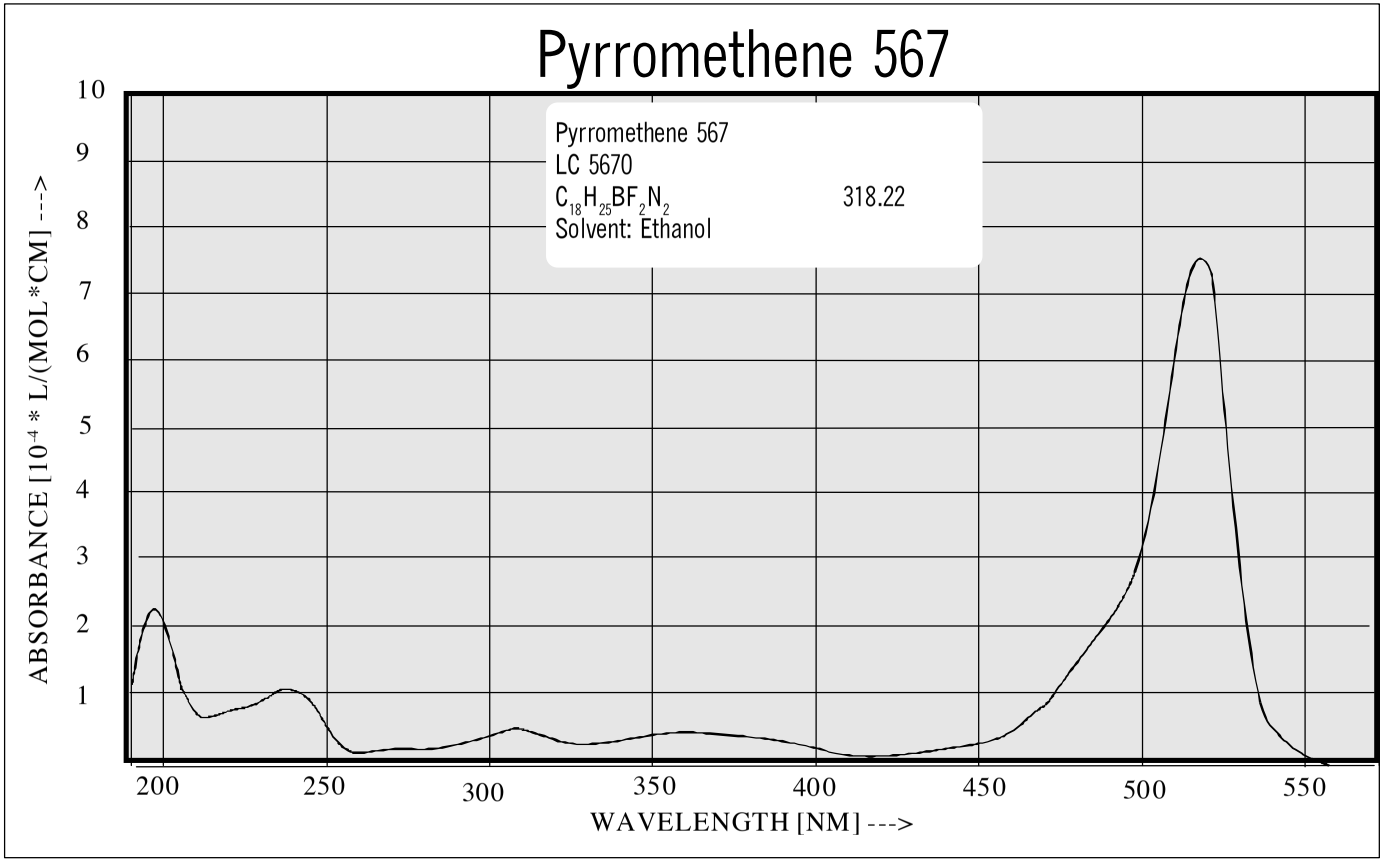
Lasing Performance

Laser dye for pulsed and CW operation; tunable around 550 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*561*	*540-580*	-	*0.03*	*Methanol*	*1*
CW, Ar^+	*458-514*	*553*	*530-624*	*45*	*0.93*	*Eg.*	*2*

References

1. M. Shah et al., *Heteroatom Chem.* 1(5), 389(1990).
2. S. G. Guggenheimer et al., *Appl. Optics* 32(21), 3942 (1993).

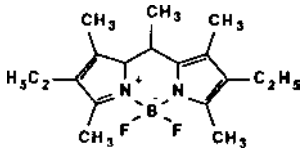

Pyrromethene 567
Pyrromethene 567
LC 5670
$C_{18}H_{25}BF_2N_2$ 318.22
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
8
9
10
200
250
300
350
400
450
500
550
WAVELENGTH [NM] --->

Pyrromethene 567 (LC 5670)

Constitution

4,4-Difluoro-2,6-diethyl-1,3,5,7,8-pentamethyl-4-bora-3a,4a-diaza-s-indacene
2,6-Diethyl-1,3,5,7,8-pentamethylpyrromethenedifluoroborate Complex

$C_{18}H_{25}BF_2N_2$ · MW: 318.22



Characteristics

Lambdachrome® number:	5670
CAS registry number:	131083-16-4
Appearance:	orange/red, crystalline solid
Absorption maximum (in ethanol):	518 nm
Molar absorptivity:	7.73×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	547 nm

For research and development purposes only.

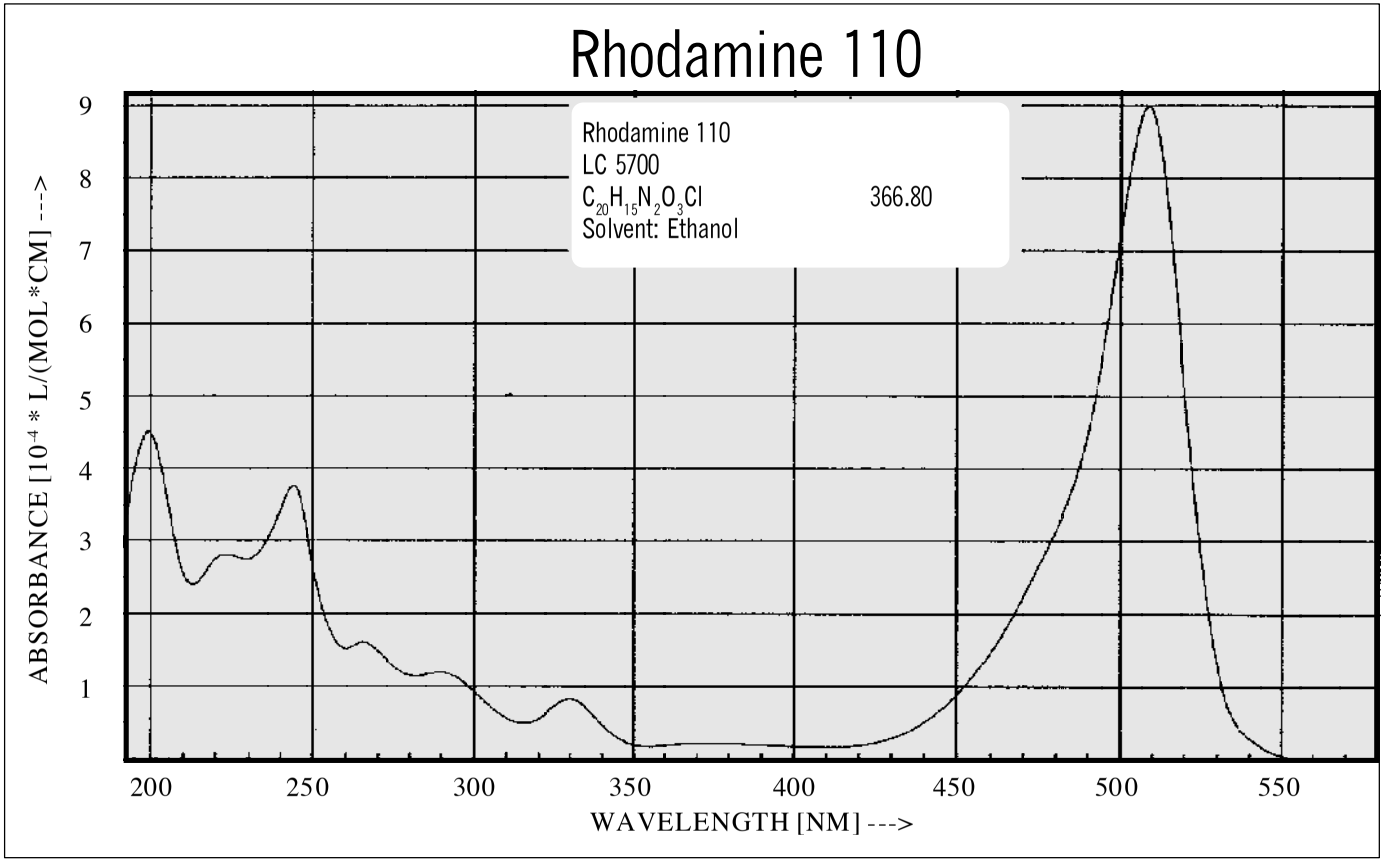
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 570 nm.
Alternative to Rhodamine 6G.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*567*	-	-	*0.06*	*Ethanol*	*1, 2*
CW, Ar^+	*all*	*571*	*552-608*	*36*	*0.45*	*PC*	*3*
Nd:YAG	*532*	*566*	*549-592*	*44*	*0.31*	*PC*	*4*

References

1. M. Shah et al., *Heteroatom Chem.* 1(5), 389(1990).
2. T. G. Pavlopoulos et al., *Appl. Optics* 29(27), 3885 (1990).
3. S. G. Guggenheimer et al., *Appl. Optics* 32(21), 3942 (1993).
4. M. P. O`Neil, *Optics Letters* 18(1), 37 (1993).
5. R. E. Hermes et al., *Appl. Phys. Letters* 63(7), 877 (1993).

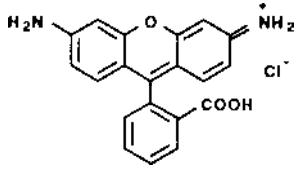

Rhodamine 110
Rhodamine 110
LC 5700
$C_{20}H_{15}N_2O_3Cl$ 366.80
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
8
9
200
250
300
350
400
450
500
550
WAVELENGTH [NM] --->

Rhodamine 110 (LC 5700)

Constitution

o-(6-Amino-3-imino-3H-xanthen-9-yl)-benzoic acid
Rhodamine 560

$C_{20}H_{15}N_2O_3Cl$ · MW: 366.80



Characteristics

Lambdachrome® number:	5700
CAS registry number:	13558-31-1
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	510 nm
Molar absorptivity:	8.99 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	535 nm

For research and development purposes only.

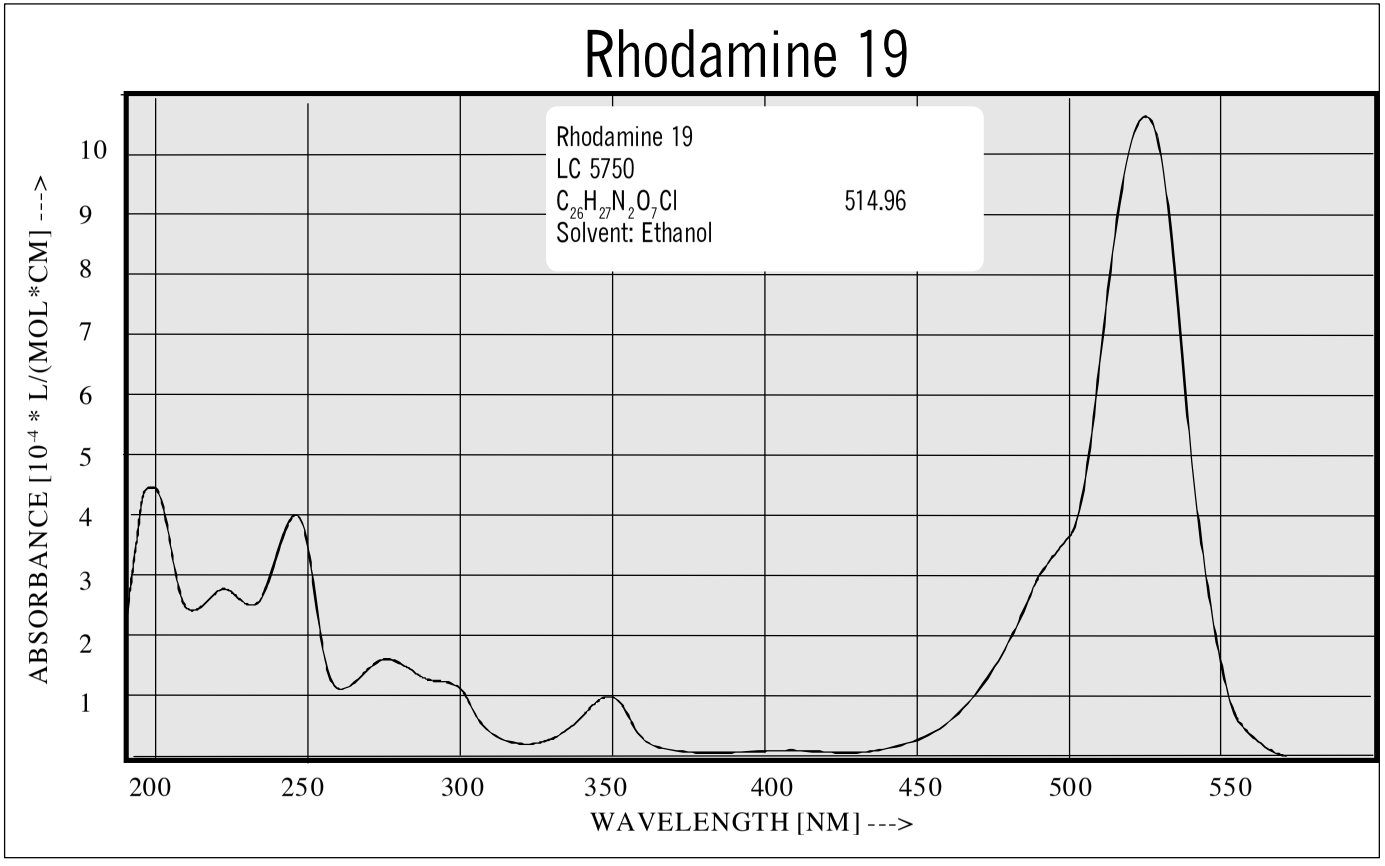
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 570 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*572*	*547 - 592*	*5*	*1.22*	*Ethanol*	*1*
Cu-vapor	*510*	*550*	*528 - 574*	*9*	*0.09*	*Methanol*	*2*
Flashlamp	*-*	*-*	*551 - 583*	*-*	*0.07*	*Ethanol*	*3*
CW, Ar^+	*all*	*560*	*530 - 580*	*-*	*0.75*	*Eg.*	*4, 5, 6*

References

1. Lambda Physik.
2. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
3. W. Sibbett, J. R. Taylor, *IEEE J. Quantum Electron.* QE-19(4), 558 (1983).
4. Coherent, *CW Dye Laser Fact Sheets.*
5. T. F. Johnston et al., *Appl. Optics* 21(13), 2307 (1982).
6. Lambda Physik, Wall Chart 1996.

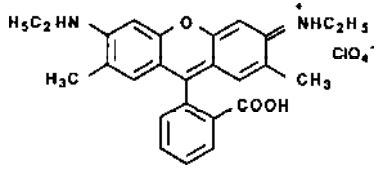

Rhodamine 19
Rhodamine 19
LC 5750
$C_{26}H_{27}N_2O_7Cl$ 514.96
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
6
7
8
9
10
200
250
300
350
400
450
500
550
WAVELENGTH [NM] --->

Rhodamine 19 (LC 5750)

Constitution

Benzoic Acid, 2-[6-(ethylamino)-3-(ethylimino)-2,7-dimethyl-3H-xanthen-9-yl], perchlorate
Rhodamine 575

$C_{26}H_{27}N_2O_7Cl$ · MW: 514.96



Characteristics

Lambdachrome® number:	5750
CAS registry number:	62669-66-3
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	528 nm
Molar absorptivity:	10.9 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

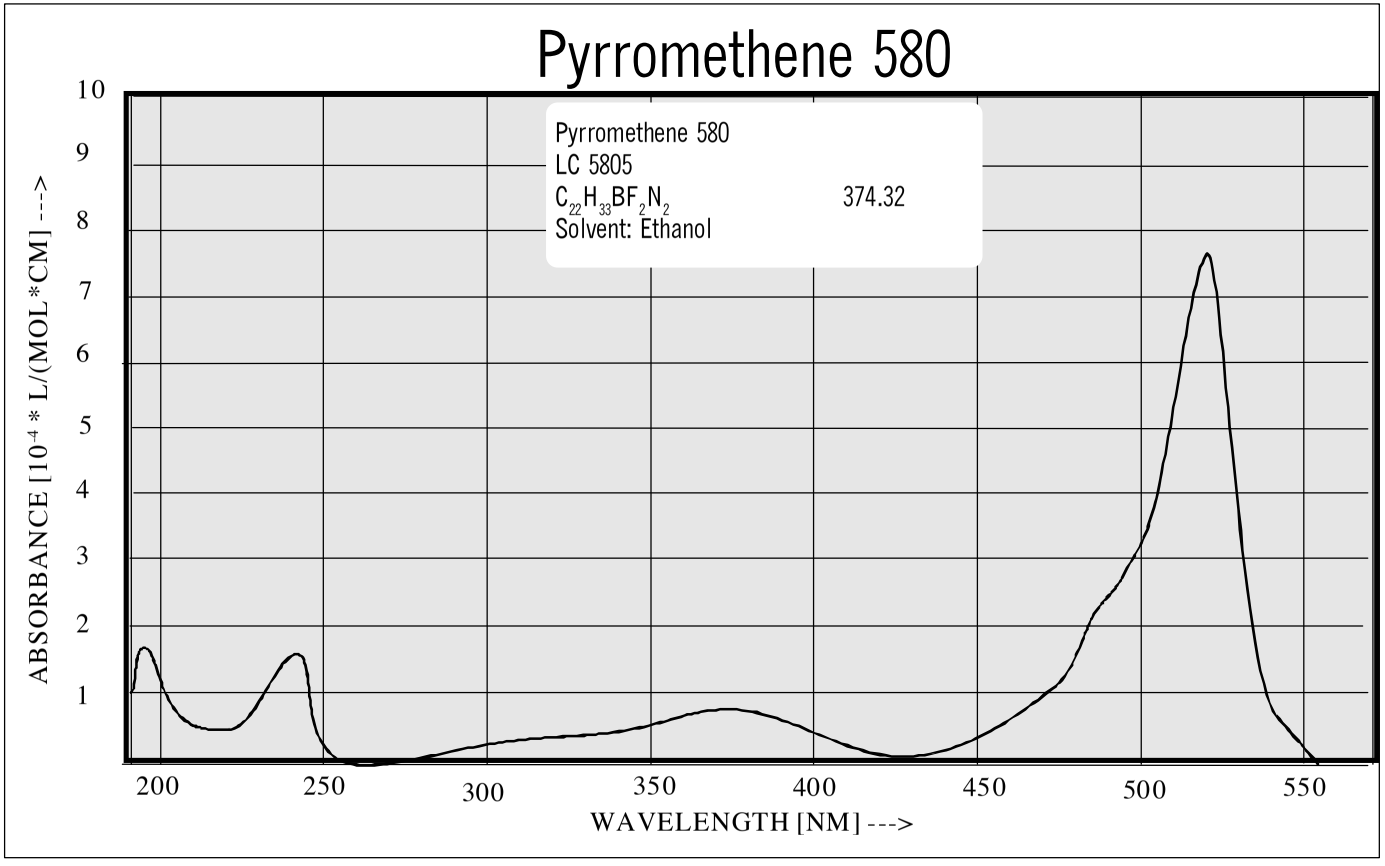
Lasing Performance

Efficient laser dye for pulsed operation; tunable around 560 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG, 3rd	*355*	*562*	*552 - 582*	*-*	*0.21*	*Ethanol*	*1*
Nd:YAG, 2nd	*532*	*567*	*556 - 586*	*31*	*0.22*	*Methanol*	*2*

References

1. D. M. Guthals, J. W. Nibler, *Opt. Commun.* 29(3), 322 (1979).
2. Lambda Physik, *Wall Chart* 1996.

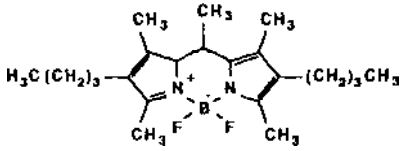

Pyrromethene 580
Pyrromethene 580
LC 5805
$C_{22}H_{33}BF_2N_2$ 374.32
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
WAVELENGTH [NM] --->
1
2
3
4
5
6
7
8
9
10
200
250
300
350
400
450
500
550

Pyrromethene 580 (LC 5805)

Constitution

4,4-Difluoro-2,6-di-n-butyl-1,3,5,7,8-pentamethyl-4-bora-3a,4a-diaza-s-indacene
2,6-Di-n-butyl-1,3,5,7,8-pentamethylpyrromethenedifluoroborate Complex

$C_{22}H_{33}BF_2N_2$ · MW: 374.32



Characteristics

Lambdachrome® number:	5805
CAS registry number:	N/A
Appearance:	orange/red, crystalline solid
Absorption maximum (in ethanol):	519 nm
Molar absorptivity:	7.68 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	550 nm

For research and development purposes only.

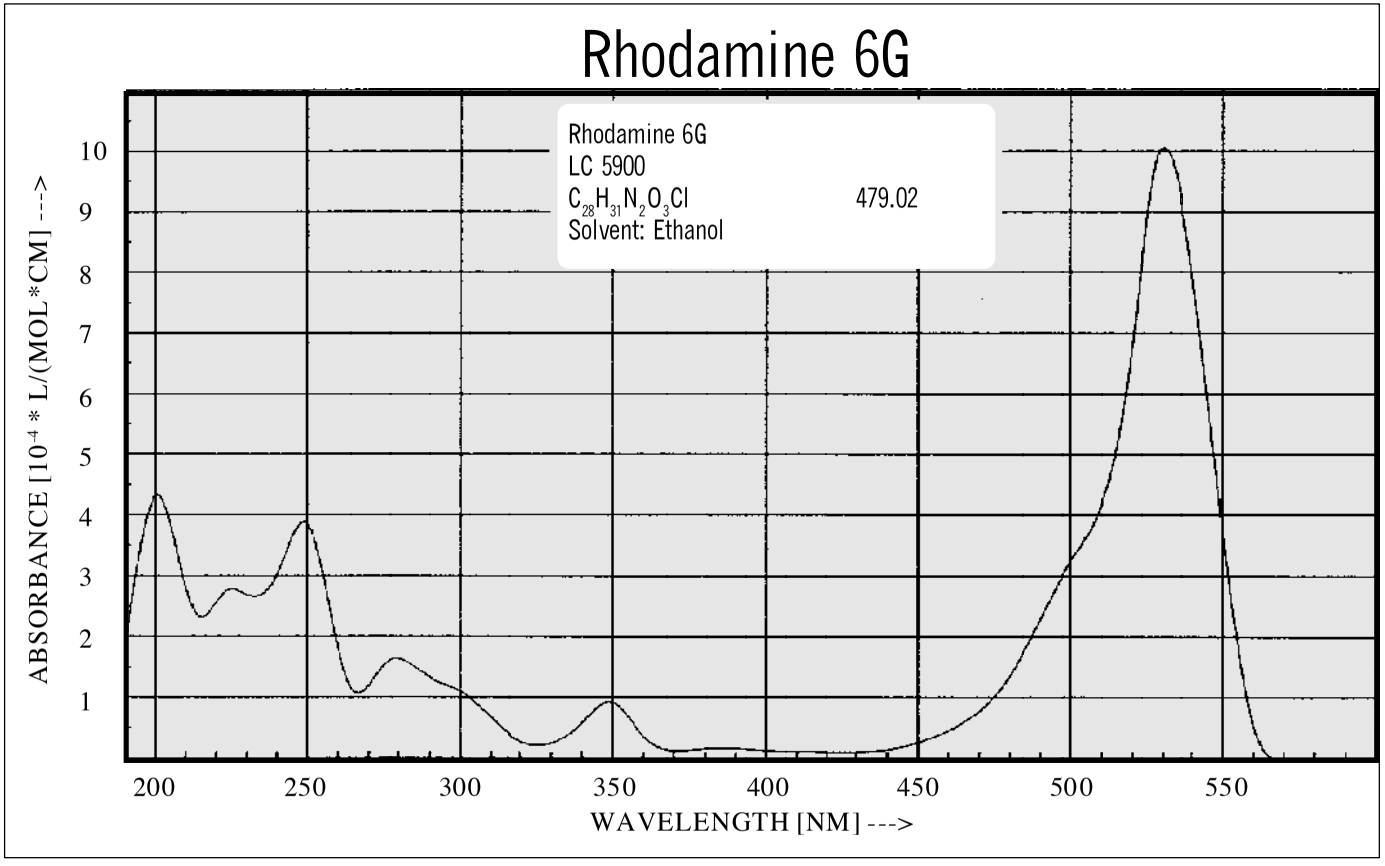
Lasing Performance

Laser dye for pulsed operation; tunable around 580 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*580*	-	-	*0.08*	*Ethanol*	*1*

References

1. M. Shah et al., *Heteroatom Chem.* 1(5), 389(1990).
2. R. E. Hermes et al., *Appl. Phys. Letters* 63(7), 877 (1993).

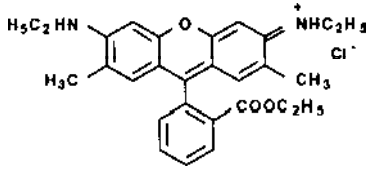

Rhodamine 6G
Rhodamine 6G
LC 5900
$C_{28}H_{31}N_2O_3Cl$ 479.02
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
8
9
10
200
250
300
350
400
450
500
550
WAVELENGTH [NM] --->

Rhodamine 6G (LC 5900)

Constitution

Benzoic Acid, 2-[6-(ethylamino)-3-(ethylimino)-2,7-dimethyl-3H-xanthen-9-yl]-ethyl ester, monohydrochloride
Rhodamine 590

$C_{28}H_{31}N_2O_3Cl$ · MW: 479.02



Characteristics

Lambdachrome® number:	5900
CAS registry number:	989-38-8
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	530 nm
Molar absorptivity:	10.50 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	556 nm

For research and development purposes only.

Lasing Performance

The laser dye "per se" Rhodamine 6G is by far the most frequently used and most widely investigated laser dye. Very efficient laser dye for pulsed and CW operation; tunable around 590 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*581*	*569 - 608*	*16*	*1.20*	*Methanol*	*1, 2, 3*
Nitrogen	*337*	*581*	*573 - 618*	*rel.*	*1.63*	*Methanol*	*3, 4, 5*
Nd:YAG, 2nd	*532*	*566*	*555 - 585*	*32*	*0.10*	*Methanol*	*1, 6, 7*
Flashlamp	*-*	*600*	*555 - 620*	*-*	*1.20*	*Ethanol*	*9, 10*
CW, Ar^+	*all*	*575*	*560 - 625*	*-*	*0.75*	*Eg.*	*1, 11, 12, 13*

References

See page 164.

References (RHODAMINE 6G)

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. A. Dienes, *Appl. Phys.* 7, 135 (1975).
6. D. M. Guthals, J. W. Nibler, *Opt. Commun.* 29(3), 322 (1979).
7. C. A. Moore, C. D. Decker, *J. Appl. Phys.* 49(1), 47 (1978).
8. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
9. P. R. Hammond, *Opt. Commun.* 29(3), 331 (1979).
10. J. Jethwa, F. P. Schäfer, *Appl. Phys.* 4, 299 (1974).
11. Coherent, *CW Dye Laser Fact Sheets.*
12. H. J. Baving et al., *Appl. Phys.* B29, 19 (1982).
13. T. F. Johnston et al., *Appl. Optics* 21(13), 2307 (1982).

References (RHODAMINE B)

1. Lambda Physik, *Wall Chart* 1996.
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. Lambda Physik, *Data Sheet.*
4. A. Dienes, *Appl. Phys.* 7, 135 (1975).
5. I. A. Stenhaouse, D. R. Williams, *Appl. Spectrosc.* 33(2), 175 (1979).
6. Q. H. F. Vrehen, *Opt. Commun.* 3(3), 144 (1971).
7. L. Masarnovskii et al., *Sov. J. Quantum Electron.* 9(7), 900 (1979).
8. R. S. Hargrove, T. Kan, *IEEE J. Quantum Electron.* QE-13, 28D (1977).
9. J. M. Drake et al., *Chem. Phys. Letters* 35(2), 181 (1975).
10. P. R. Hammond, *Opt. Commun.* 29(3), 331 (1979).
11. Coherent, *CW Dye Laser Fact Sheets.*

References (SULFORHODAMINE B)

1. Lambda Physik, *Wall Chart* 1996.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. Lambda Physik, *Data Sheet.*
4. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
5. P. R. Hammond, *Opt. Commun.* 29(3), 331 (1979).
6. R. M. Schotland, *Appl. Optics* 19(1), 124 (1980).
7. J. M. Yarborough, *Appl. Phys. Letters* 24(12), 629 (1974).

References (RHODAMINE 101)

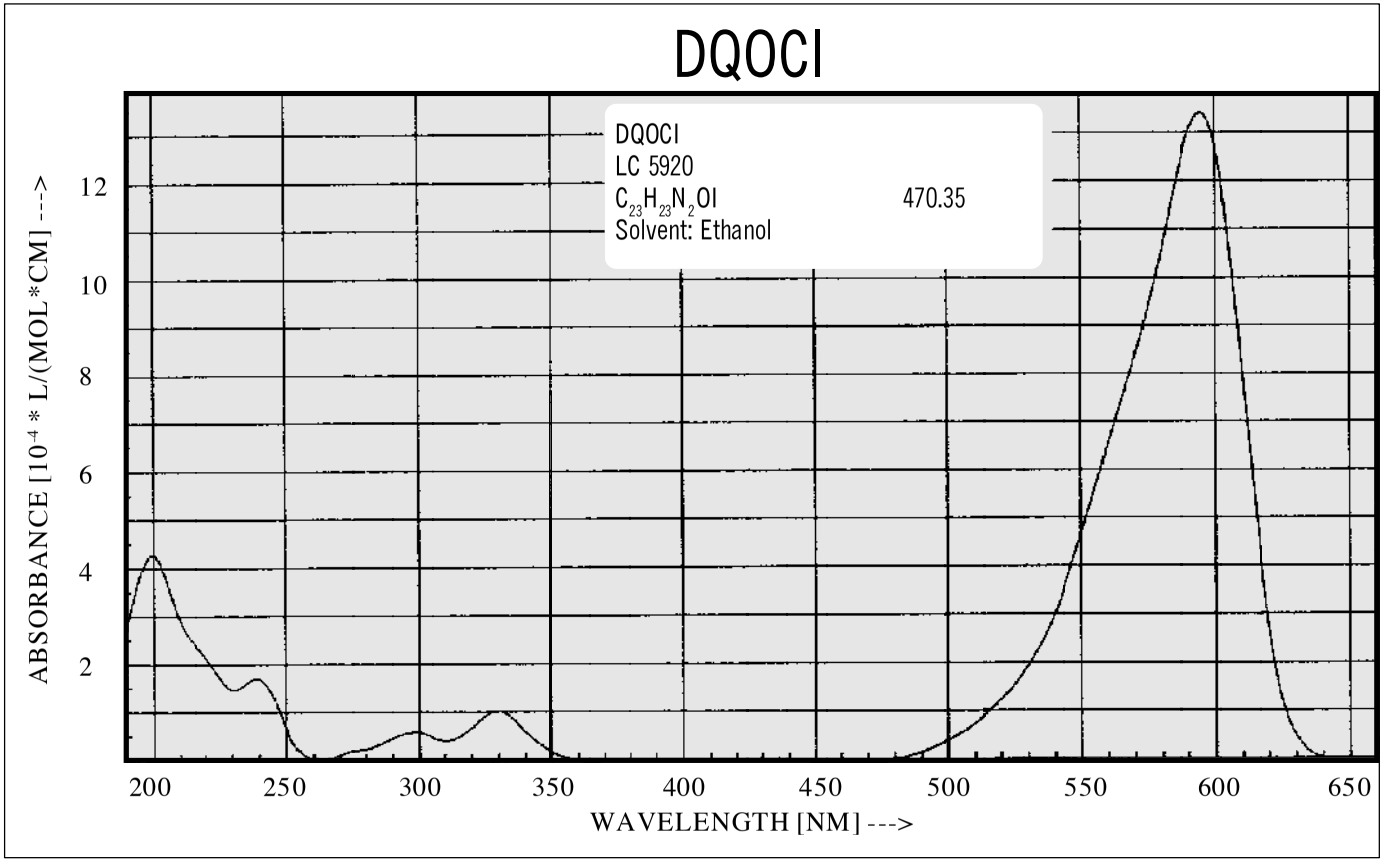
1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. Lambda Physik.
6. Bos, *Appl. Optics* 20(10), 1886 (1981).
7. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
8. T. J. Negran, A. M. Glass, *Appl. Optics* 17(17), 2812 (1978).
9. Coherent, *CW Dye Laser Fact Sheets.*

References (DCM)

1. Lambda Physik, *Wall Chart* 1996.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. Lambda Physik, *Data Sheet.*
4. Lambda Physik.
5. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
6. P. R. Hammond, *Opt. Commun.* 29(3), 331 (1979).
7. G. P. Weber, *IEEE J. Quantum Electron.* QE-19(7), 1200 (1983).
8. Coherent, *Data Sheet.*
9. E. G. Marason, *Opt. Commun.* 37(1), 56 (1981).
10. T. F. Johnston et al., *Appl. Optics* 21(13), 2307 (1982).

References (CRESYL VIOLET)

1. Lambda Physik.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6) 403 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. F. Castelli, *Appl. Phys. Letters* 26(1), 18 (1975).
5. A. Dienes, *Appl. Phys.* 7, 135(1975).
6. I. A. Stenhouse, D. R. Williams, *Appl. Spectrosc.* 33(2), 175 (1979).
7. C. A. Moore, C. D. Decker, *J. Appl. Phys.* 49(1), 47 (1978).
8. W. Schmidt, W. Appt, N. Wittekindt, *Z. Naturforsch.* 27a, 37 (1972).
9. J. B. Marling et al., *Appl. Optics.* 13(10), 2317 (1974).
10. J. M. Yarborough, *Appl. Phys. Letters* 24(12), 629 (1974).

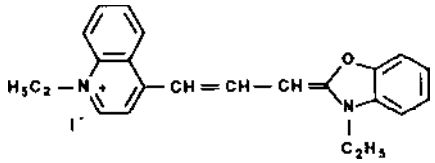

DQOCI
DQOCI
LC 5920
$C_{23}H_{23}N_2OI$ 470.35
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
2
4
6
8
10
12
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

DQOCI (LC 5920)

Constitution

1,3'-Diethyl-4,2'-quinolyloxacarbocyanine Iodide

$C_{23}H_{23}N_2OI$ · MW: 470.35



Characteristics

Lambdachrome® number:	5920
CAS registry number:	-
Appearance:	violet, crystalline solid
Absorption maximum (in ethanol):	592 nm
Molar absorptivity:	13.5 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

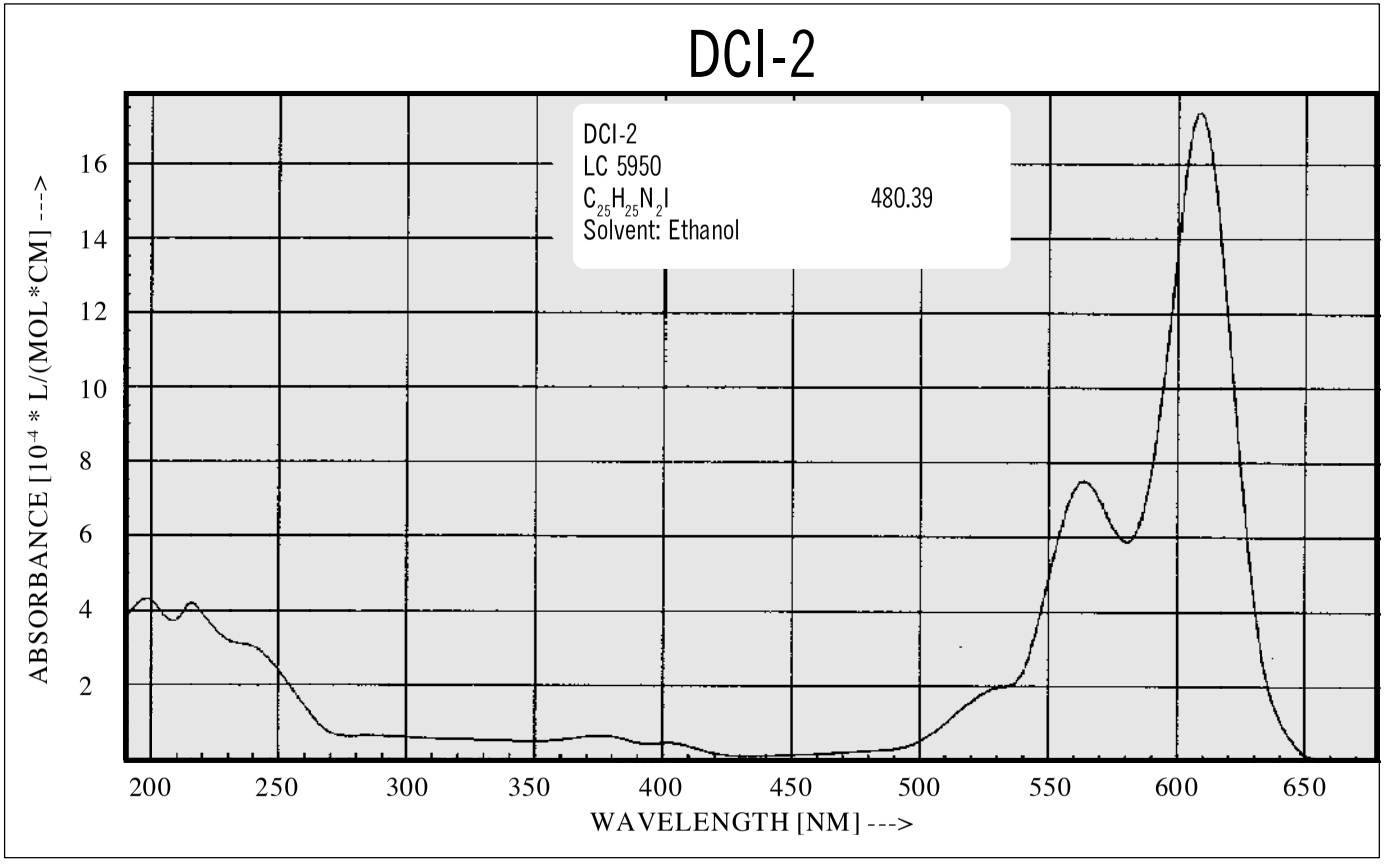
For research and development purposes only.

Lasing Performance

Saturable absorber for flashlamp pumped Fluorol 7GA and Rhodamine 6G dye lasers [1.,2.]. Applicable around 590 nm.

References

1. E. Lill, S. Schneider, F. Dörr, *Opt. Commun.* 20(2), 223 (1977).
2. R. S. Adrain et al., *Opt. Commun.* 12(2), 140 (1974).

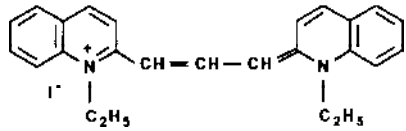

DCI-2
DCI-2
LC 5950
$C_{25}H_{25}N_2I$ 480.39
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

DCI-2 (LC 5950)

Constitution

1,1'-Diethyl-2,2'-carbocyanine Iodide
Pinacyanol Iodide · Chinaldinblau

$C_{25}H_{25}N_2I$ · MW: 480.39



Characteristics

Lambdachrome® number:	5950
CAS registry number:	-
Appearance:	violet, crystalline solid
Absorption maximum (in ethanol):	606 nm
Molar absorptivity:	17.0 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

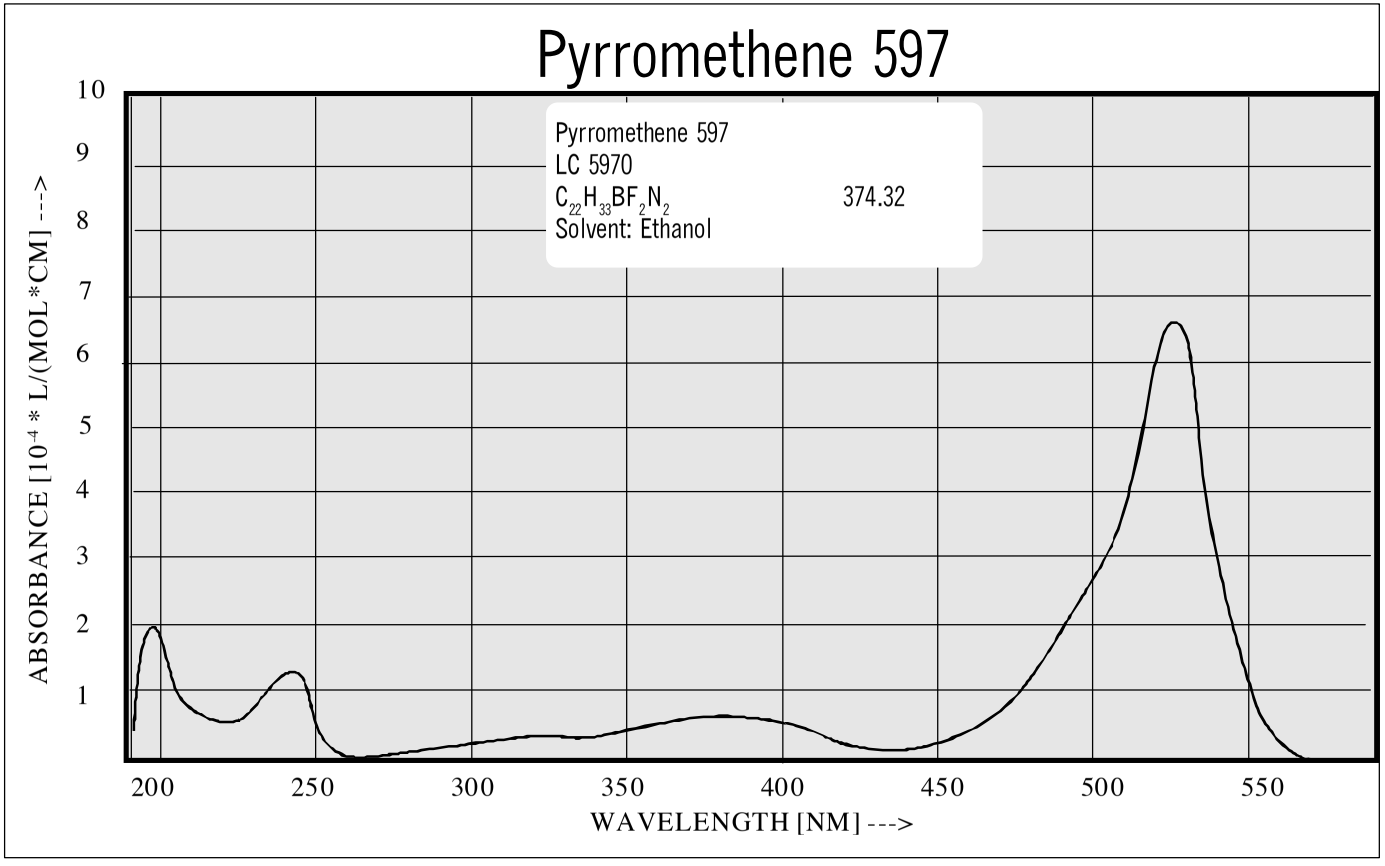
For research and development purposes only.

Lasing Performance

Saturable absorber for flashlamp pumped Rhodamine 6G dye lasers [1.]. Applicable around 606 nm.

References

1. M. Maeda, Y. Miyazoe, *Jap. J. Appl. Phys.* 13(1), 193 (1974).

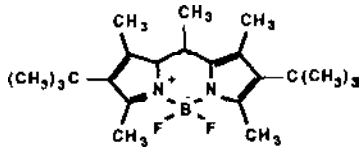

Pyrromethene 597
Pyrromethene 597
LC 5970
$C_{22}H_{33}BF_2N_2$ 374.32
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
WAVELENGTH [NM] --->
10
9
8
7
6
5
4
3
2
1
200
250
300
350
400
450
500
550

Pyrromethene 597 (LC 5970)

Constitution

4,4-Difluoro-2,6-di-t-butyl-1,3,5,7,8-pentamethyl-4-bora-3a,4a-diaza-s-indacene
2,6-Di-t-butyl-1,3,5,7,8-pentamethylpyrromethenedifluoroborate Complex

$C_{22}H_{33}BF_2N_2$ · MW: 374.32



Characteristics

Lambdachrome® number:	5970
CAS registry number:	137829-79-9
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	524 nm
Molar absorptivity:	6.76 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	557 nm

For research and development purposes only.

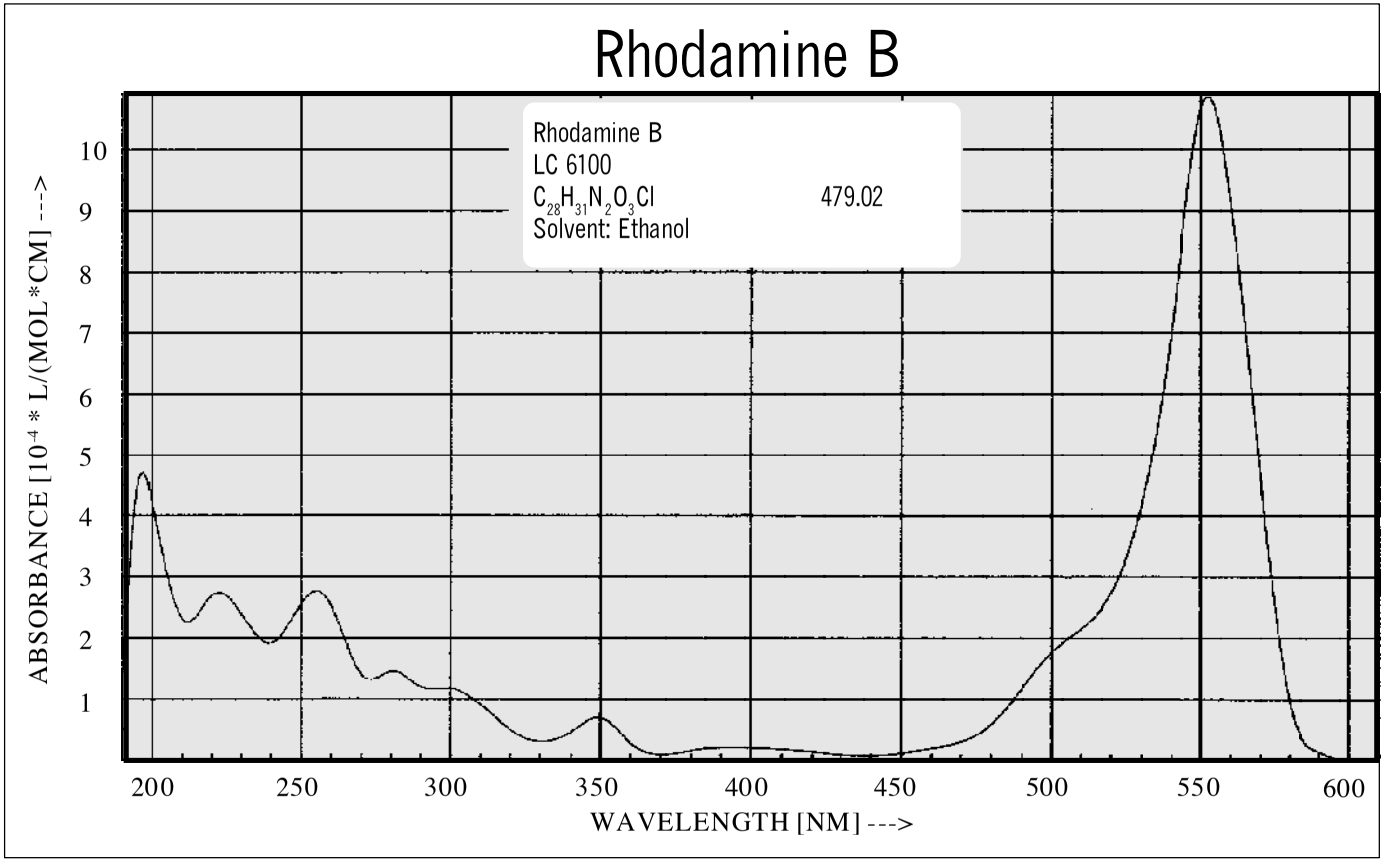
Lasing Performance

Laser dye for pulsed operation; tunable around 590 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*593*	-	-	*0.08*	*Ethanol*	*1, 2*

References

1. J. H. Boyer et al., *Appl. Optics* 30(27), 3788 (1991).
2. J. H. Boyer et al., *Heteroatom Chem.* 4(1), 39 (1993).

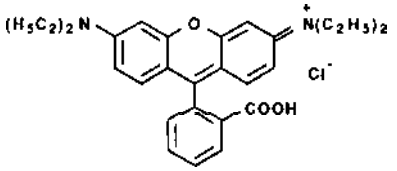

Rhodamine B
Rhodamine B
LC 6100
$C_{28}H_{31}N_2O_3Cl$ 479.02
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
6
7
8
9
10
200
250
300
350
400
450
500
550
600
WAVELENGTH [NM] --->

Rhodamine B (LC 6100)

Constitution

2-[6-(Diethylamino)-3-(diethylimino)-3H-xanthen-9-yl] benzoic acid
Rhodamine 610

$C_{28}H_{31}N_2O_3Cl$ · MW: 479.02



Characteristics

Lambdachrome® number:	6100
CAS registry number:	81-88-9
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	552 nm
Molar absorptivity:	10.7 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	580 nm

For research and development purposes only.

Lasing Performance

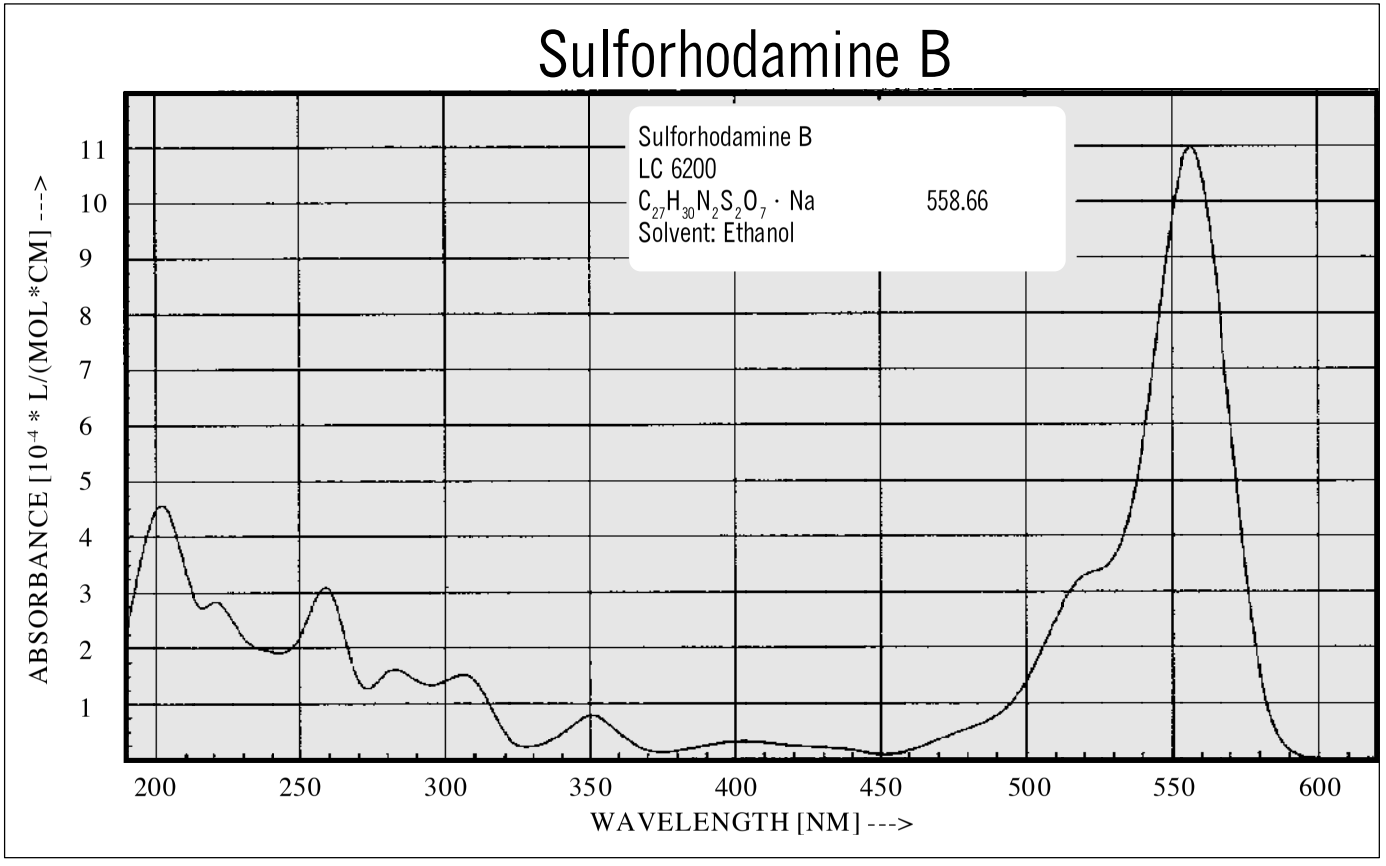
Very efficient and frequently used laser dye for pulsed and CW operation; tunable around 610 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*600*	*588 - 644*	*12*	*0.91*	*Methanol*	*1, 2*
Nitrogen	*337*	*622*	*599 - 650*	*rel.*	*2.13*	*Methanol*	*2, 3, 4*
Nd:YAG, 2nd	*532*	*594*	*584 - 619*	*29*	*0.22*	*Methanol*	*1, 5, 6*
Cu-vapo	*510*	*591*	*582 - 618*	*21*	*0.62*	*Ethanol*	*7, 8*
Flashlamp	*-*	*618*	*590 - 640*	*-*	*0.05*	*Ethanol*	*9, 10*
CW, Ar^+	*all*	*640*	*605 - 675*	*-*	*3.53*	*MeOH/Eg.*	*11*

References

see page 164.

Sulforhodamine B

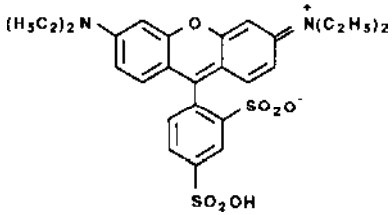


Sulforhodamine B (LC 6200)

Constitution

Ethanaminium, N-[6-diethylamino)-9-(2,4-disulfophenyl)-3H-xanthen-3-ylidene]-N-ethylhydroxid, inner salt, sodium salt
Kiton Red 620 · Kiton Red S

$C_{27}H_{30}N_2S_2O_7$ · Na · MW: 558.66



Characteristics

Lambdachrome® number:	6200
CAS registry number:	3520-42-1
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	556 nm
Molar absorptivity:	11.1 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	575 nm

For research and development purposes only.

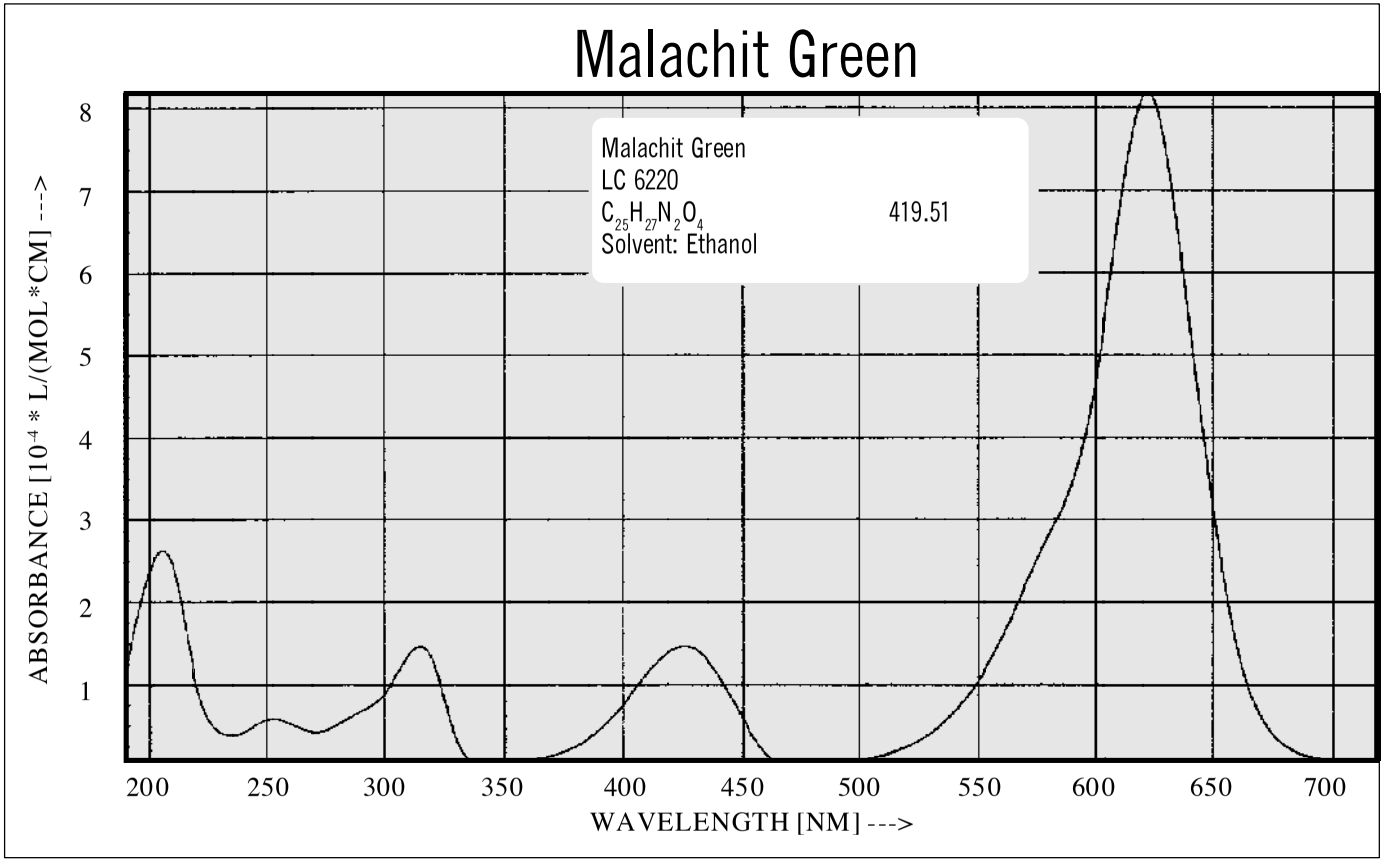
Lasing Performance

Efficient and frequently used laser dye for pulsed and CW operation; performance similar to Rhodamin B; tunable around 620 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*605*	*594 - 642*	*12*	*0.90*	*Methanol*	*1, 2*
Nitrogen	*337*	*622*	*600 - 646*	*rel.*	*2.85*	*Methanol*	*3*
Nd:YAG, 2nd	*532*	*588*	*579 - 600*	*29*	*0.27*	*Methanol*	*1*
Cu-vapo	*510*	*620*	*598 - 645*	*14*	*1.74*	*Methanol*	*4*
Flashlamp	*-*	*629*	*600 - 650*	*-*	*3.91*	*Methanol*	*5, 6*
CW, Ar^+	*all*	*625*	*598 - 650*	*-*	*2.50*	*MeOH/Eg.*	*1, 7*

References

See page 164.

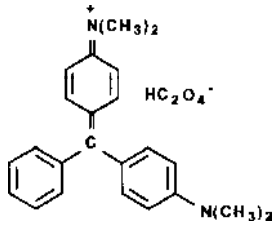

Malachit Green
Malachit Green
LC 6220
$C_{25}H_{27}N_2O_4$ 419.51
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
8
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Malachit Green (LC 6220)

Constitution

Malachit Grün Oxalat

$C_{25}H_{27}N_2O_4$ · MW: 419.51



Characteristics

Lambdachrome® number:	6220
CAS registry number:	-
Appearance:	green, crystalline solid
Absorption maximum (ethanol):	622 nm
Molar absorptivity:	8.07 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in bas. ethanol):	530 nm

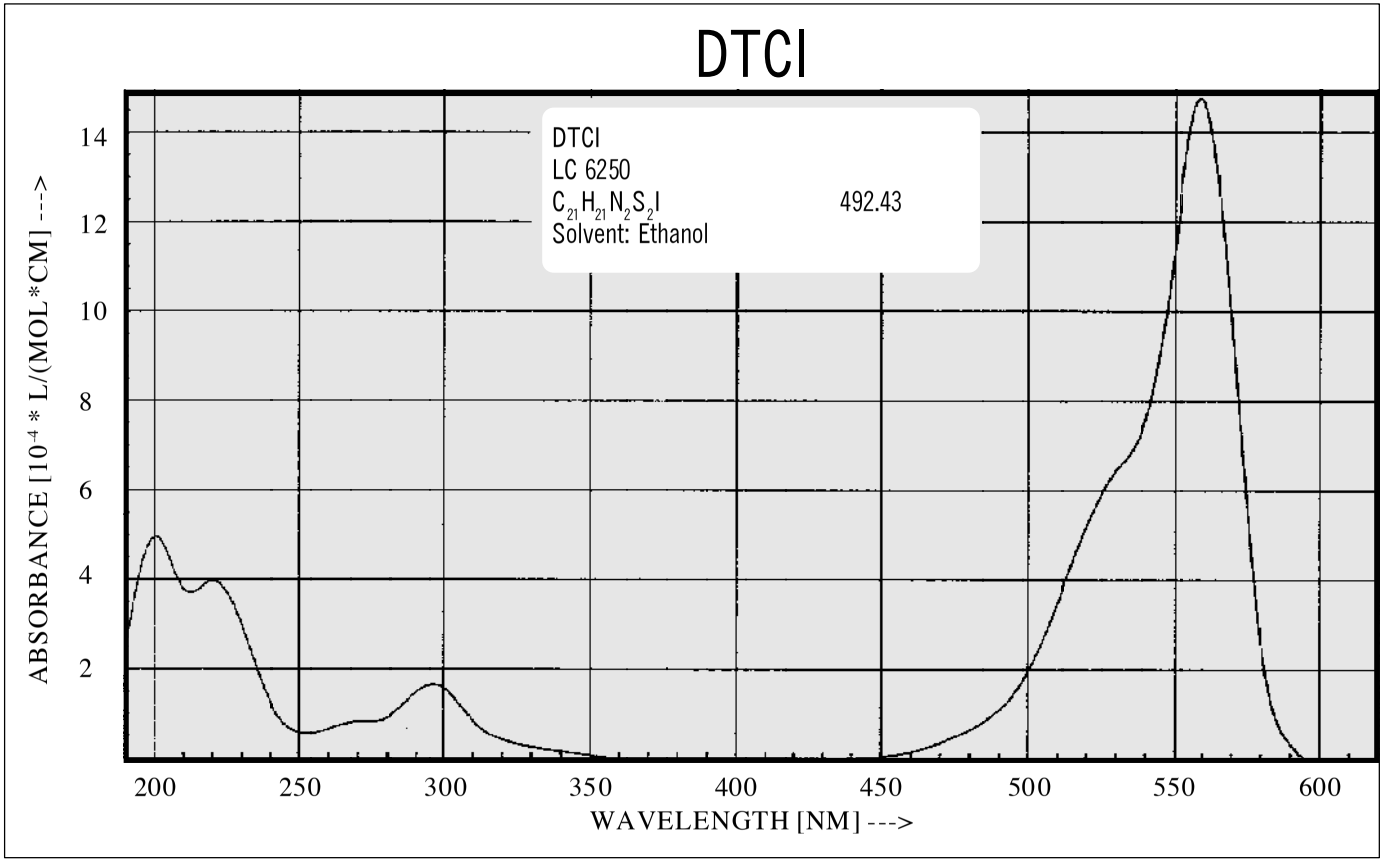
For research and development purposes only.

Lasing Performance

Additive for CW pumped, passivlely mode locked Rhodamine 6G dye lasers.

References

1. M. Young, *Appl. Optics* 18(19), 3212 (1979).
2. A. Watanabe et al., *IEEE J. Quantum Electron.* QE-19(4), 533 (1983).

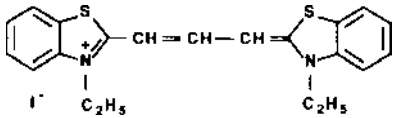

DTCI
DTCI
LC 6250
$C_{21}H_{21}N_2S_2I$ 492.43
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
WAVELENGTH [NM] --->

DTCI (LC 6250)

Constitution

3,3'-Diethylthiacarbocyanine Iodide

$C_{21}H_{21}N_2S_2I$ · MW: 492.43



Characteristics

Lambdachrome® number:	6250
CAS registry number:	-
Appearance:	red, crystalline solid
Absorption maximum (in methanol):	557 nm
Molar absorptivity:	14.60 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

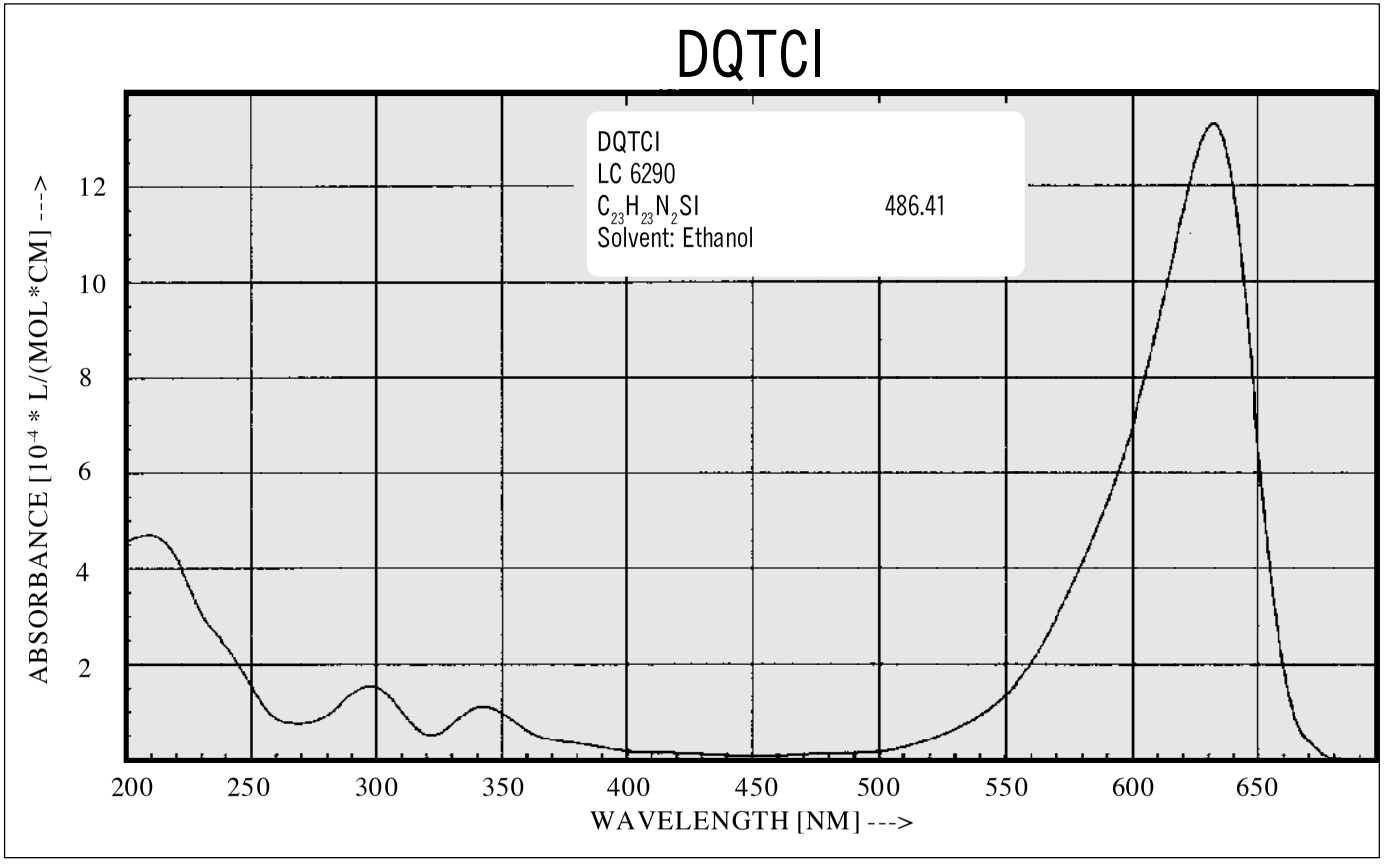
Lasing Performance

Laser dye for pulsed operation; tunable around 625 nm. Saturable absorber for flashlamp pumped Rhodamine 6G dye lasers; applicable around 560 nm[2.].

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*625*	-	-	*0.10*	*Glyzerine*	*1*

References

1. M. Maeda, Y. Miyazoe, *Jap. J. Appl. Phys.* 11(5), 692 (1972).
2. M. Maeda, Y. Miyazoe, *Jap. J. Appl. Phys.* 13(1), 193 (1974).

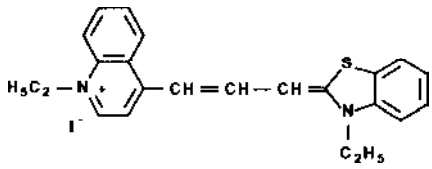

DQTCI
DQTCI
LC 6290
$C_{23}H_{23}N_2SI$ 486.41
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

DQTCI (LC 6290)

Constitution

1,3'-Diethyl-4,2'-quinolylthiacarbocyanine Iodide

$C_{23}H_{23}N_2SI$ · MW: 486.41



Characteristics

Lambdachrome® number:	6290
CAS registry number:	-
Appearance:	green, crystalline solid
Absorption maximum (in methanol):	629 nm
Molar absorptivity:	13.1 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

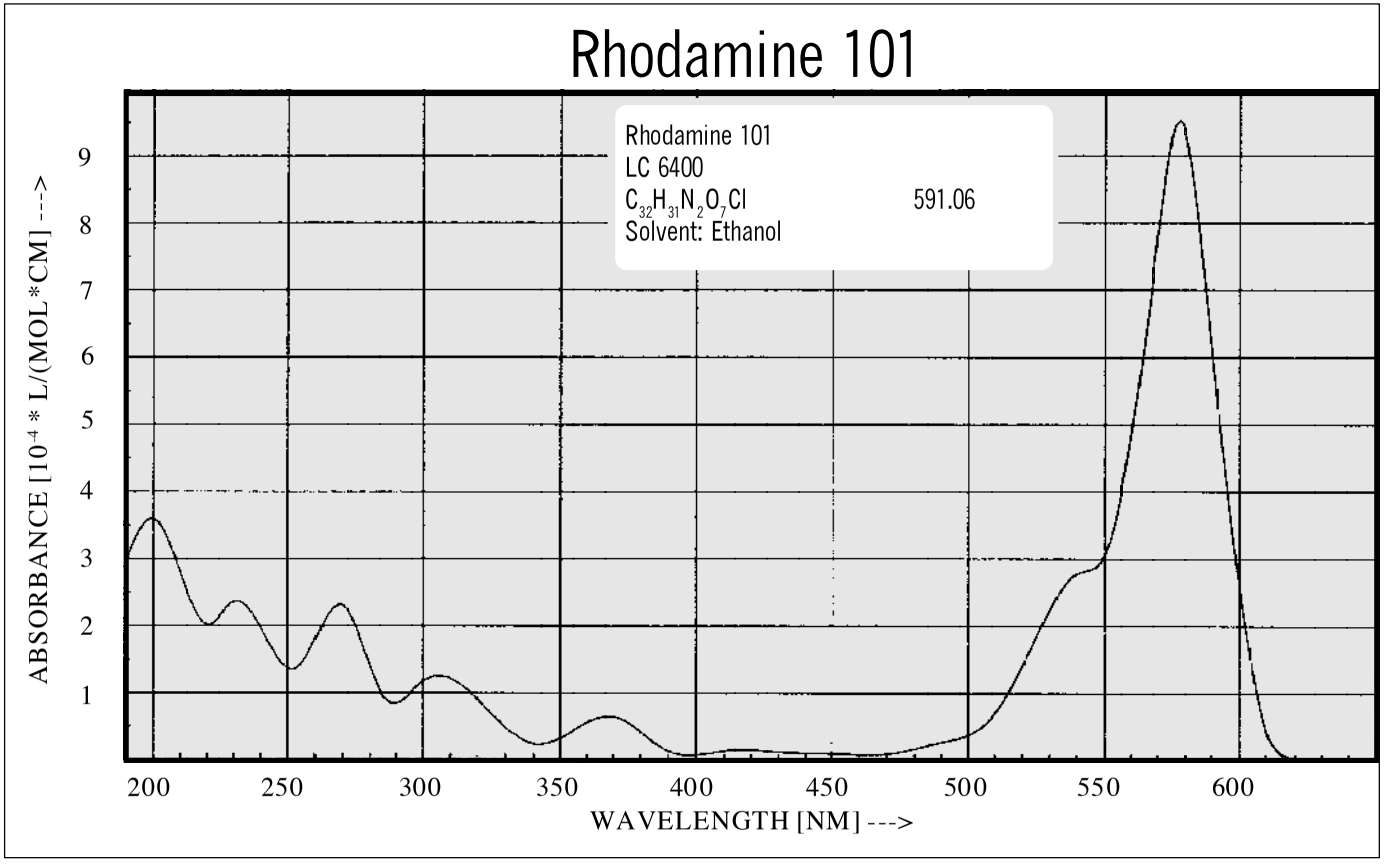
Lasing Performance

Saturable absorber for flashlamp pumped Rhodamine B dye lasers; applicable around 630 nm [1.,2.].

References

1. E. G. Arthurs et al., *Appl. Phys. Lett.* 20(3), 125(1972).
2. E. Lill, S. Schneider, F. Dörr, *Opt. Commun.* 22(1), 107(1977).

Rhodamine 101

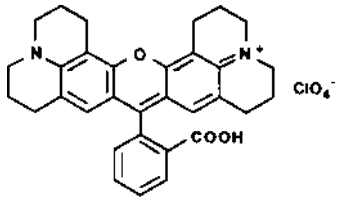


Rhodamine 101 (LC 6400)

Constitution

8-(2-Carboxyphenyl)-2,3,5,6,11,12,14,15-octahydro-1*H*,4*H*,10*H*,13*H*-diquinolizino[9,9a,1-*bc*:9',9a',1-*hi*]xanthylium Perchlorate
Rhodamine 640

$C_{32}H_{31}N_2O_7Cl$ · MW: 591.06



Characteristics

Lambdachrome® number:	6400
CAS registry number:	64339-18-0
Appearance:	red, crystalline solid
Absorption maximum (in acidic ethanol):	576 nm
Molar absorptivity:	9.50 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

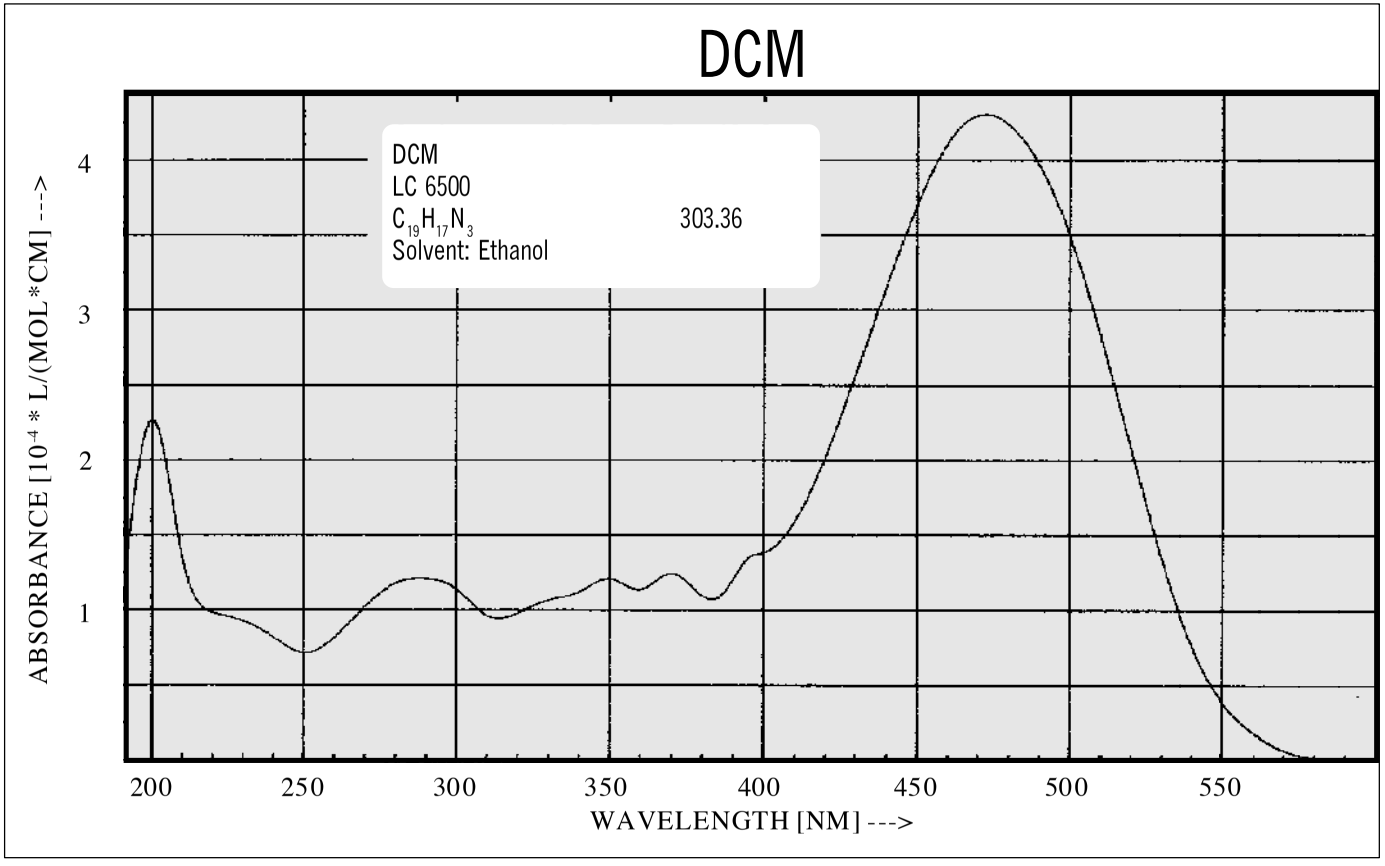
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 640 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*623*	*614 - 672*	*12*	*0.75*	*Methanol*	*1, 2, 3*
Nitrogen	*337*	*648*	*623 - 676*	*rel.*	*2.36*	*Methanol*	*2, 4*
Nd:YAG, 2nd	*532*	*621*	*611 - 662*	*26*	*0.50*	*Methanol*	*1, 5, 6*
Cu-vapor	*510*	*630*	*607 - 659*	*14*	*-*	*Methanol*	*7*
Flashlamp	*-*	*-*	*-*	*-*	*-*	*Ethanol*	*8*
CW, Ar^+	*VIS*	*625*	*610 - 695*	*-*	*2.5*	*MeOH/Eg.*	*1, 9*

References

See page 165.

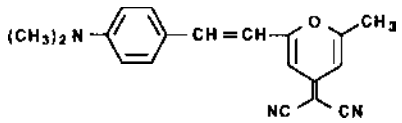

DCM
DCM
LC 6500
C19H17N3 303.36
Solvent: Ethanol
ABSORBANCE [10-4 * L/(MOL *CM] --->
1
2
3
4
200
250
300
350
400
450
500
550
WAVELENGTH [NM] --->

DCM (LC 6500)

Constitution

4-Dicyanmethylene-2-methyl-6-(p-dimethylaminostyryl)-4*H*-pyran

$C_{19}H_{17}N_3$ · MW: 303.36



Characteristics

Lambdachrome® number:	6500
CAS registry number:	51325-91-8
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	472 nm
Molar absorptivity:	4.25 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	644 nm

For research and development purposes only.

Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 650 nm. DCM Special gives higher efficiency due to better solubility.

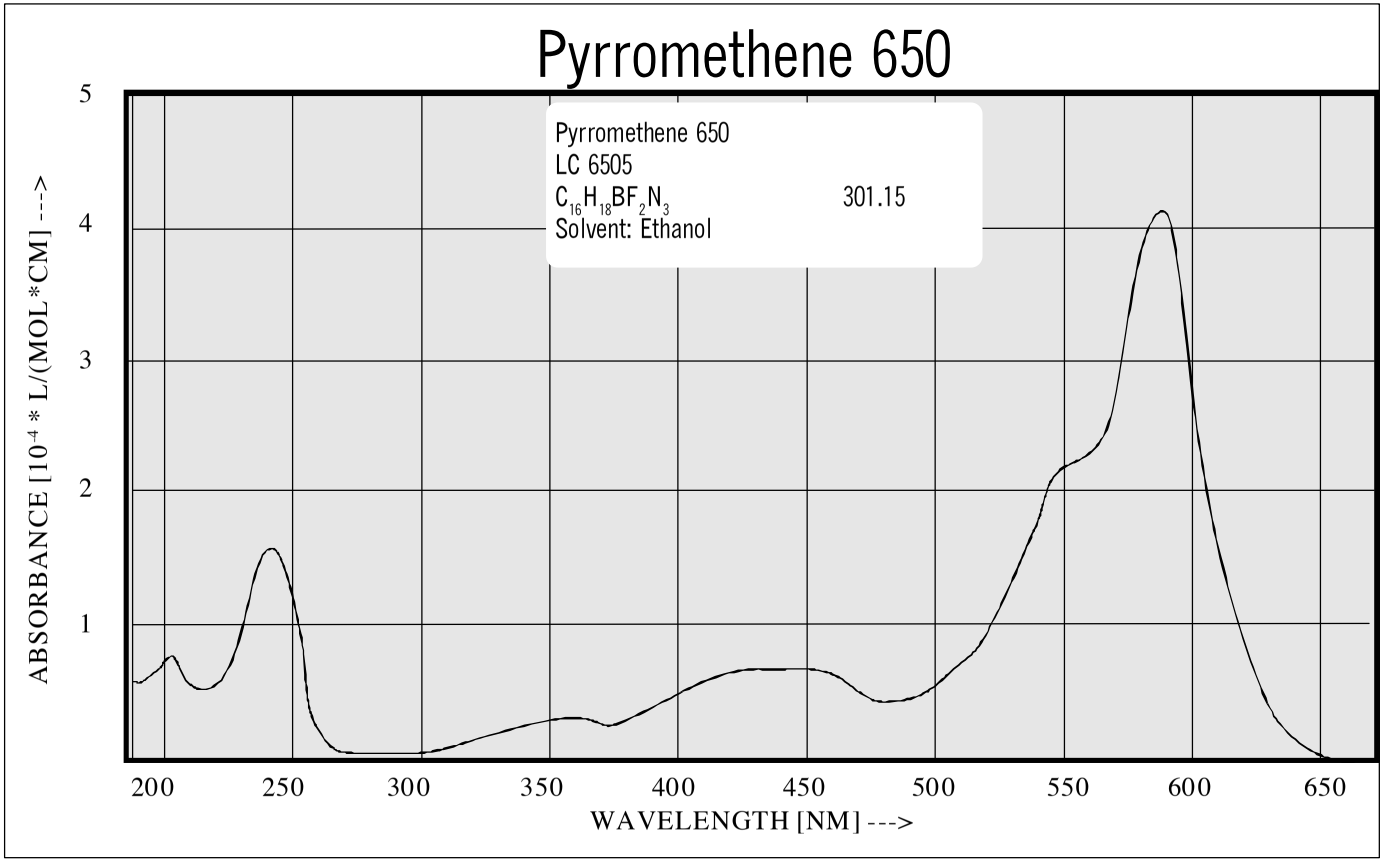
Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*658*	*632 - 690*	*12*	*0.71*	*DMSO*	*1, 2*
Nitrogen	*337*	*659*	*626 - 703*	*rel.*	*0.50*	*DMSO*	*3*
Nd:YAG, 2nd	*532*	*639*	*615 - 666*	*27*	*0.50*	*PC*	*1, 4*
Cu-vapor	*510*	*644*	*598 - 677*	*14*	*0.61*	*Methanol*	*5*
Flashlamp	*-*	*655*	*610 - 710*	*-*	*0.76*	*DMSO*	*6, 7*
CW, Ar^+	*VIS*	*660*	*-*	*-*	*0.45*	*Bz./Eg.*	*1, 8, 9, 10*

References

See page 165.

P.S.

LC 6501 is a 1:1 mixture of LC 6500 and LC 6200 giving high absorption at the green line of an Ar-Ion laser. Its application should be restricted tothis pump laser only.

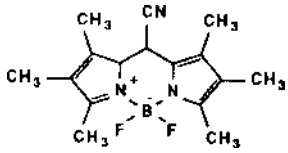

Pyrromethene 650
Pyrromethene 650
LC 6505
$C_{16}H_{18}BF_2N_3$ 301.15
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
5
4
3
2
1
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

Pyrromethene 650 (LC 6505)

Constitution

4,4-Difluoro-8-cyano-1,2,3,5,6,7-hexamethyl-4-bora-3a,4a-diaza-s-indacene
8-Cyano-1,2,3,5,6,7-hexamethylpyrromethenedifluoroborate Complex

$C_{16}H_{18}BF_2N_3$ · MW: 301.15



Characteristics

Lambdachrome® number:	6505
CAS registry number:	-
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	590 nm
Molar absorptivity:	4.05 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	612 nm

For research and development purposes only.

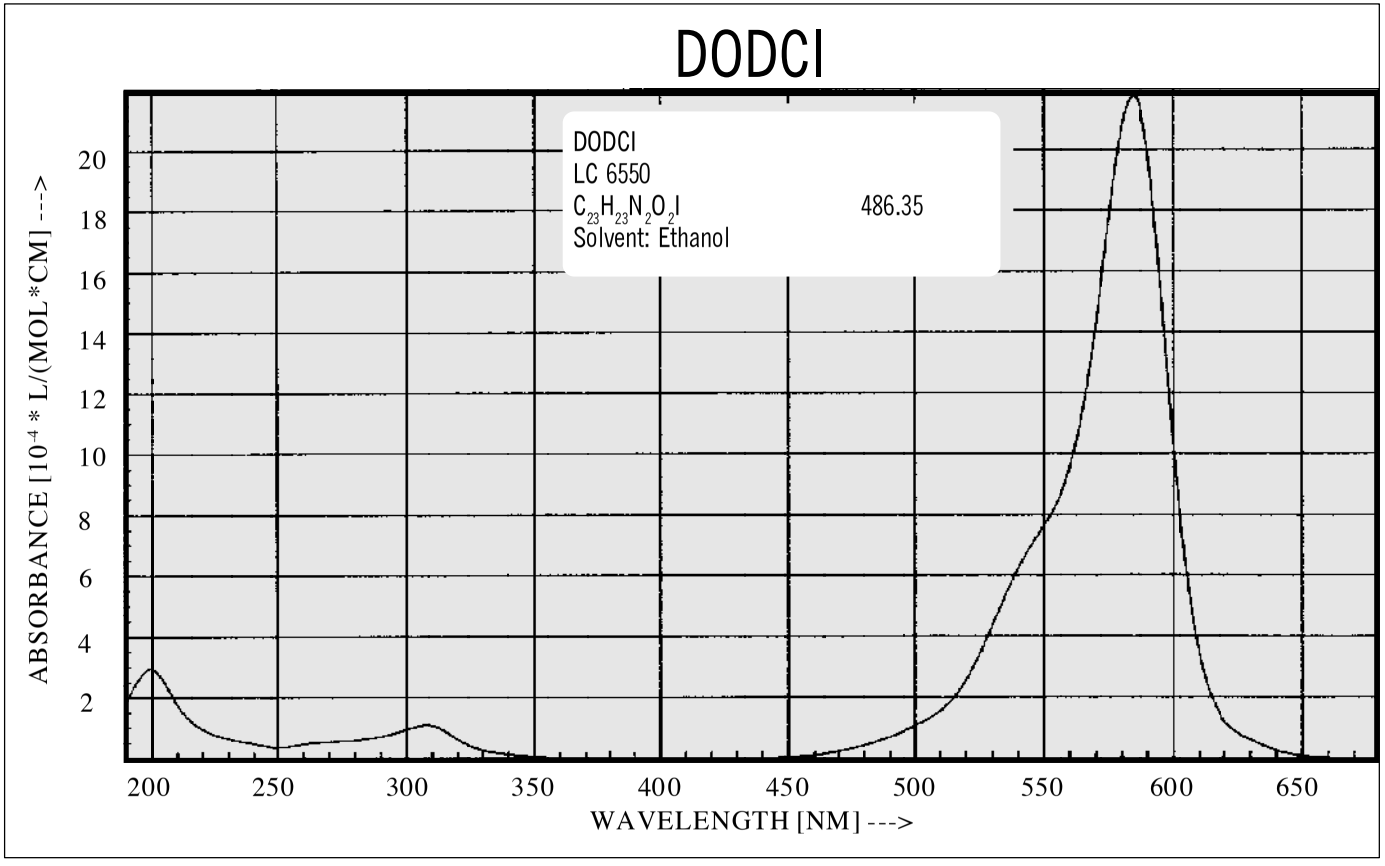
Lasing Performance

Laser dye for pulsed operation; tunable around 630 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG	*532*	*630*	*-*	*31*	*0.03*	*Ethanol*	*1*

References

1. T. H. Allik et al., *SPIE Proceedings* 2115, 240 (1994).

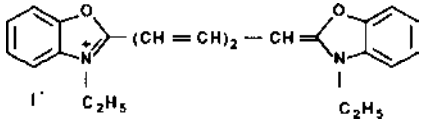

DODCI
DODCI
LC 6550
$C_{23}H_{23}N_2O_2I$ 486.35
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
2
4
6
8
10
12
14
16
18
20
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

DODCI (LC 6550)

Constitution

3,3'-Diethyloxadicarbocyanine Iodide
NK 1533

$C_{23}H_{23}N_2O_2I$ · MW: 486.35



Characteristics

Lambdachrome® number:	6550
CAS registry number:	-
Appearance:	blue, crystalline solid
Absorption maximum (in ethanol):	582 nm
Molar absorptivity:	22.3 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

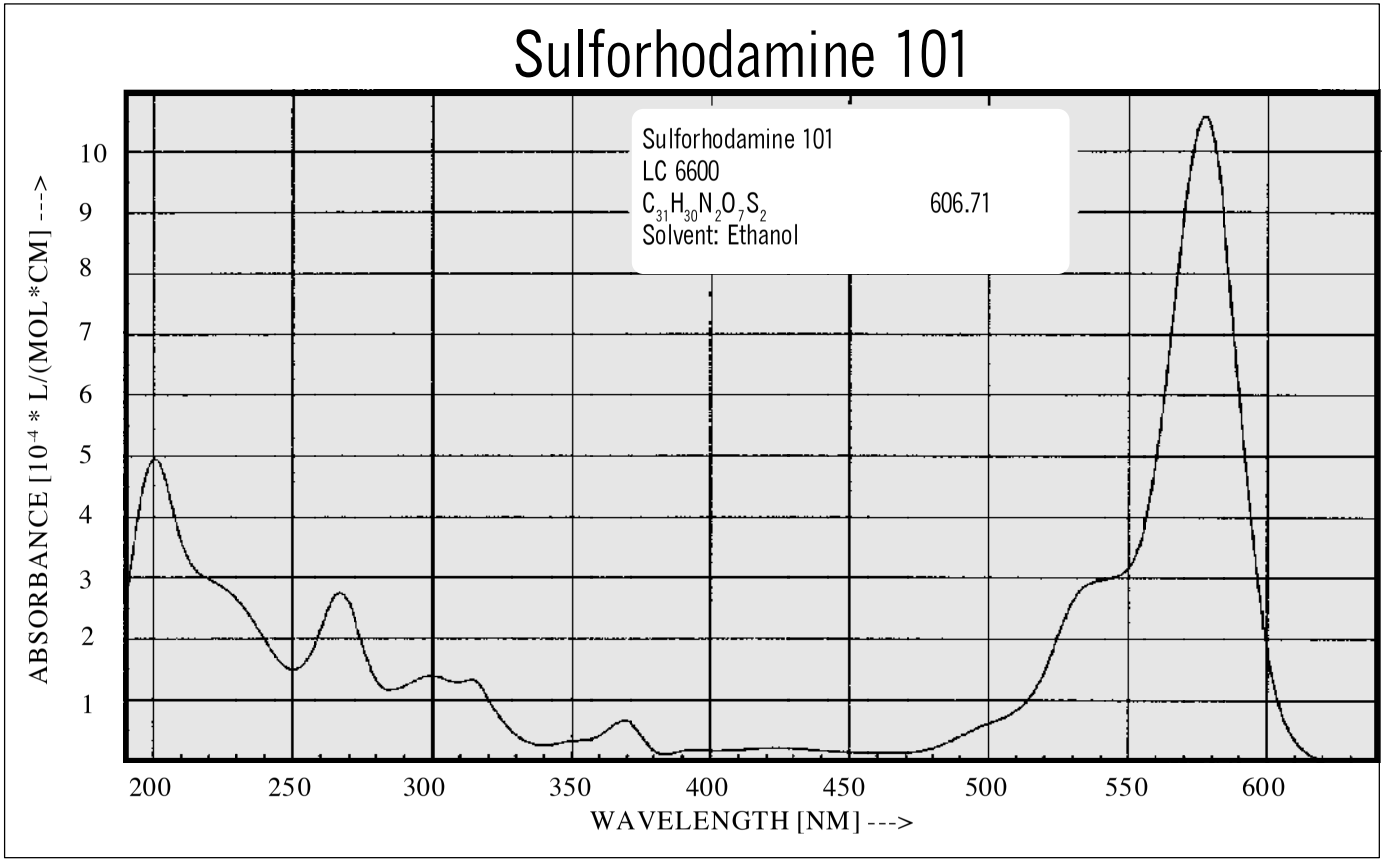
Lasing Performance

Laser dye for pulsed operation; tunable around 660 nm. Most frequently used saturable absorber for flashlamp and CW pumped Rhodamine 6G und Rhodamin B dye lasers [3., 4., 5.]. Applicable around 580 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG, 2nd	*532*	-	-	-	*0.49*	*Ethanol*	*1*
Flashlamp	-	*662*	-	-	*0.10*	*DMSO*	*2*

References

1. C. Rulliere, *Chem. Phys. Letters* 43(2), 303 (1976).
2. M. Maeda, Y. Miyazoe, *Jap. J. Appl. Phys.* 11(5), 692 (1972).
3. M. Young, *Appl. Optics.* 18(19), 3212 (1979).
4. A. Watanabe et al., *IEEE J. Quantum Electron.* QE-19(4), 533 (1983).
5. E. G. Arthurs et al., *Appl. Phys. Letters* 20(3), 125 (1972).

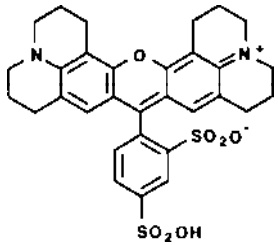

Sulforhodamine 101
Sulforhodamine 101
LC 6600
$C_{31}H_{30}N_2O_7S_2$ 606.71
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
10
9
8
7
6
5
4
3
2
1
200
250
300
350
400
450
500
550
600
WAVELENGTH [NM] --->

Sulforhodamine 101 (LC 6600)

Constitution

8-(2, 4-Disulfophenyl)-2,3,5,6,11,12,14,15-octahydro-1*H*,4*H*,10*H*,13*H*-diquinolizino[9,9a,1-*bc*:9',9a',1-*hi*]xanthene
Sulforhodamine 640

$C_{31}H_{30}N_2O_7S_2$ · MW: 606.71



Characteristics

Lambdachrome® number:	6600
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	578 nm
Molar absorptivity:	10.6 x 10^4 L mol^{-1} cm^{-1}

For research and development purposes only.

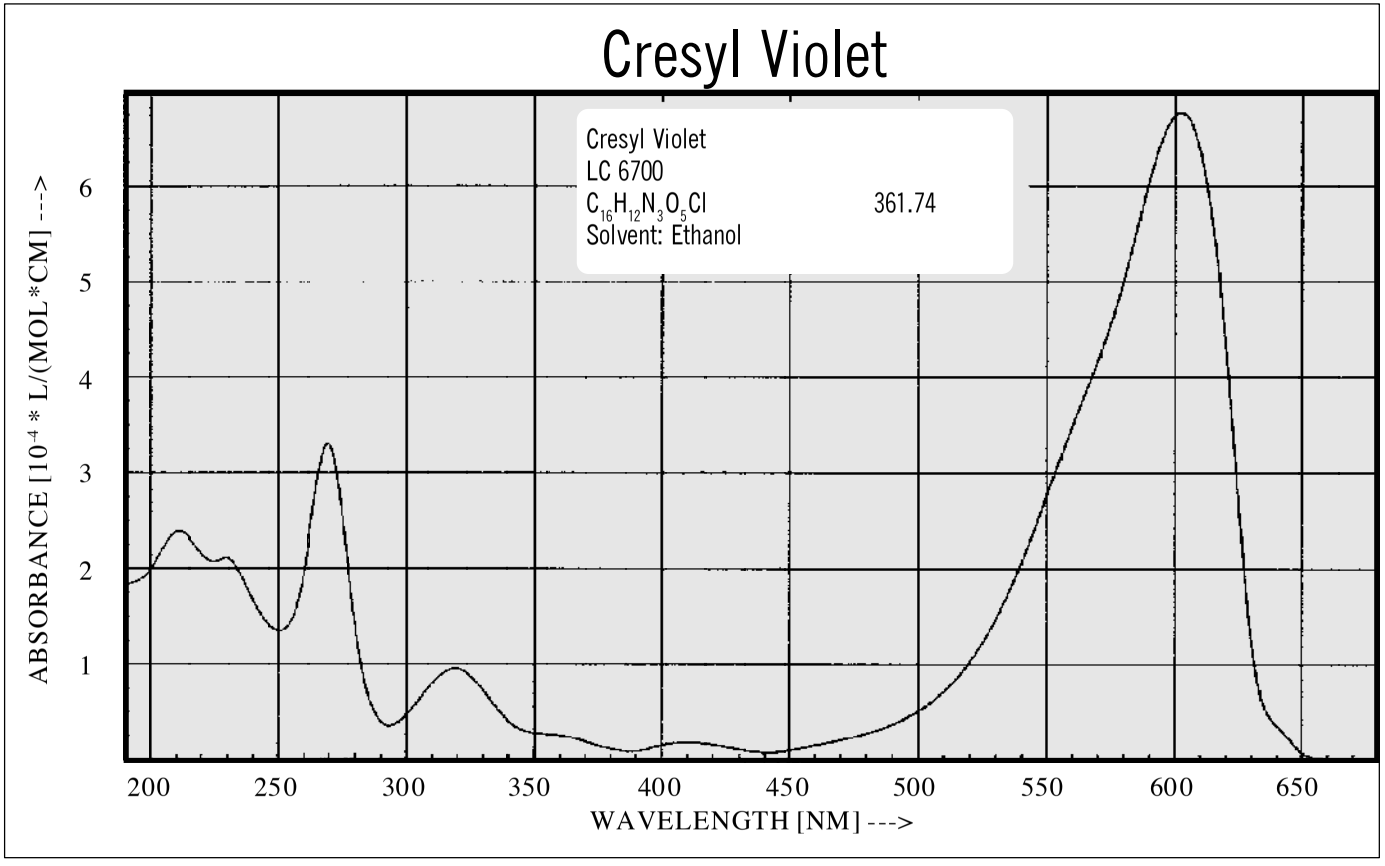
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 650 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*652*	*616 - 667*	*15*	*0.78*	*Methanol*	*2, 3*
Nd:YAG, 2nd	*532*	*628*	*619 - 673*	*15*	*0.3*	*Methanol*	*1, 4*
CW, Ar^+	*VIS*	*625*	*598 - 650*	*-*	*2.5*	*Eg.*	*5, 6*

References

1. Lambda Physik, *Wall Chart* 1996.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. Lambda Physik.
4. K. Kato, *IEEE J. Quantum Electron.* QE-13(7), 544 (1977).
5. Lambda Physik, *Wall Chart* 6/90.
6. M. Yamashita et al., *Opt. Commun.* 26(3), 343 (1978).

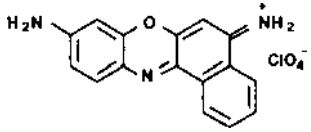

Cresyl Violet
Cresyl Violet
LC 6700
$C_{16}H_{12}N_3O_5Cl$ 361.74
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

Cresyl Violet (LC 6700)

Constitution

5,9-Diaminobenzo[a]phenoxazonium Perchlorate
Cresyl Violet 670

$C_{16}H_{12}N_3O_5Cl$ · MW: 361.74



Characteristics

Lambdachrome® number:	6700
CAS registry number:	41830-80-2
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	601 nm
Molar absorptivity:	6.74 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	632 nm

For research and development purposes only.

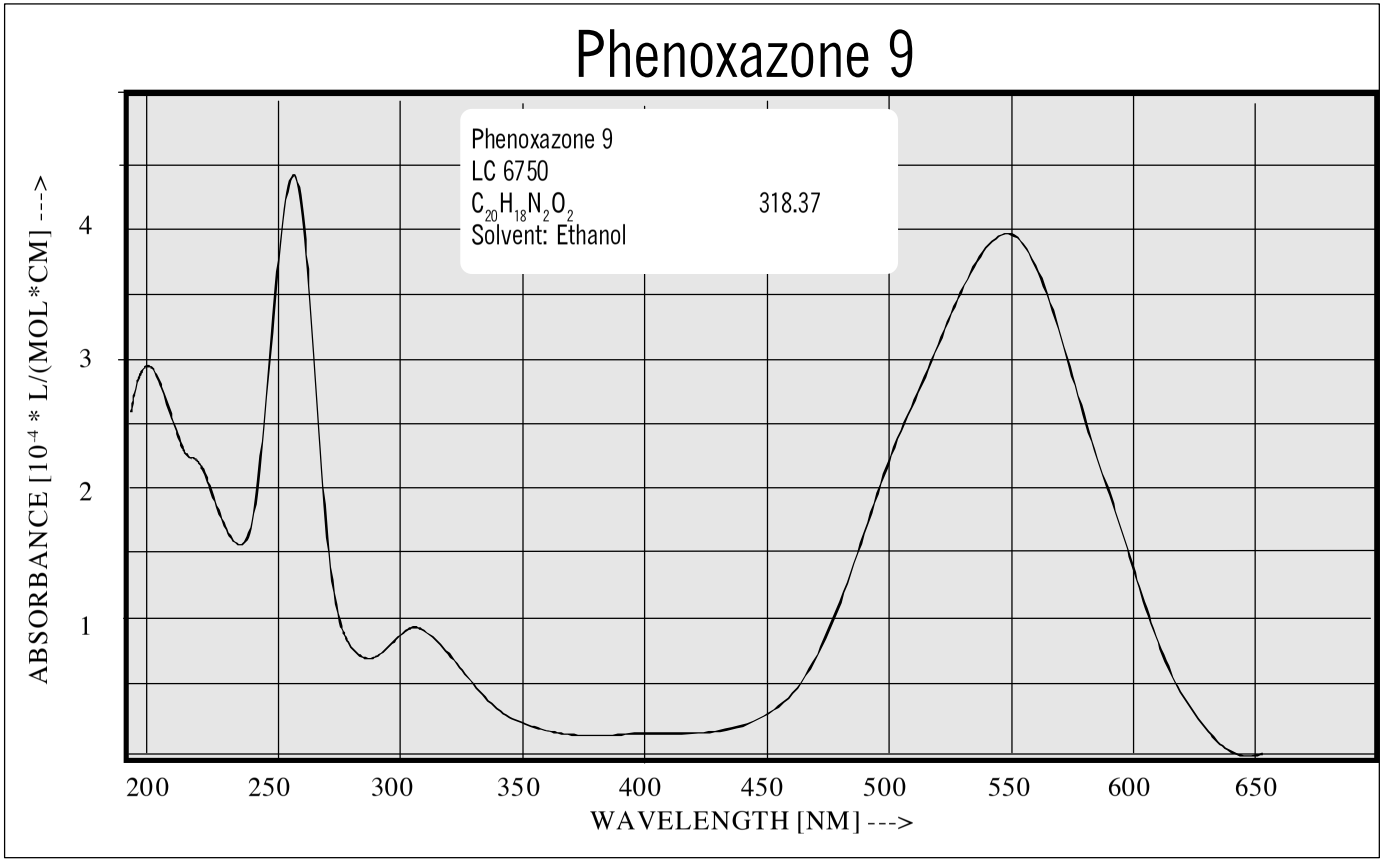
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 650 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*656*	*643 - 688*	*5*	*0.50*	*Ethanol*	*1, 2, 3*
Nitrogen	*337*	*650*	*630 - 680*	*rel.*	*0.36*	*Ethanol*	*4, 5*
Nd:YAG, 2nd	*532*	*630*	*614 - 654*	*36*	*0.04*	*Methanol*	*6, 7*
Flashlamp	*-*	*650*	*630 - 680*	*-*	*0.01*	*Methanol*	*8, 9*
CW, Ar^+	*VIS*	*670*	*650 - 695*	*4*	*1.09*	*Eg.*	*10*

References

See page 165.

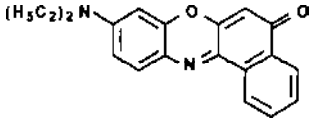

Phenoxazone 9
Phenoxazone 9
LC 6750
$C_{20}H_{18}N_2O_2$ 318.37
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

Phenoxazone 9 (LC 6750)

Constitution

9-Diethylamino-5H-benzo(a)phenoxazin-5-one

$C_{20}H_{18}N_2O_2$ · MW: 318.37



Characteristics

Lambdachrome® number:	6750
CAS registry number:	7385-67-3
Appearance:	green, crystalline solid
Absorption maximum (ethanol):	550 nm
Molar absorptivity:	2.83 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in bas. ethanol):	650nm

For research and development purposes only.

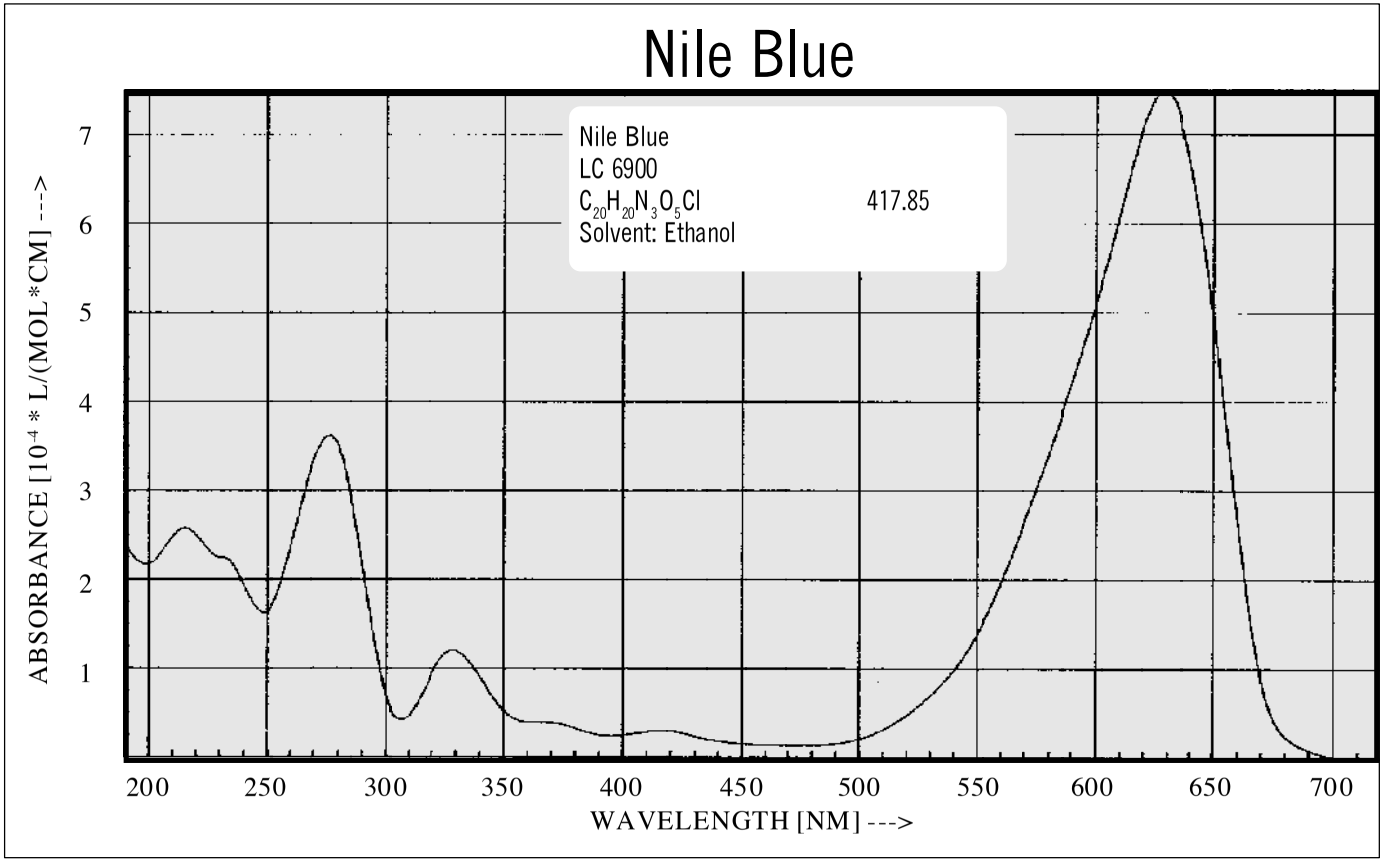
Lasing Performance

Laser dye for pulsed operation; tunable around 620 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nitrogen	*337*	*620*	*560 - 700*	*rel.*	*0.32*	*Ethanol*	*1*
Flashlamp	*-*	*-*	*-*	*-*	*0.03*	*various*	*1*

References

1. D. Basting, D. Ouw, F. P. Schäfer, *Opt. Commun.* 18(3), 260 (1976).

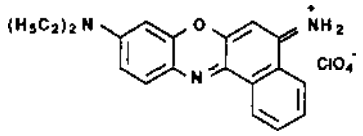

Nile Blue
Nile Blue
LC 6900
$C_{20}H_{20}N_3O_5Cl$ 417.85
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
5
6
7
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Nile Blue (LC 6900)

Constitution

5-Amino-9-diethyliminobenzo[a]phenoxazonium Perchlorate

$C_{20}H_{20}N_3O_5Cl$ · MW: 417.85



Characteristics

Lambdachrome® number:	6900
CAS registry number:	53340-16-2
Appearance:	green, crystalline solid
Absorption maximum (ethanol):	633 nm
Molar absorptivity:	7.75 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in bas. ethanol):	672 nm

For research and development purposes only.

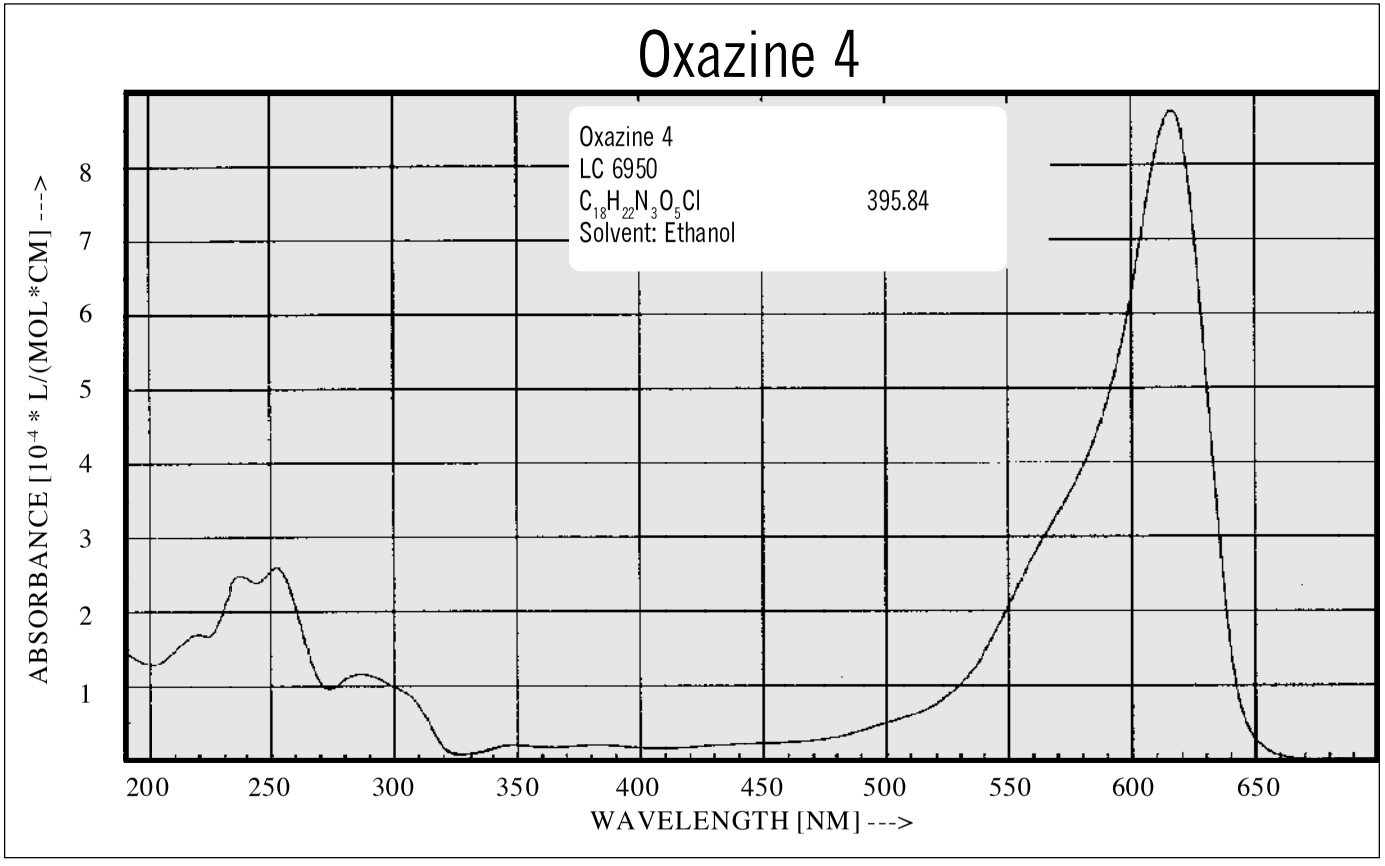
Lasing Performance

Laser dye for pulsed operation; tunable around 690 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*703*	*688 - 747*	*5*	*0.47*	*Methanol*	*1, 2*
Nitrogen	*337*	*695*	*683 - 751*	*rel.*	*0.45*	*Methanol*	*2*
Nd:YAG, 2nd	*532*	*683*	*-*	*18*	*0.08*	*Methanol*	*3*
Cu-vapor	*510*	*695*	*682 - 730*	*4*	*0.84*	*Methanol*	*4*
Flashlamp	*-*	*710*	*690 - 750*	*poor*	*0.31*	*Methanol*	*5*
CW, Kr^+	*red*	*730*	*690 - 780*	*7*	*1.2*	*Eg.*	*6*

References

1. Lambda Physik.
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. K. Kato, *Opt. Commun.* 19(1), 19 (1976).
4. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
5. J. B. Marling et al., *Appl. Optics* 13(10), 2317 (1974).
6. J. M. Yarborough, *Appl. Phys. Letters* 24(12), 629 (1974).

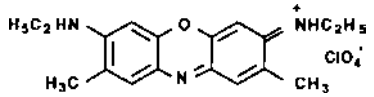

Oxazine 4
Oxazine 4
LC 6950
$C_{18}H_{22}N_3O_5Cl$ 395.84
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
8
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

Oxazine 4 (LC 6950)

Constitution

3-Ethylamino-7-ethylimino-2,8-dimethylphenoxazin-5-ium Perchlorate
LD 690

$C_{18}H_{22}N_3O_5Cl$ · MW: 395.84



Characteristics

Lambdachrome® number:	6950
CAS registry number:	-
Appearance:	green, crystalline solid
Absorption maximum (ethanol):	615 nm
Molar absorptivity:	10.9 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

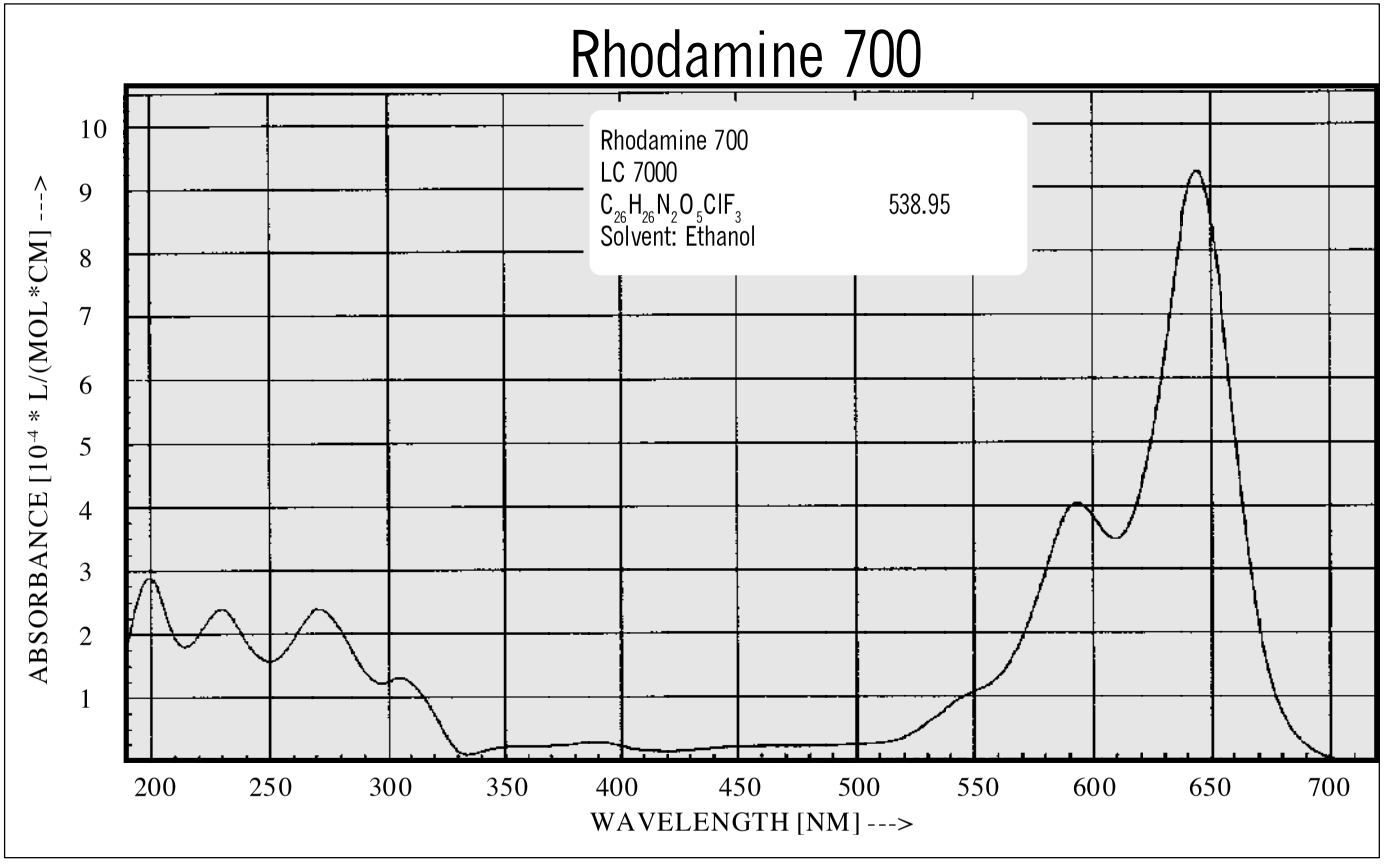
Lasing Performance

Laser dye for pulsed operation; tunable around 690 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*703*	*665 - 718*	*5*	*0.53*	*DMSO*	*1*
Nd:YAG, 2nd	*532*	*660*	-	-	-	-	*2*
CW, Ar^+	*all*	-	-	-	*+ DCM*	-	*3*

References

1. Lambda Physik.
2. R. J. Hall et al., *Opt. Letters* 4(3), 87 (1979).
3. J. Heber, A. Szabo, *IEEE J. Quantum Electron.* QE-20(1), 9 (1984).

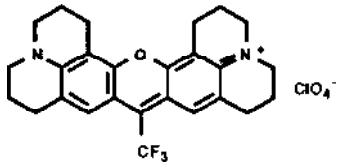

Rhodamine 700
Rhodamine 700
LC 7000
$C_{26}H_{26}N_2O_5ClF_3$ 538.95
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
8
9
10
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Rhodamine 700 (LC 7000)

Constitution

8-(Trifluoromethyl)-2,3,5,6,11,12,14,15-octahydro-1*H*,4*H*,10*H*,13*H*-diquinolizino[9,9a,1-*bc*:9',9a',1-*hi*]xanthylium Perchlorate
LD 700

$C_{26}H_{26}N_2O_5ClF_3$ · MW: 538.95



Characteristics

Lambdachrome® number:	7000
Appearance:	brown, crystalline solid
Absorption maximum (in ethanol):	643 nm
Molar absorptivity:	9.25 x 10^4 L mol^{-1} cm^{-1}

For research and development purposes only.

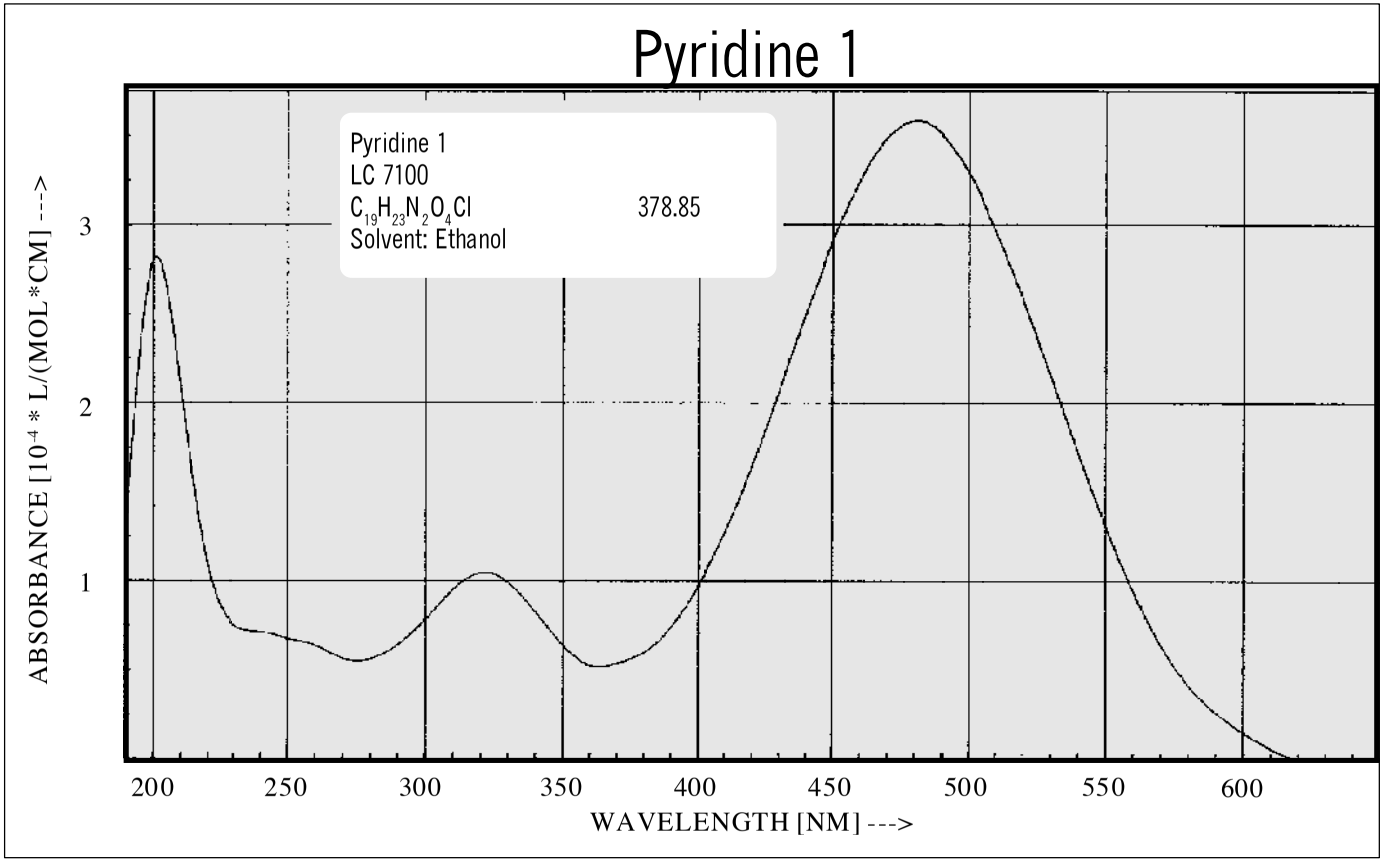
Lasing Performance

Very efficient laser dye for pulsed and CW operation; tunable around 750 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*723*	*701 - 768*	*11*	*0.85*	*Methanol*	*1, 2*
Flashlamp	*-*	*-*	*705 - 798*	*-*	*0.11*	*Ethanol*	*3*
CW, Kr^+	*red*	*740*	*690 - 785*	*-*	*1.0*	*Eg.*	*1, 4, 5, 6*

References

1. Lambda Physik, *Wall Chart* 1996.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. W. Sibbett, J. R. Taylor, *IEEE J. Quantum Electron.* QE-20(2), 108 (1984).
4. T. F. Johnston, R. H. Brady, W. Proffitt, *Appl. Optics.* 21(13), 2307 (1982).
5. G. D. Aumiller, *Appl. Optics 23(5)*, 651 (1984).
6. E. G. Marason, *Opt. Commun.* 40(3), 212 (1982).

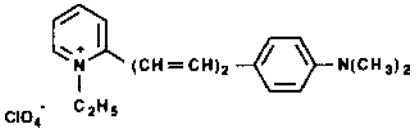

Pyridine 1
Pyridine 1
LC 7100
$C_{19}H_{23}N_2O_4Cl$ 378.85
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
200
250
300
350
400
450
500
550
600
WAVELENGTH [NM] --->

Pyridine 1 (LC 7100)

Constitution

1-Ethyl-2-(4-(p-Dimethylaminophenyl)-1,3-butadienyl)-pyridinium Perchlorat
LDS 698

$C_{19}H_{23}N_2O_4Cl$ · MW: 378.85



Characteristics

Lambdachrome® number:	7100
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	480 nm
Molar absorptivity:	3.80 x 10^4 L mol^{-1} cm^{-1}

For research and development purposes only.

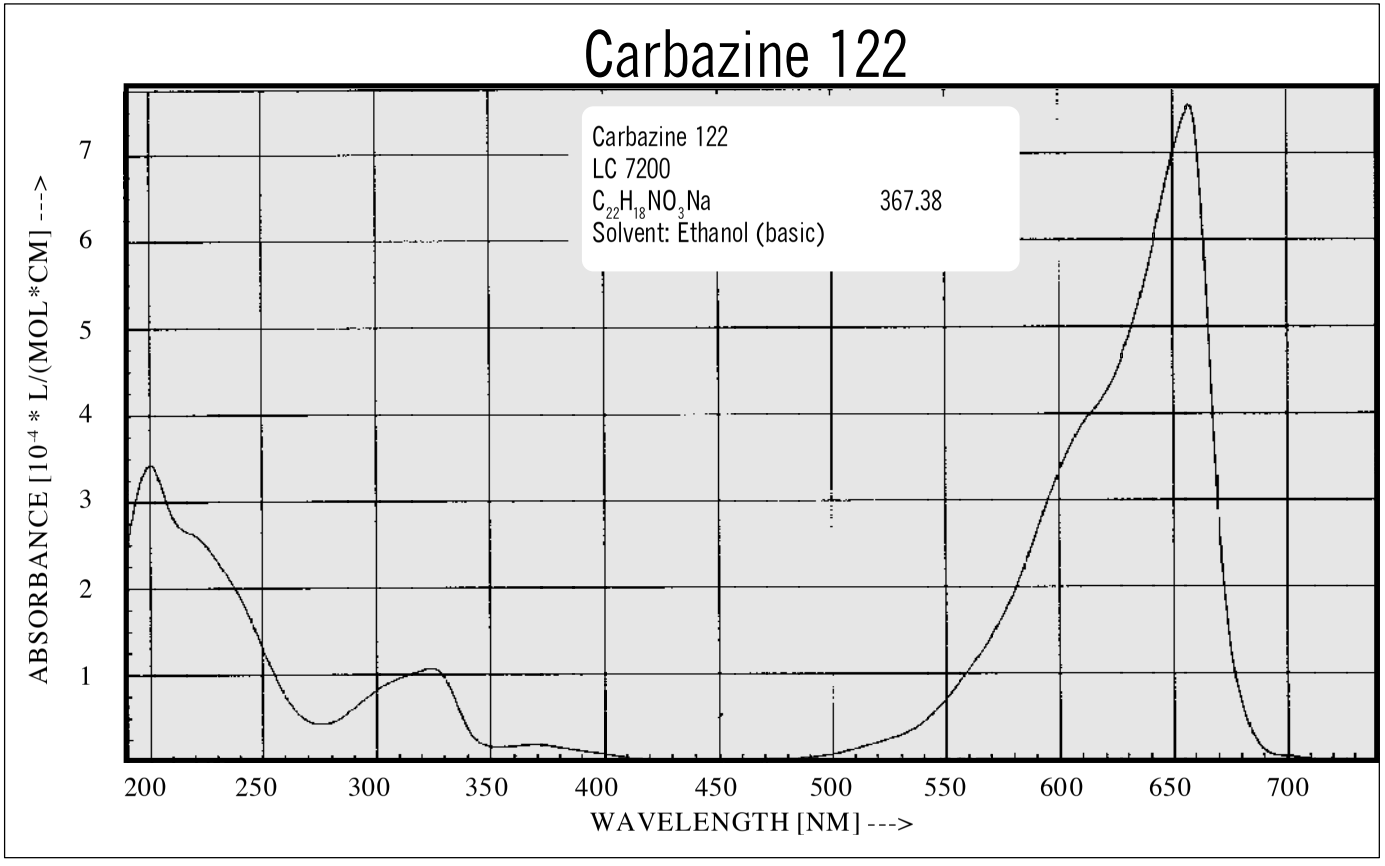
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 710 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*710*	*670 - 760*	*10*	*0.84*	*DMSO*	*1, 2*
Nitrogen	*337*	*703*	*675 - 750*	*rel.*	*0.88*	*DMSO*	*3*
Nd:YAG, 2nd	*532*	*697*	*667 - 736*	*32*	*0.36*	*PC*	*1, 4*
Cu-vapor	*510*	*684*	*661 - 724*	*6*	*1.17*	*Methanol*	*5*
CW, Ar^+	*VIS*	*710*	*670 - 780*	*-*	*-*	*Pc./Eg.*	*6, 7*

References

1. Lambda Physik, *Wall Chart* 1996.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. Lambda Physik, *Data Sheet.*
4. Lambda Physik.
5. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
6. J. Hoffnagle et al., *Opt. Commun.* 42(4), 267 (1982).
7. Ph. Bado et al., *Opt. Commun.* 46(3,4), 241 (1983).

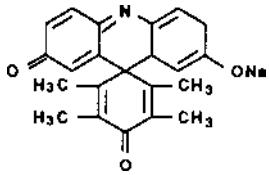

Carbazine 122
Carbazine 122
LC 7200
$C_{22}H_{18}NO_3Na$ 367.38
Solvent: Ethanol (basic)
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Carbazine 122 (LC 7200)

Constitution

Carbazine 720

$C_{22}H_{18}NO_3Na$ · MW: 367.38



Characteristics

Lambdachrome® number:	7200
CAS registry number:	-
Appearance:	red, crystalline solid
Absorption maximum (in basic ethanol):	655 nm
Molar absorptivity:	7.54×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

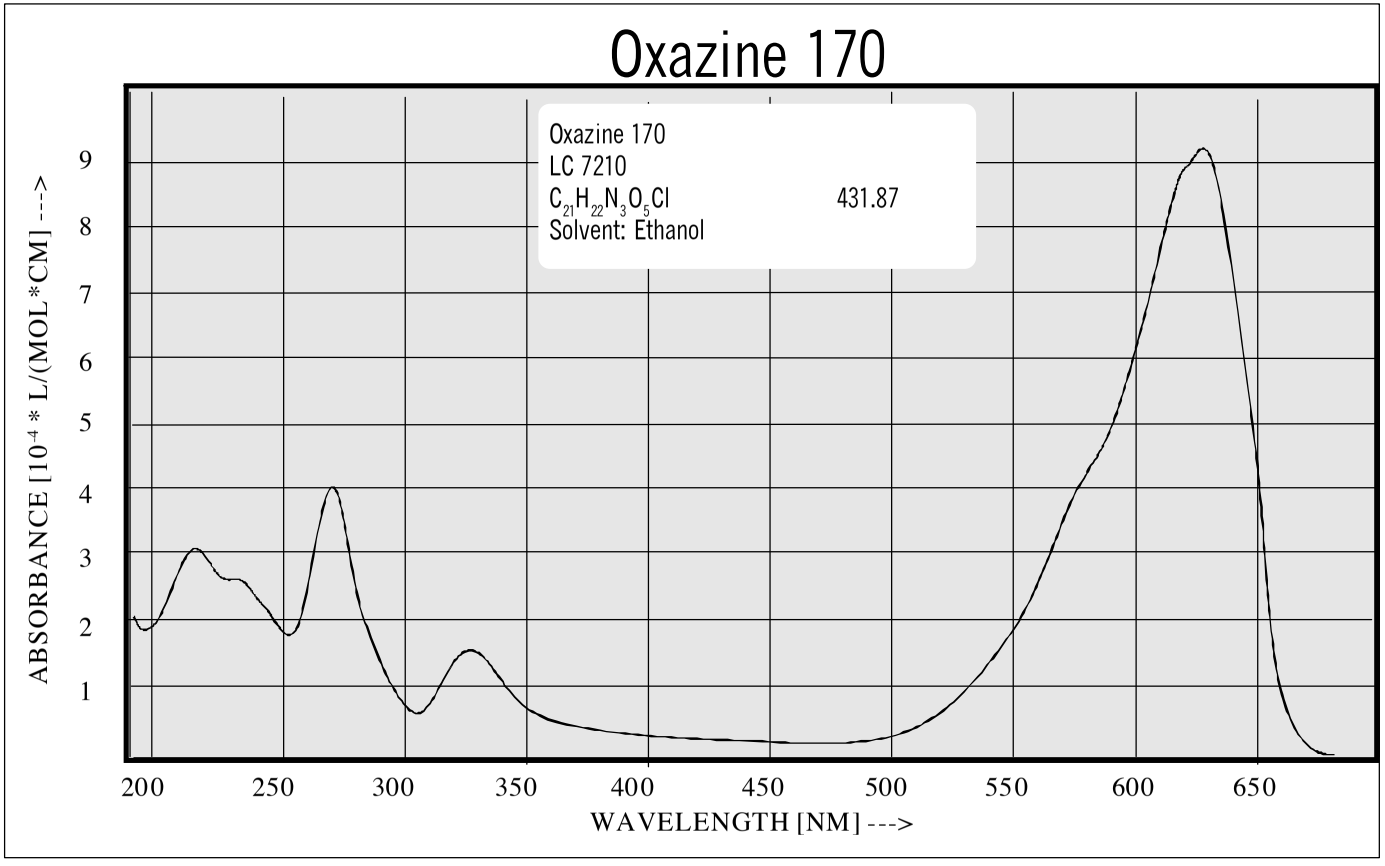
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 640 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XNd:YAG, 2nd	*532*	*720*	*-*	*30*	*1.10*	*Water*	*1, 2, 3*
Flashlamp	*-*	*700*	*680 - 740*	*-*	*0.07*	*Methanol*	*4*
CW, Kr^+	*red*	*750*	*690 - 820*	*-*	*0.72*	*Eg.*	*5*

References

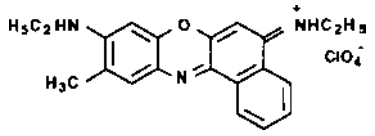
1. F. Bos, *Appl. Optics* 20(10), 1886 (1981).
2. K. Kato, *Opt. Commun.* 19(1), 18 (1976).
3. K. Kato, *Opt. Commun.* 18(4), 447 (1976).
4. J. B. Marling et al., *Appl. Optics* 13(10), 2317 (1974).
5. P. E. Jessop, A. Szabo, *IEEE J. Quantum Electr.* QE-16(8), 812 (1980).


Oxazine 170
Oxazine 170
LC 7210
$C_{21}H_{22}N_3O_5Cl$ 431.87
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
5
6
7
8
9
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

Oxazine 170 (LC 7210)

Constitution

9-Ethylamino-5-ethylimino-10-methyl-5H-benzo(a)phenoxazonium Perchlorate
Oxazine 720
$C_{21}H_{22}N_3O_5Cl$ · MW: 431.87



Characteristics

Lambdachrome® number:	7210
CAS registry number:	62669-60-7
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	627 nm
Molar absorptivity:	9.20×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	650 nm

For research and development purposes only.

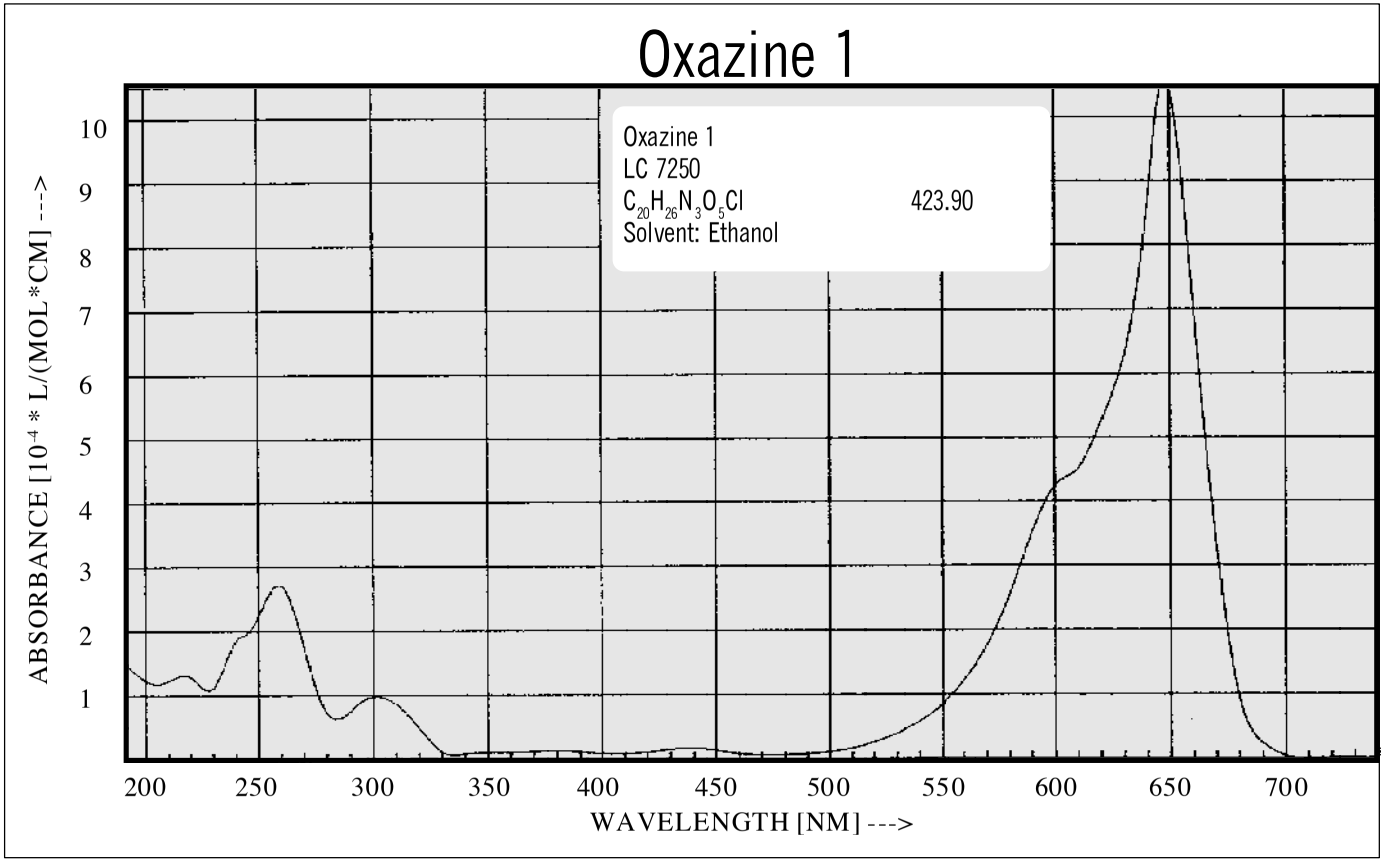
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 670 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*708*	*660 - 728*	*4*	*1.14*	*Methanol*	*1, 2, 3*
Nitrogen	*337*	*705*	*672 - 727*	*rel.*	*0.79*	*Methanol*	*4*
Nd:YAG, 2nd	*532*	*672*	*-*	*20*	*0.08*	*Methanol*	*5, 6*
Cu-vapor	*510*	*675*	*660 - 712*	*12*	*0.13*	*Methanol*	*7*
CW, Kr^+	*red*	*730*	*670 - 740*	*-*	*0.86*	*Eg.*	*8*

References

1. Lambda Physik, *Wall Chart* 6/83.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. K. Kato, *Opt. Commun.* 19(1), 18 (1976).
6. C. A. Moore, C. D. Decker, *J. Appl. Phys.* 49(1), 47 (1978).
7. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
8. P. E. Jessop, A. Szabo, *IEEE J. Quantum Electr.* QE-16(8), 812 (1980).

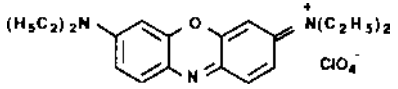

Oxazine 1
Oxazine 1
LC 7250
$C_{20}H_{26}N_3O_5Cl$ 423.90
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
5
6
7
8
9
10
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Oxazine 1 (LC 7250)

Constitution

3-Diethylamino-7-diethyliminophenoxazonium Perchlorate
Oxazine 725

$C_{20}H_{26}N_3O_5Cl$ · MW: 423.90



Characteristics

Lambdachrome® number:	7250
CAS registry number:	24796-94-9
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	646 nm
Molar absorptivity:	13.0 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	670 nm

For research and development purposes only.

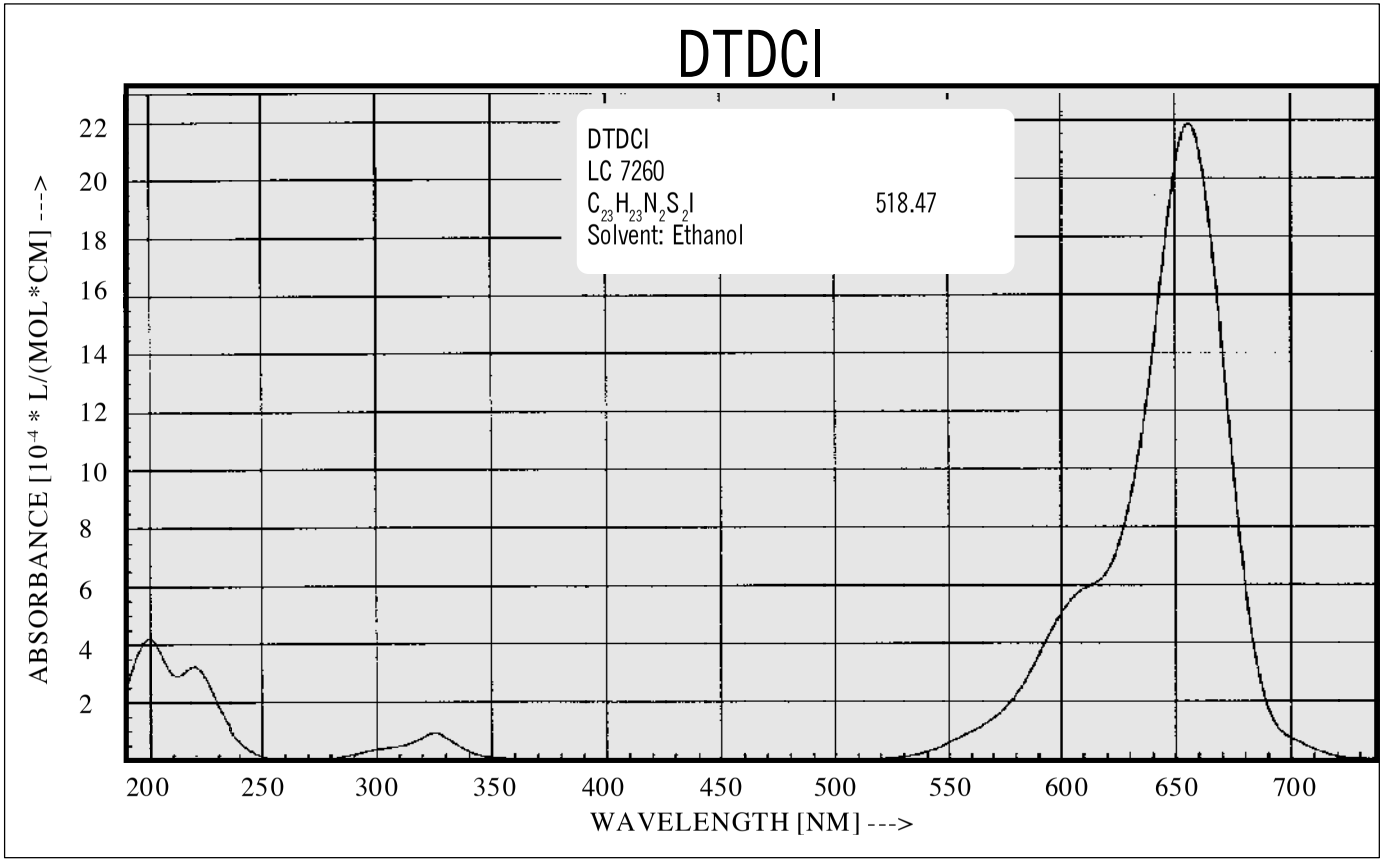
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 670 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*734*	*692 - 768*	*6*	*0.85*	*Ethanol*	*1, 2, 3*
Nitrogen	*337*	*730*	*692 - 751*	*-*	*1.96*	*Ethanol*	*4*
Nd:YAG, 2nd	*532*	*695*	*-*	*18*	*0.07*	*Methanol*	*5, 6*
Flashlamp	*-*	*720*	*700 - 740*	*-*	*-*	*Methanol*	*7*
CW, Kr^+	*red*	*720*	*695 - 800*	*-*	*1.20*	*Eg.*	*8*

References

1. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. B. M. Pierce, R. R. Birge, *IEEE J. Quantum Electr.* QE-18(7), 1164 (1982).
5. F. Bos, *Appl. Optics* 20(10), 1886 (1981).
6. C. A. Moore, C. D. Decker, *J. Appl. Phys.* 49(1), 47 (1978).
7. J. B. Marling et al., *Appl. Optics* 13(10), 2317 (1974).
8. Coherent, *CW Dye Laser Fact Sheets.*

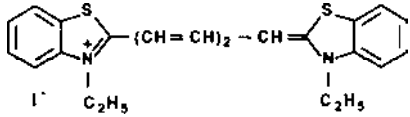

DTDCI
DTDCI
LC 7260
$C_{23}H_{23}N_2S_2I$ 518.47
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
22
20
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

DTDCI (LC 7260)

Constitution

3-Diethylthiadicarbocyanine Iodide
NK 136

$C_{23}H_{23}N_2S_2I$ · MW: 518.47



Characteristics

Lambdachrome® number:	7260
CAS registry number:	-
Appearance:	blue, crystalline solid
Absorption maximum (in ethanol):	653 nm
Molar absorptivity:	22.3 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

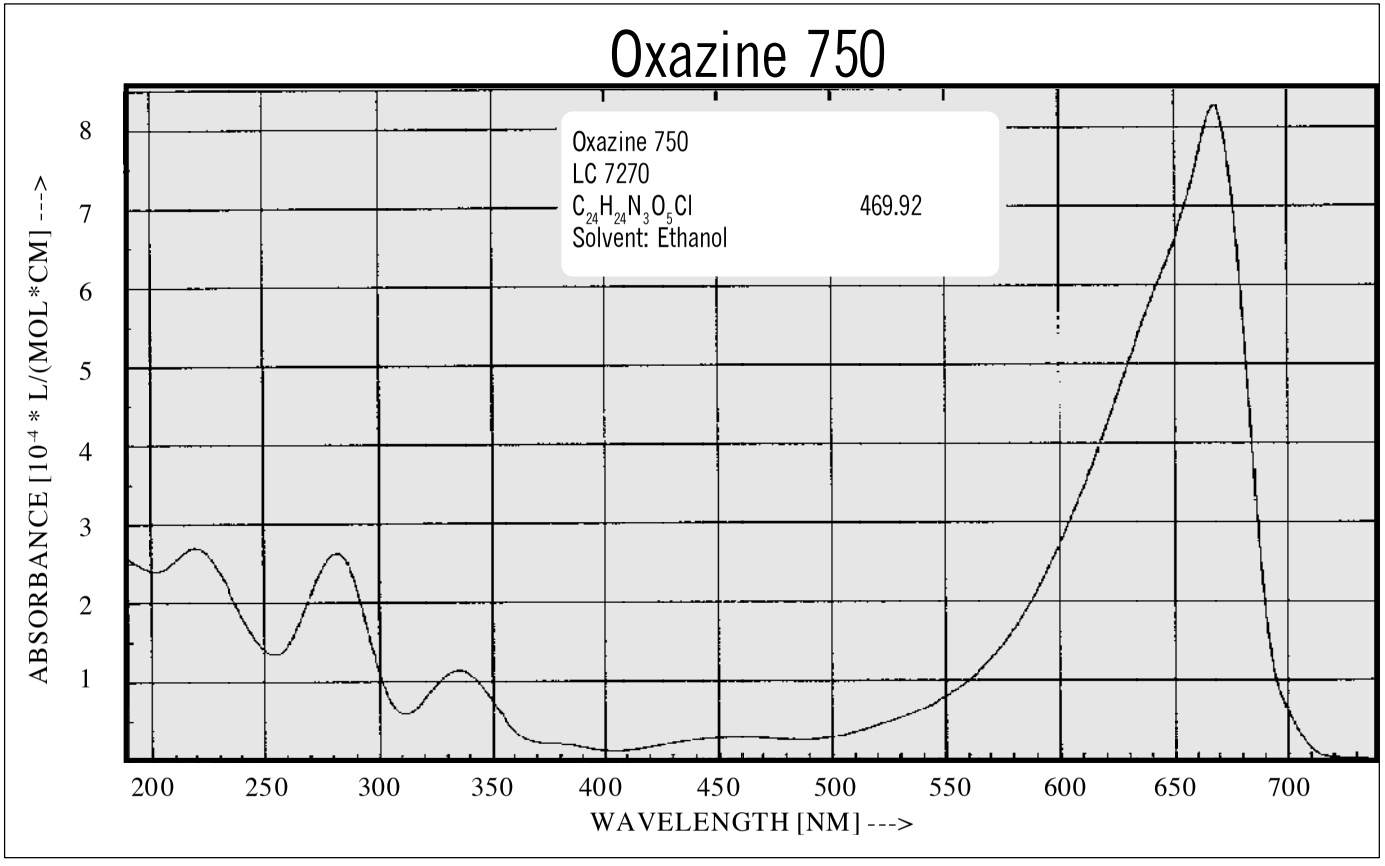
Lasing Performance

Laser dye for pulsed operation; tunable around 760 nm. Saturable absorber for flashlamp pumped Rhodamine 101 dye lasers; applicable around 650 nm [1,].

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nitrogen	*337*	*695*	-	-	*0.13*	*Acetone*	*2*
Flashlamp	-	*760*	-	-	*0.10*	*DMSO*	*3*

References

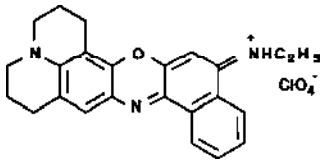
1. T. J. Negran, A. M. Glass, *Appl. Optics* 17(17), 2812 (1978).
2. Chinlon Lin, *IEEE J. Quantum Electr.* QE-11, 61 (1975).
3. A. Hirth, K. Vollrath, J. Faure, D. Lougnot, *Opt. Commun.* 7(4), 339 (1973).


Oxazine 750
Oxazine 750
LC 7270
$C_{24}H_{24}N_3O_5Cl$ 469.92
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
7
8
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Oxazine 750 (LC 7270)

Constitution

$C_{24}H_{24}N_3O_5Cl$ · MW: 469.92



Characteristics

Lambdachrome® number:	7270
CAS registry number:	-
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	667 nm
Molar absorptivity:	8.25 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

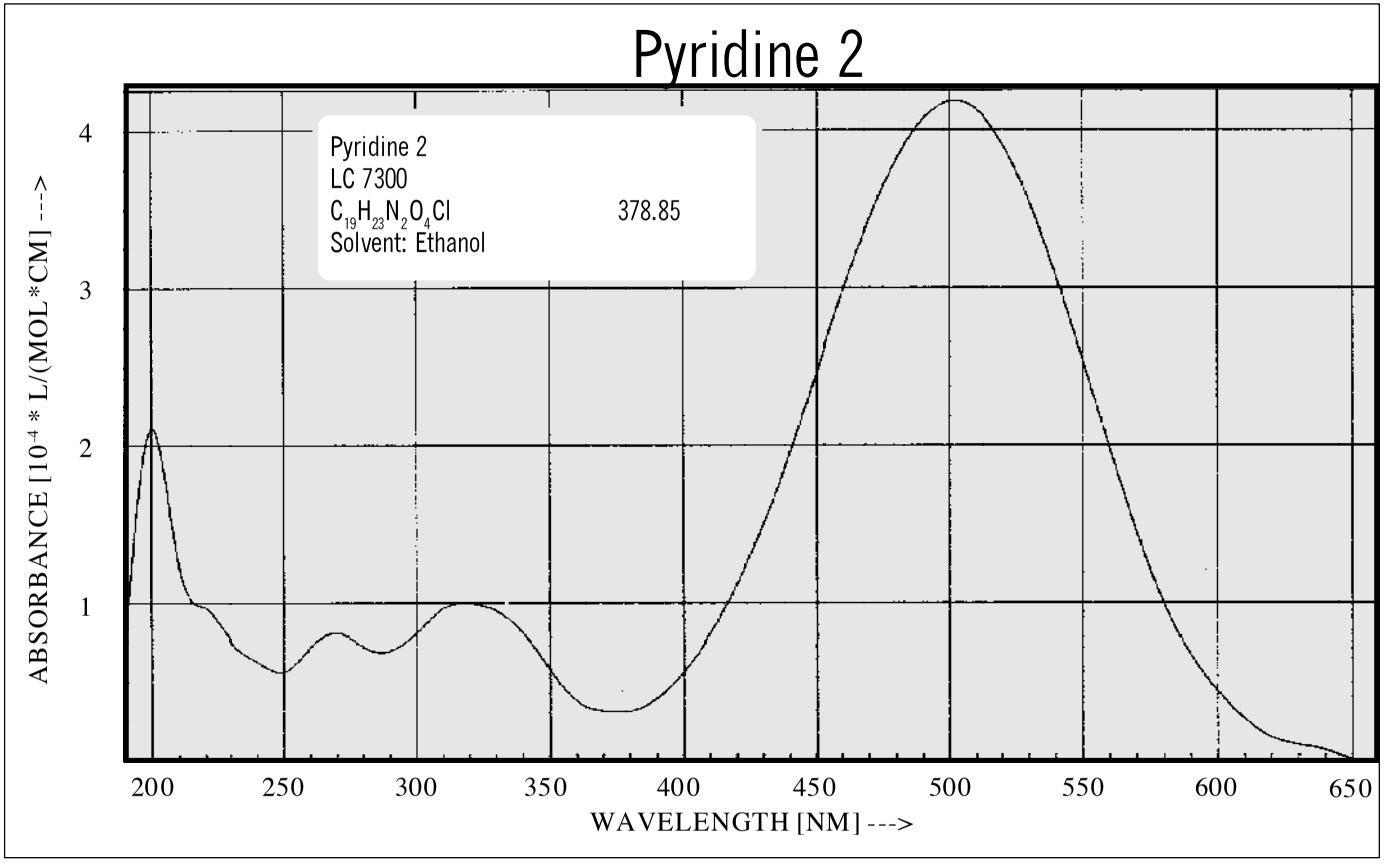
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 750 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*777*	*735 - 796*	*6*	*1.25*	*DMSO*	*1, 2, 3*
Nitrogen	*337*	*724*	*708 - 780*	*rel.*	*0.50*	*Ethanol*	*3, 4*
CW, Kr^+	*red*	*810*	*790 - 900*	*-*	*0.62*	*PC./Eg.*	*5*

References

1. Lambda Physik, *Wall Chart* 6/83.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1983).
4. B. M. Pierce, R. R. Birge, *IEEE J. Quantum Electr.* QE18(7), 1164 (1982).
5. G. D. Aumiller, *Opt. Commun.* 41(2), 115 (1982).

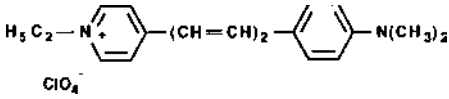

Pyridine 2
Pyridine 2
LC 7300
$C_{19}H_{23}N_2O_4Cl$ 378.85
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
4
3
2
1
200
250
300
350
400
450
500
550
600
650
WAVELENGTH [NM] --->

Pyridine 2 (LC 7300)

Constitution

1-Ethyl-4-(4-(p-Dimethylaminophenyl)-1,3-butadienyl)-pyridinium Perchlorat
LDS 722

$C_{19}H_{23}N_2O_4Cl$ · MW: 378.85



Characteristics

Lambdachrome® number:	7300
Appearance:	red, crystalline solid
Absorption maximum (in ethanol):	500 nm
Molar absorptivity:	4.22×10^4 L mol^{-1} cm^{-1}

For research and development purposes only.

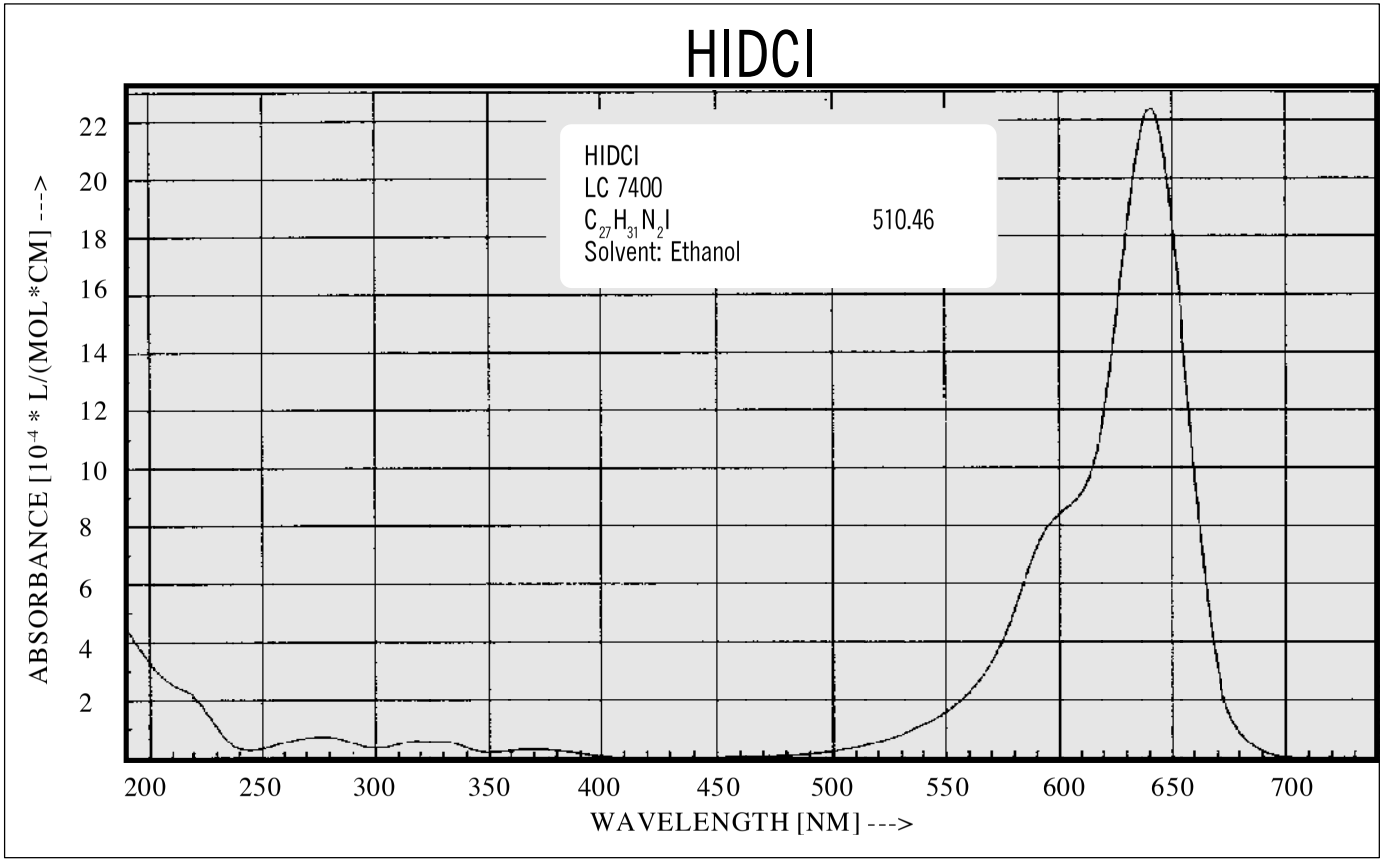
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 740 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*740*	*695 - 790*	*11*	*0.72*	*DMSO*	*1*
Nitrogen	*337*	*743*	*710 - 790*	*rel.*	*0.85*	*DMSO*	*2*
Nd:YAG	*532*	*750*	*725 - 776*	*21*	*0.22*	*PC*	*3*
Cu-vapor	*510*	*722*	*687 - 755*	*4*	*1.00*	*Methanol*	*4*
CW, Ar^+	*VIS*	*720*	*685 - 820*	*-*	*0.75*	*Pc./Eg.*	*1*

References

1. Lambda Physik, *Wall Chart* 1996.
2. Lambda Physik, *Data Sheet.*
3. Lambda Physik.
3. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).

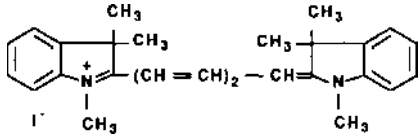

HIDCI
HIDCI
LC 7400
$C_{27}H_{31}N_2I$ 510.46
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
22
20
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

HIDCI (LC 7400)

Constitution

1,1',3,3,3',3'-Hexamethylindodicarbocyanine Iodide
Hexacyanine 2

$C_{27}H_{31}N_2I$ · MW: 510.46



Characteristics

Lambdachrome® number:	7400
CAS registry number:	36536-22-8
Appearance:	blue, crystalline solid
Absorption maximum (in ethanol):	639 nm
Molar absorptivity:	22.5 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

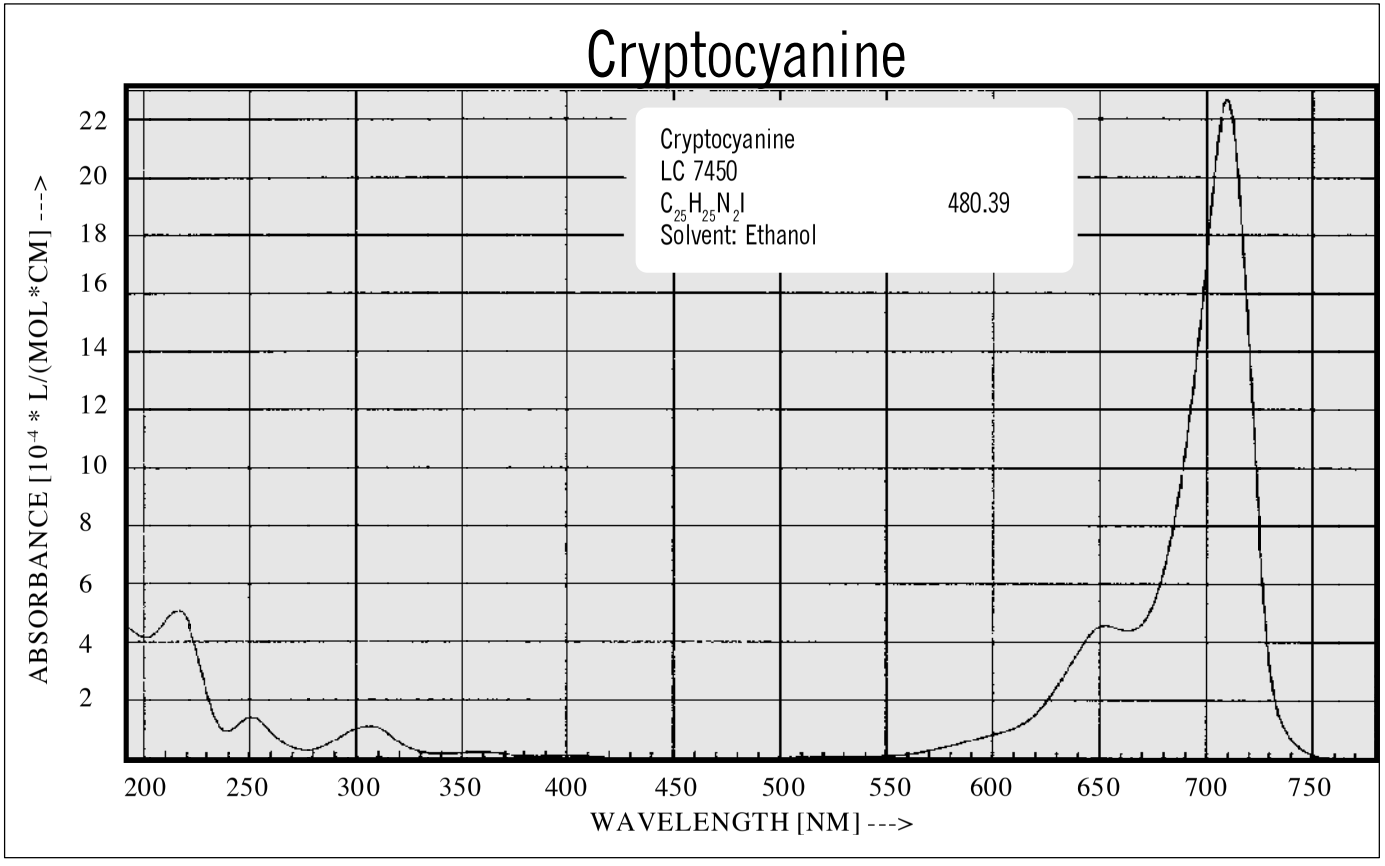
Lasing Performance

Laser dye for pulsed operation; tunable around 740 nm. Saturable absorber for flashlamp pumped Rhodamine 6G dye lasers; applicable around 630 nm[1,].

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*740*	-	-	*0.11*	*DMSO*	*2*

References

1. M. Maeda, Y. Miyazoe, *Jap. J. Appl. Phys.* 13(1), 193 (1974).
2. M. Maeda, Y. Miyazoe, *Jap. J. Appl. Phys.* 11(5), 692 (1972).

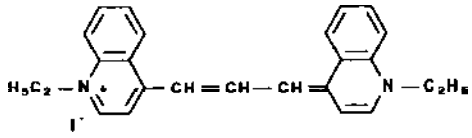

Cryptocyanine
Cryptocyanine
LC 7450
$C_{25}H_{25}N_2I$ 480.39
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
22
20
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
750
WAVELENGTH [NM] --->

Cryptocyanine (LC 7450)

Constitution

1,1'-Diethyl-4,4'-carbocyanine Iodide
DCI-4

$C_{25}H_{25}N_2I$ · MW: 480.39



Characteristics

Lambdachrome® number:	7450
CAS registry number:	4727-50-8
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	708 nm
Molar absorptivity:	22.5 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

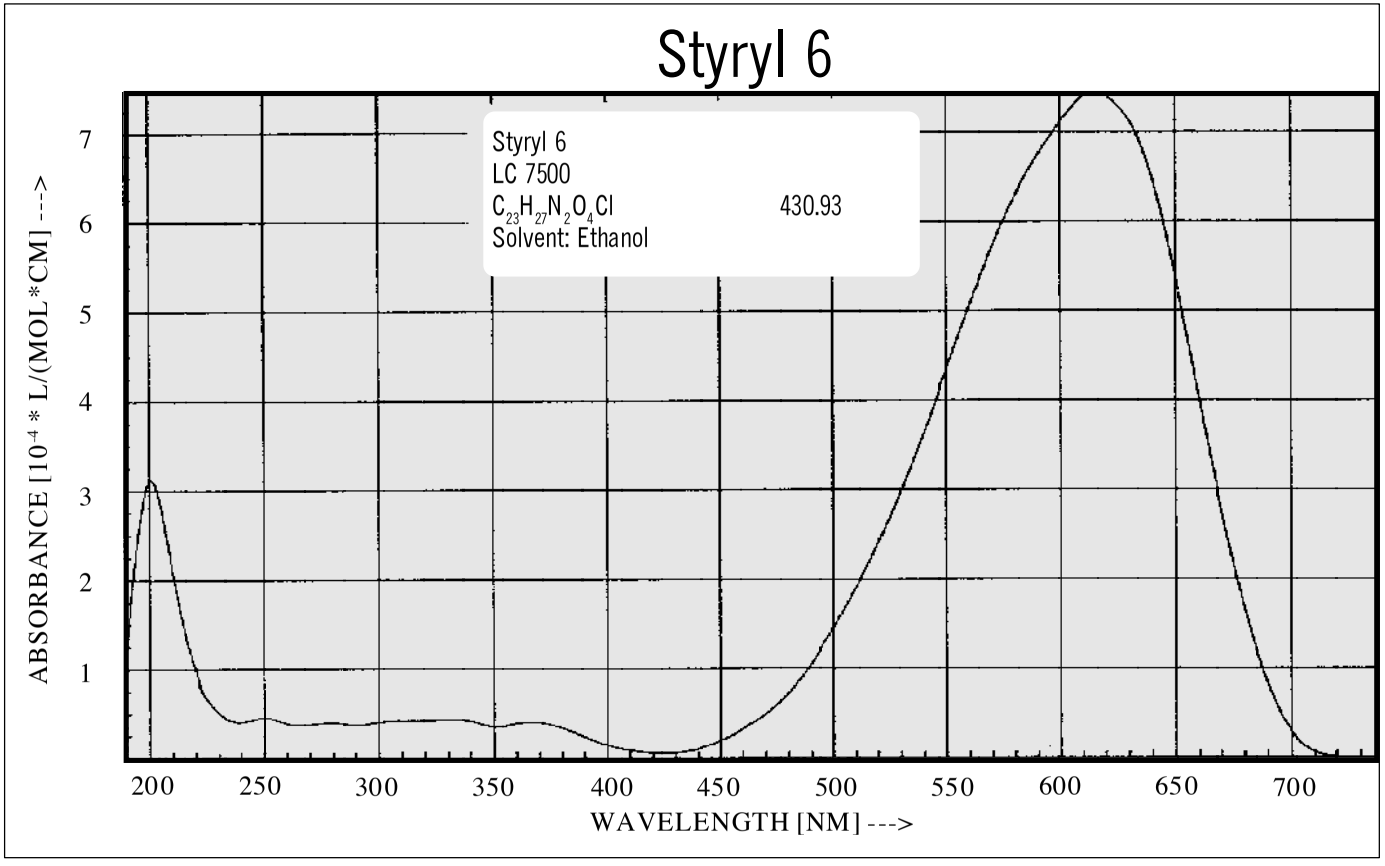
For research and development purposes only.

Lasing Performance

Saturable absorber for the ruby laser; applicable around 700 nm[1., 2., 3., 4.].

References

1. M. L. Spaeth, W. R. Sooy, *J. Chem. Phys.* 48(5), 2315 (1968).
2. I. K. Krasyuk et al., *JETP Letters* 7(4), 89 (1968).
3. H. W. Mocker, R. J. Collins, *Appl. Phys. Letters* 7(10), 270 (1965).
4. V. I. Malyshev, A. S. Markin, A. A. Sychev, *JETP Letters* 6, 34 (1967).

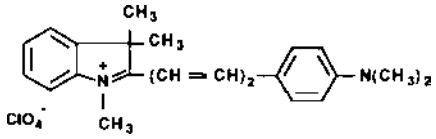

Styryl 6
Styryl 6
LC 7500
C23H27N2O4Cl 430.93
Solvent: Ethanol
ABSORBANCE [10-4 * L/(MOL *CM] --->
1
2
3
4
5
6
7
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Styryl 6 (LC 7500)

Constitution

2-(4-(p-Dimethylaminophenyl)-1,3-butadienyl)-1,3,3-trimethyl-3H-indolium Perchlorate
LDS 730

$C_{23}H_{27}N_2O_4Cl$ · MW: 430.93



Characteristics

Lambdachrome® number:	7500
CAS registry number:	-
Appearance:	blue, crystalline solid
Absorption maximum (in ethanol):	615 nm
Molar absorptivity:	7.38 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

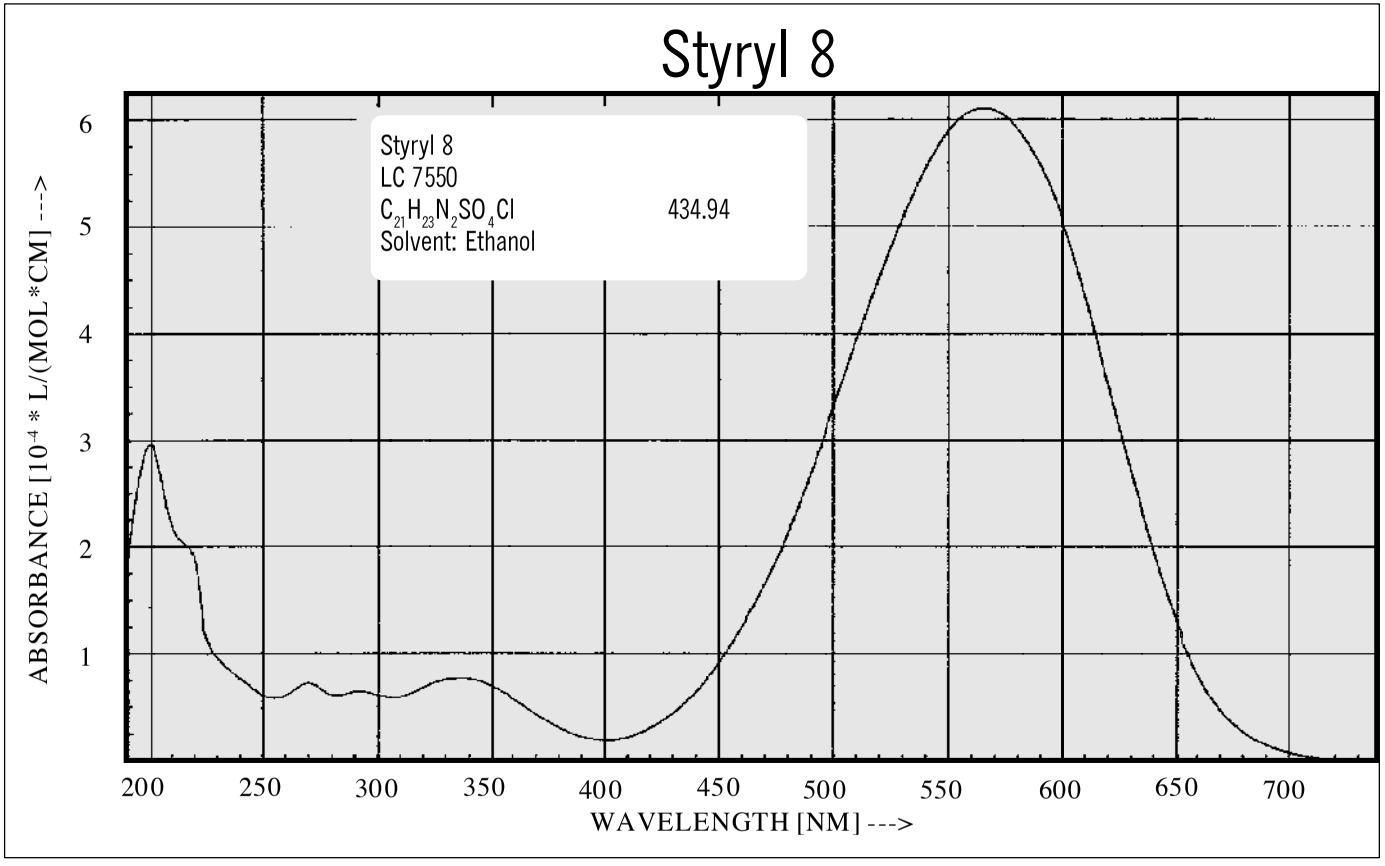
Lasing Performance

Laser dye for pulsed operation; tunable around 720 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG, 2nd	*532*	*721*	*708 - 735*	*16*	*0.28*	*PC*	*1*

References

1. Lambda Physik, *Wall Chart* 1996.
2. K. Kato, *IEEE J. Quantaum Electr.* QE-16(10), 1017 (1980).

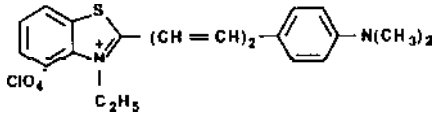

Styryl 8
Styryl 8
LC 7550
$C_{21}H_{23}N_2SO_4Cl$ 434.94
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
6
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Styryl 8 (LC 7550)

Constitution

2-(4-(p-Dimethylaminophenyl)-1,3-butadienyl)-3-ethylbenzothoazolium Perchlorat
LDS 751

$C_{21}H_{23}N_2SO_4Cl$ · MW: 434.94



Characteristics

Lambdachrome® number:	7550
CAS registry number:	76433-29-9
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	570 nm
Molar absorptivity:	6.15 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

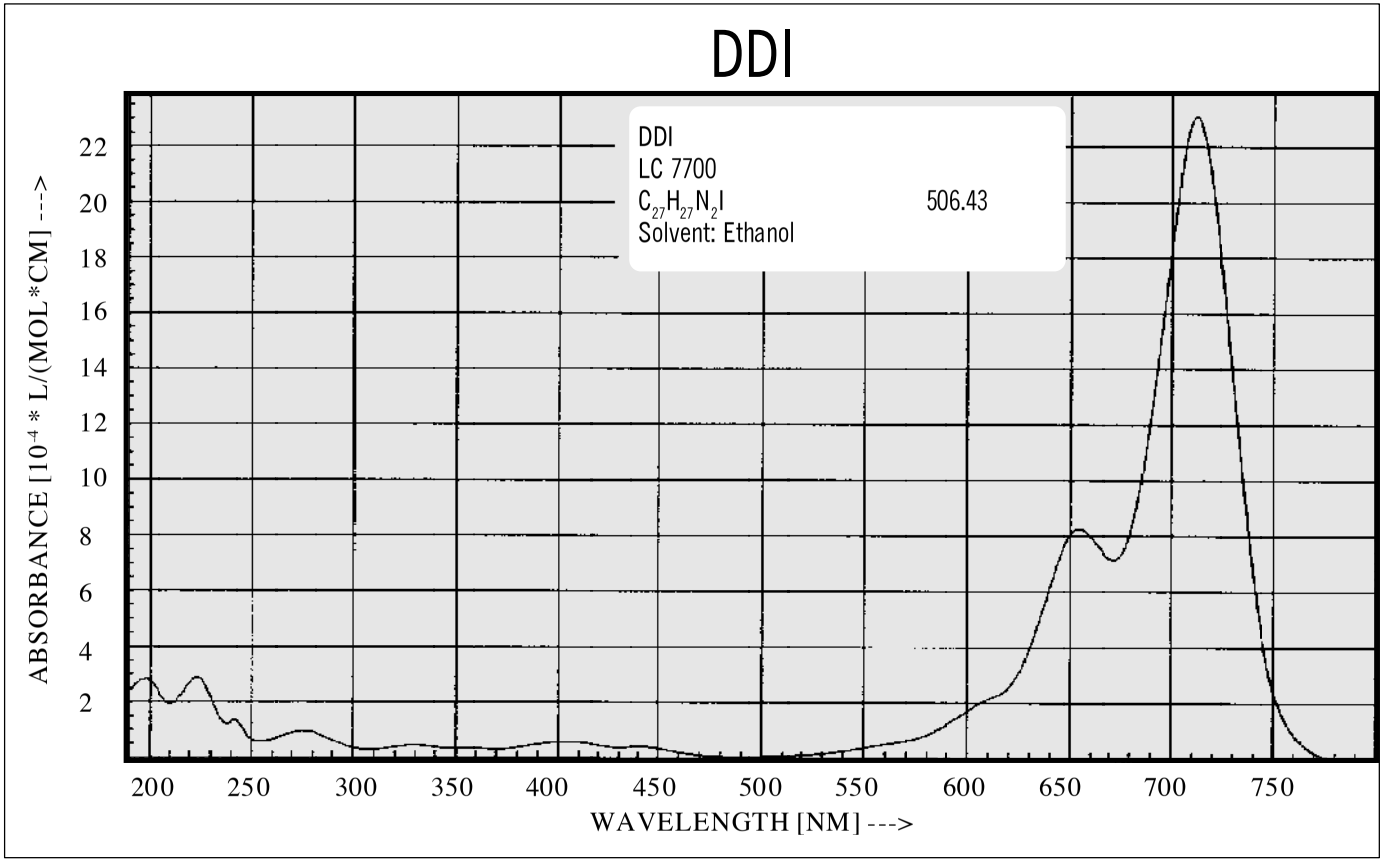
Lasing Performance

Laser dye for pulsed and CW operation; tunable around 750 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG, 2nd	*532*	*750*	*717 - 780*	*13*	*0.15*	*PC*	*1*
Cu-vapor	*510*	*711*	*703 - 724*	*3*	*1.70*	*Methanol*	*2*
CW, Ar^+	*VIS*	*780*	*700 - 840*	*-*	*-*	*Pc./Eg.*	*3, 4*

References

1. Lambda Physik, *Wall Chart* 1996.
2. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
3. J. Hoffnagle et al., *Opt. Commun.* 42(4), 267 (1982).
4. J. J. L. Mulders, L. W. G. Steenhuysen, *Opt. Commun.* 54(5), 295 (1985).

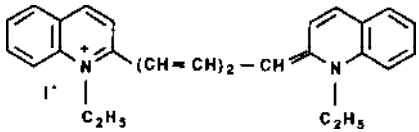

DDI
DDI
LC 7700
$C_{27}H_{27}N_2I$ 506.43
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
22
20
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
750
WAVELENGTH [NM] --->

DDI (LC 7700)

Constitution

1,1'-Diethyl-2,2'-dicarbocyanine Iodide

$C_{27}H_{27}N_2I$ · MW: 506.43



Characteristics

Lambdachrome® number:	7700
CAS registry number:	14187-31-6
Appearance:	green, crystalline solid
Absorption maximum (in methanol):	710 nm
Molar absorptivity:	23.0 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	745 nm

For research and development purposes only.

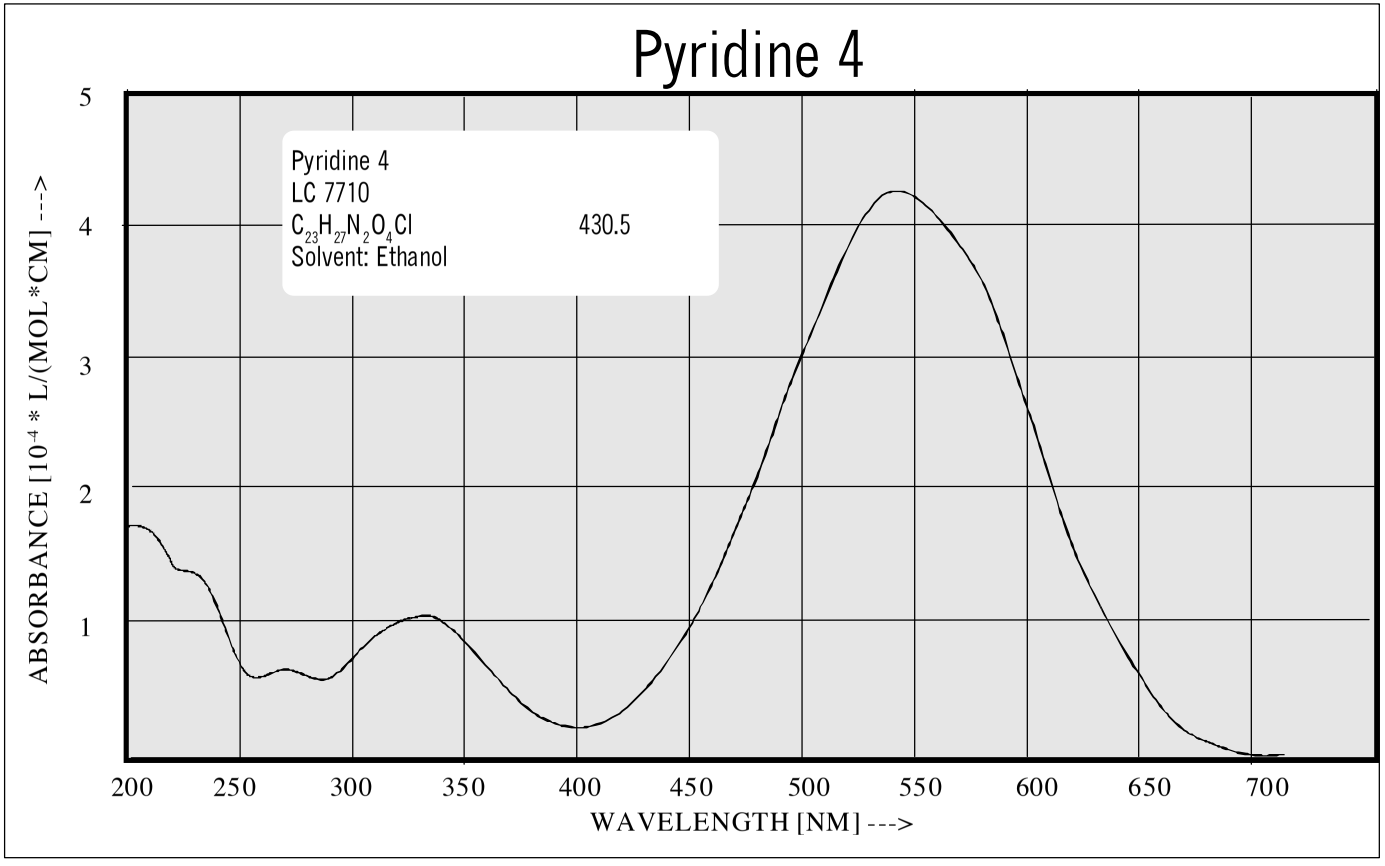
Lasing Performance

Laser dye for pulsed operation; tunable around 800 nm. Saturable absorber for the Ruby laser and flashlamp pumped Cresyl Violet and Rhodamine 700 dye lasers; applicable around 710 nm[1., 2., 3.].

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Ruby	*694*	*806*	*-*	*13*	*0.03*	*Ethanol*	*4*

References

1. E. G. Arthurs et al., *Appl. Phys. Letters* 20(3), 125 (1972).
2. M. E. Mack, *IEEE J. Quantum Electr.* QE-4, 1015 (1968).
3. W. Sibbett, J. R. Taylor, *IEEE J. Quantum Electr.* 20(2), 108 (1984).
4. A. M. Bonch-Bruevich, *Opt. Spectr.* 28, 51 (1970).

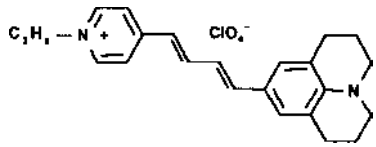

Pyridine 4
Pyridine 4
LC 7710
$C_{23}H_{27}N_2O_4Cl$ 430.5
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
5
4
3
2
1
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Pyridine 4 (LC 7710)

Constitution

1-Ethyl-4-(4-(9-(2,3,6,7-tetrahydro-1H,5H-benzo(i,j)-chinolizinium))-1,3-butadienyl)-pyridinium Perchlorate

$C_{23}H_{27}N_2O_4Cl$ · MW: 430.5



Characteristics

Lambdachrome® number:	7710
CAS Registry number:	-
Appearance:	dark brown, crystalline solid
Absorption maximum (in ethanol):	550 nm
Molar absorptivity:	4.26×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	-

For research and development purposes only.

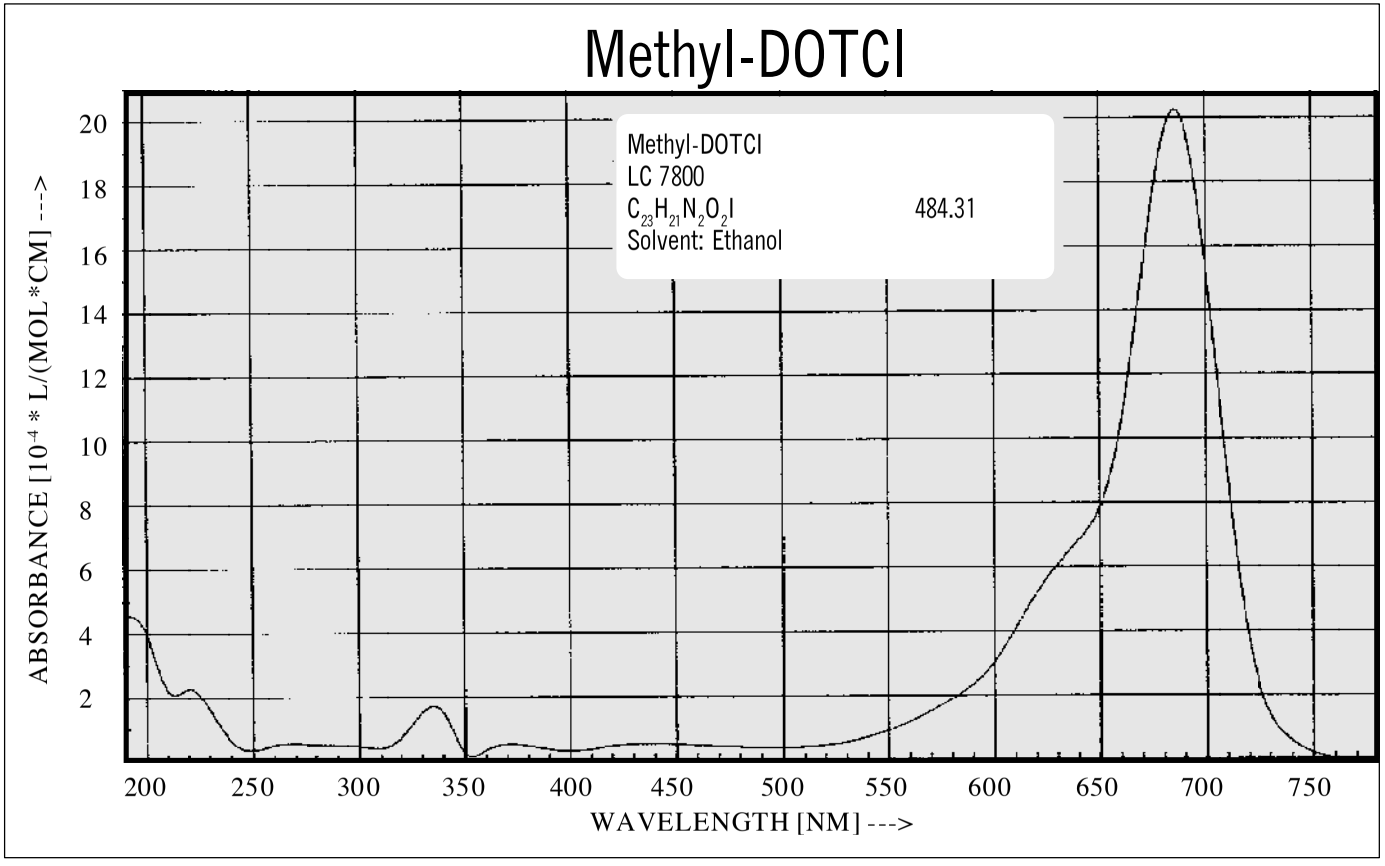
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 770 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*771*	*744 - 812*	*7*	*0.75*	*DMSO*	*1*

References

1. Lambda Physik, *Wall Chart* 1996.

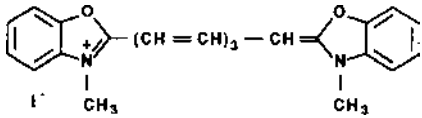

Methyl-DOTCl
Methyl-DOTCl
LC 7800
$C_{23}H_{21}N_2O_2I$ 484.31
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
20
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
750
WAVELENGTH [NM] --->

Methyl-DOTCI (LC 7800)

Constitution

3,3'-Dimethyloxatricarbocyanine Iodide DMOTCI · NK 199

$C_{23}H_{21}N_2O_2I$ · MW: 484.31



Characteristics

Lambdachrome® number:	7800
Appearance:	blue, crystalline solid
Absorption maximum (in ethanol):	682 nm
Molar absorptivity:	19.8 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	718 nm

For research and development purposes only.

Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 780 nm.

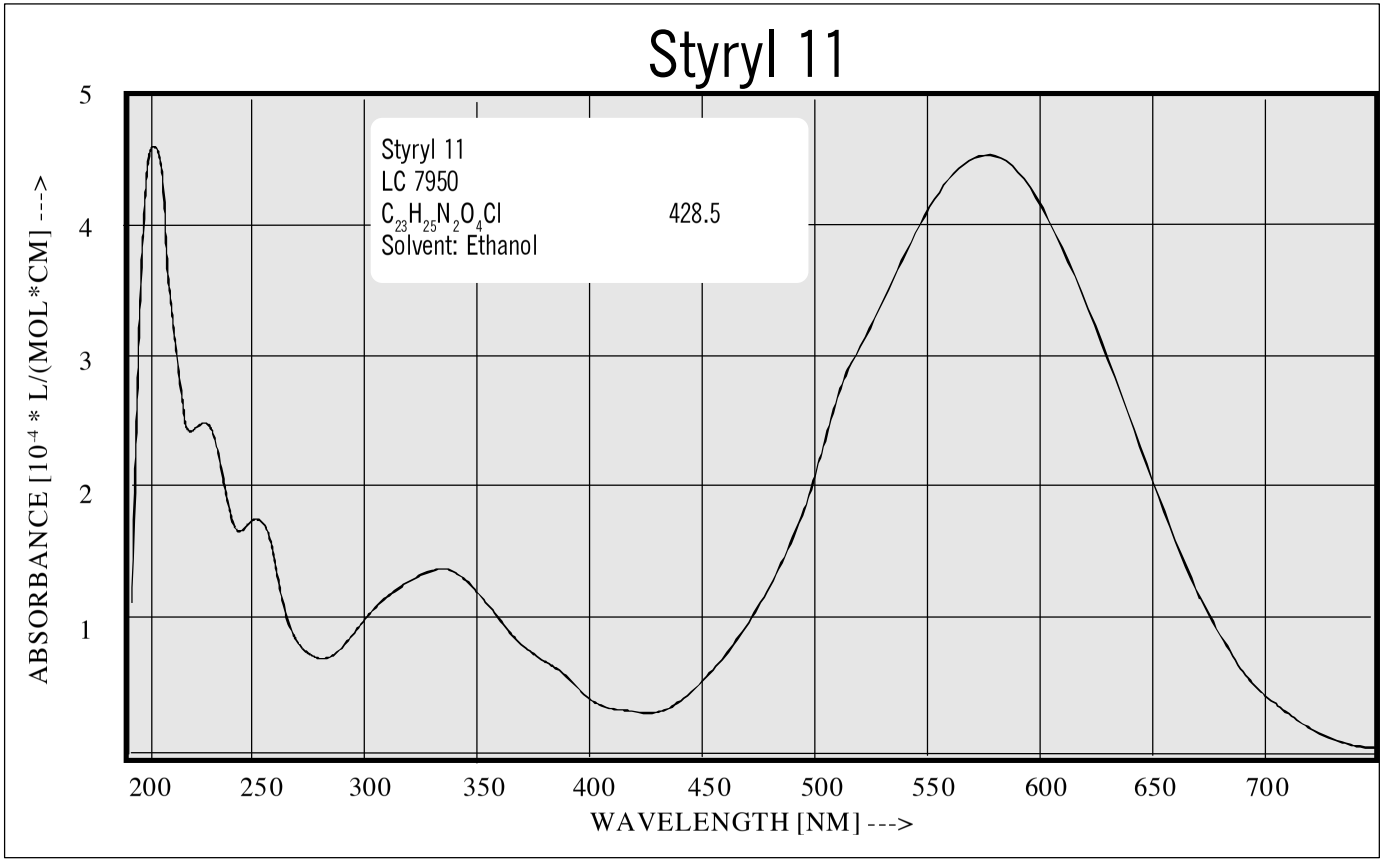
Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*792*	*774 - 810*	*4*	*0.90*	*DMSO*	*1, 2, 3*
Nitrogen	*337*	*780*	*768 - 820*	*rel.*	*0.51*	*DMSO*	*3, 4*
Nd:YAG, 2nd	*532*	*780*	*-*	*rel.*	*-*	*DMSO*	*5*
Flashlamp	*-*	*810*	*-*	*-*	*0-07*	*DMSO*	*6*
CW, Kr^+	*red*	*-*	*745 - 790*	*-*	*1.45*	*Eg.*	*7*

References

1. Lambda Physik, *Wall Chart* 6/83.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
3. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. F. Bos, *Appl. Optics* 20(10), 1886 (1981).
6. C. Loth, P. Flamant, *Opt. Commun.* 21(1), 13 (1977).
7. J. M. Yarborough, *Appl. Phys. Letters* 24(12), 629 (1974).

P.S.

The DOTCI (3,3'-Diethyloxatricarbocyanine Iodide) shows identical performance, however, its photochemical stability is much lower.

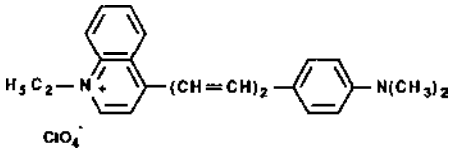

Styryl 11
Styryl 11
LC 7950
$C_{23}H_{25}N_2O_4Cl$ 428.5
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
5
4
3
2
1
200
250
300
350
400
450
500
550
600
650
700
WAVELENGTH [NM] --->

Styryl 11 (LC 7950)

Constitution

1-Ethyl-4-(4-(p-Dimethylaminophenyl)-1,3-butadienyl)-quinolinium Perchlorate
LDS 798

$C_{23}H_{25}N_2O_4Cl$ · MW: 428.5



Characteristics

Lambdachrome® number:	7950
CAS registry number:	92479-59-9
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	575 nm
Molar absorptivity:	4.55×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

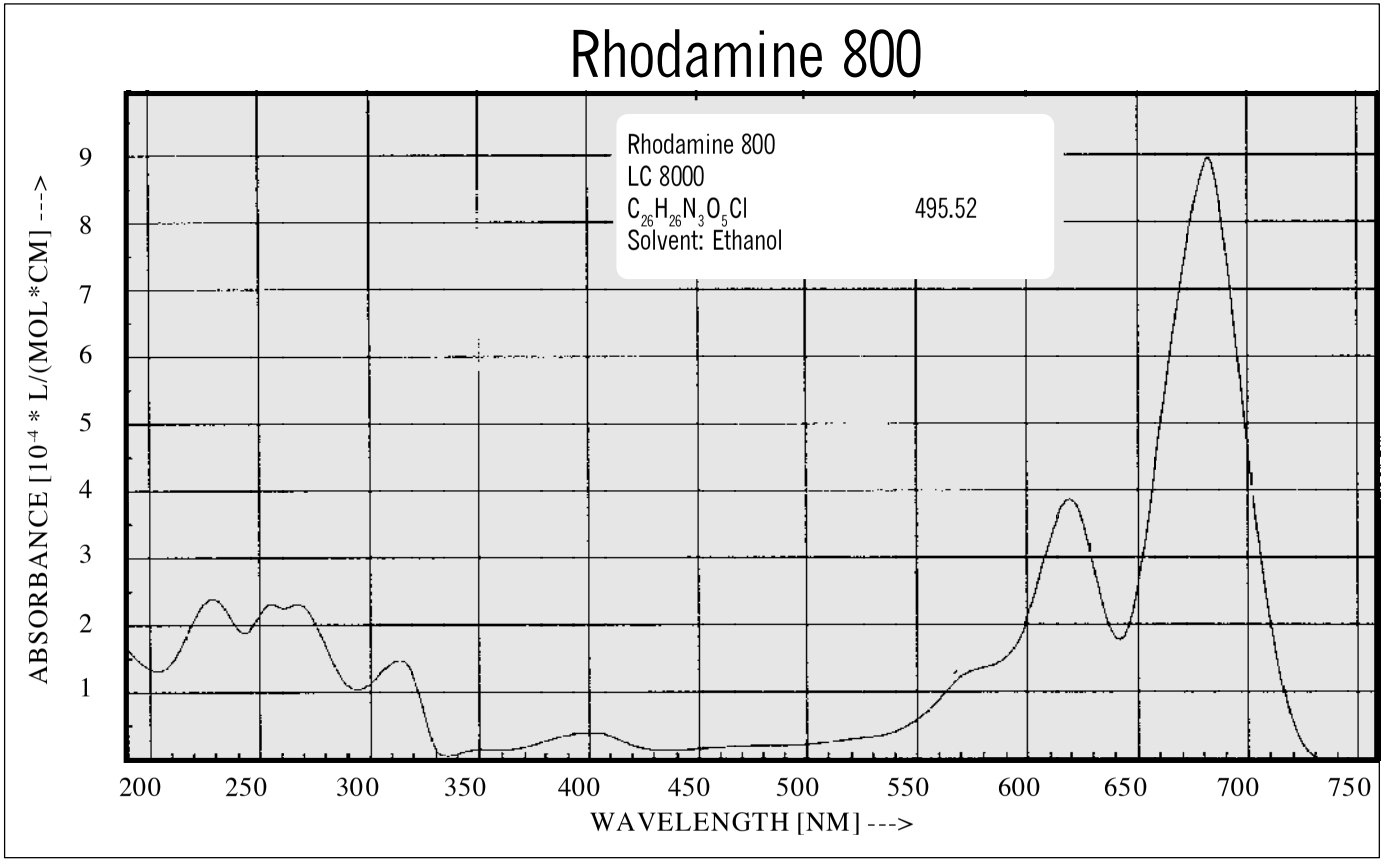
Lasing Performance

Laser dye for pulsed operation; tunable around 800 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
CW, Ar^+	*VIS*	*800*	*770 - 845*	*5*	*0.51*	*Pc./Eg.*	*1*

References

1. J. Hoffnagle et al., *Opt. Commun.* 42(4), 267 (1982).

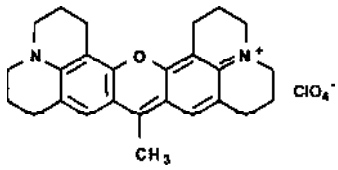

Rhodamine 800
Rhodamine 800
LC 8000
$C_{26}H_{26}N_3O_5Cl$ 495.52
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
6
7
8
9
200
250
300
350
400
450
500
550
600
650
700
750
WAVELENGTH [NM] --->

Rhodamine 800 (LC 8000)

Constitution

8-Cyano-2,3,5,6,11,12,14,15-octahydro-1*H*,4*H*,10*H*,13*H*-diquinolizino[9,9a,1-*bc*:9',9a',1-*hi*]xanthylium Perchlorate

$C_{26}H_{26}N_3O_5Cl$ · MW: 495.52



Characteristics

Lambdachrome® number:	8000
CAS registry number:	101027-54-7
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	682 nm
Molar absorptivity:	8.95 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

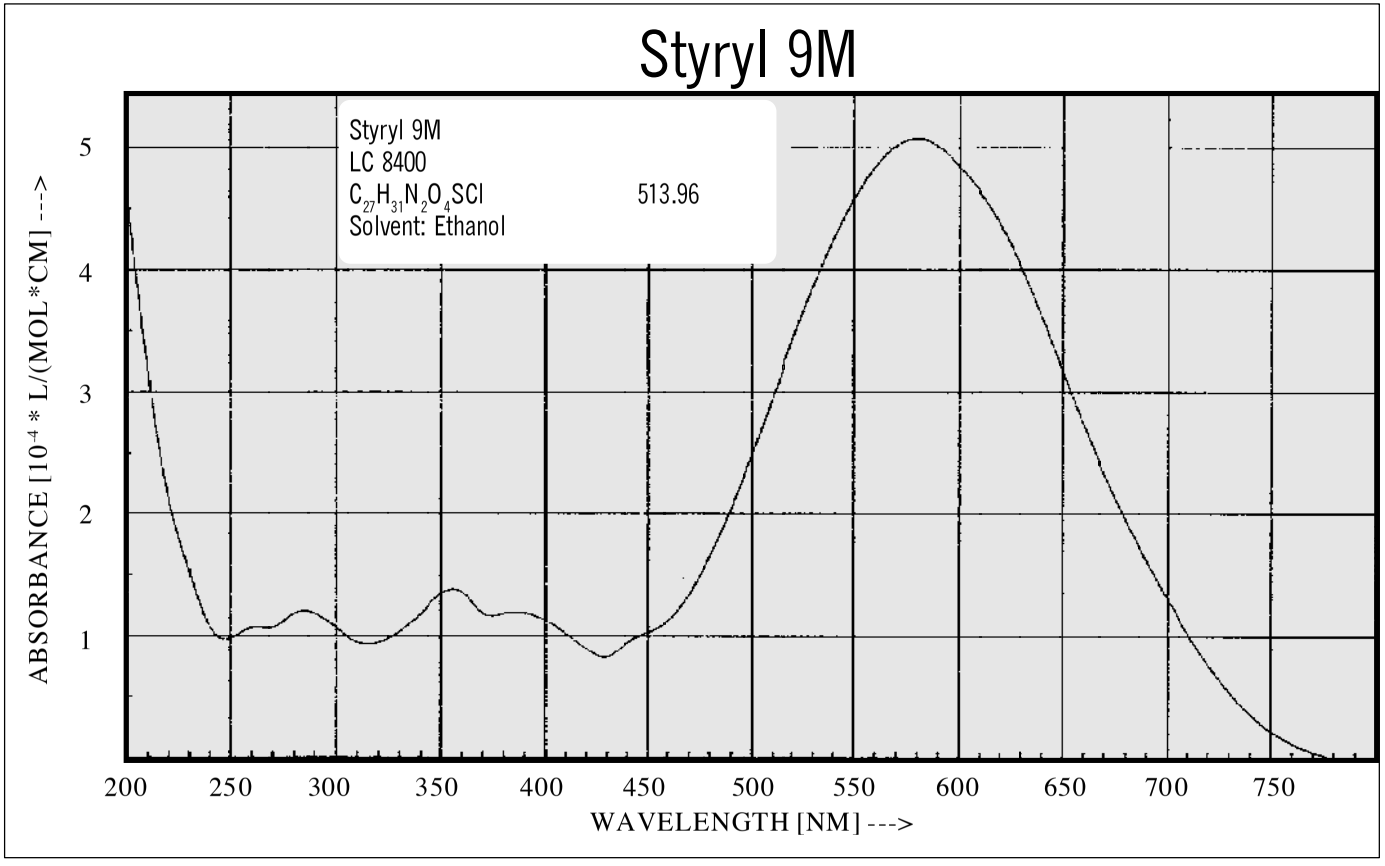
Lasing Performance

Very efficient laser dye for pulsed and CW operation; tunable around 810 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*810*	*776 - 823*	*6*	*1.00*	*DMSO*	*1*
CW, Kr^+	*red*	*795*	*730 - 835*	*22*	*0.21*	*Eg.*	*2*

References

1. Lambda Physik, *Wall Chart* 1996.
2. R. Raue, H. Harnisch, K. H. Drexhage, *Heterocycles* 21(1), 167 (1984).

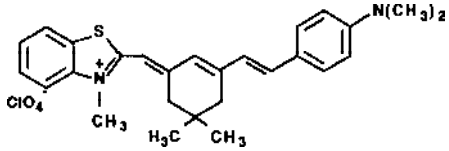

Styryl 9M
Styryl 9M
LC 8400
$C_{27}H_{31}N_2O_4SCl$ 513.96
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
1
2
3
4
5
200
250
300
350
400
450
500
550
600
650
700
750
WAVELENGTH [NM] --->

Styryl 9M (LC 8400)

Constitution

2-(6-(4-Dimethylaminophenyl)-2,4-neopentylene-1,3,5-hexatrienyl)-3-methyl-benzothiazolium Perchlorat
LDS 821

$C_{27}H_{31}N_2O_4SCl$ · MW: 513.96



Characteristics

Lambdachrome® number:	8400
CAS registry number:	120528-73-6
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	585 nm
Molar absorptivity:	5.05 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

Lasing Performance

Very efficient laser dye for pulsed and CW operation; tunable around 840 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*840*	*810 - 875*	*9*	*1.10*	*DMSO*	*1,2*
Nitrogen	*337*	*840*	*803 - 875*	*rel.*	*1.03*	*DMSO*	*3*
Nd:YAG, 2nd	*532*	*824*	*797 - 851*	*15*	*0.26*	*Pc.*	*1, 4*
Cu-vapor	*510*	*815*	*793 - 845*	*14*	*0.67*	*Methanol*	*5*
Flashlamp	*-*	*840*	*810 - 860*	*-*	*0.01*	*Pc./Eg.*	*6, 7*
CW, Ar^+	*VIS*	*830*	*785 - 900*	*-*	*2.0*	*Pc./Eg.*	*1, 8,9*

References

See page 236.

P.S.

The 3-Ethyl-derivative (Styryl 9/LDS 820) shows similar performance. However, its photochemical stability in CW pumped dye lasers is slightly lower.

References (STYRYL 9M)

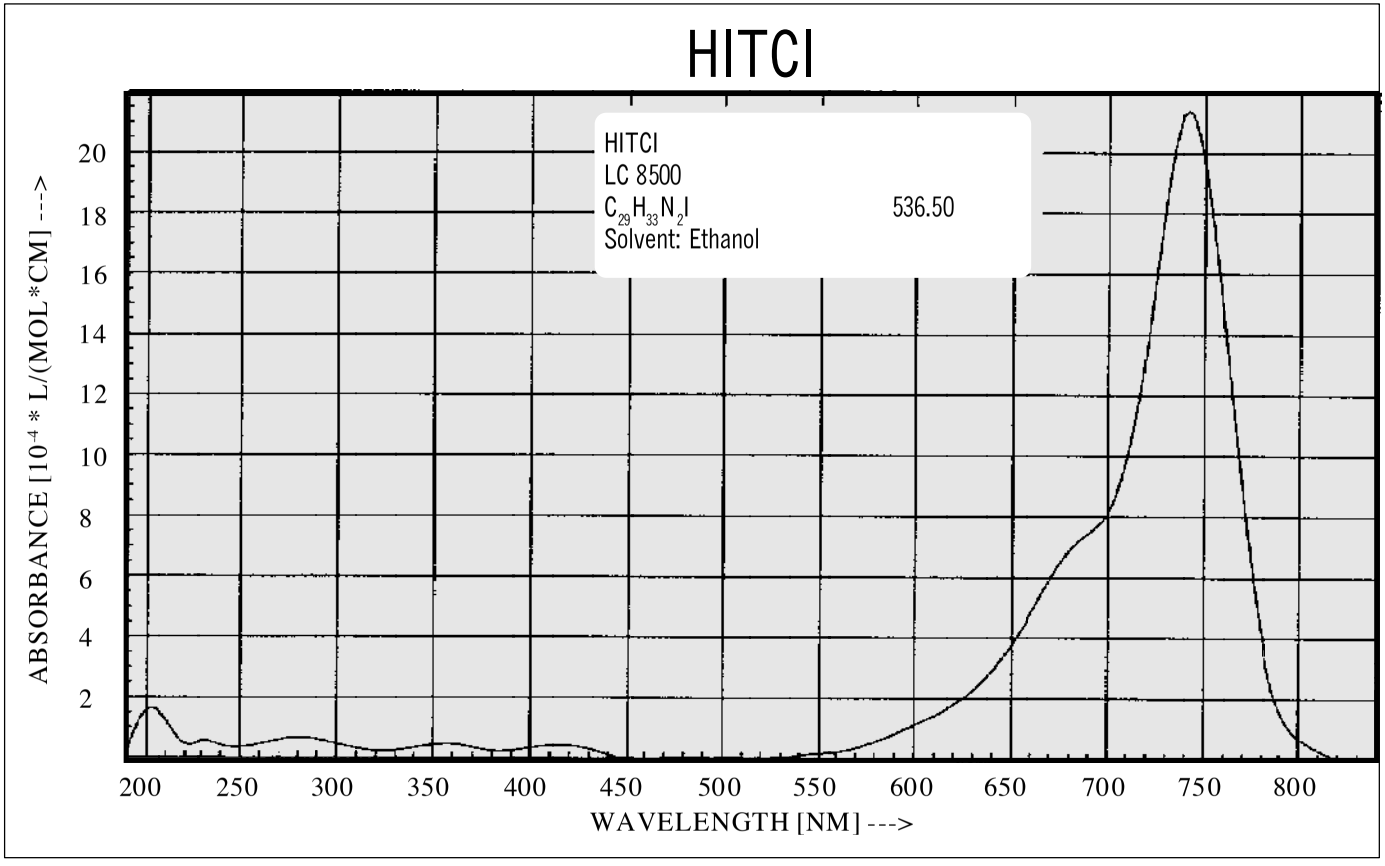
1. Lambda Physik, *Wall Chart* 1996.
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B32, 9 (1983).
3. Lambda Physik, *Data Sheet.*
4. K. Kato, *IEEE J. Quantum Electr.* QE-16(19), 1017 (1980).
5. M. Broyer et al., *Appl. Phys.* B35, 31 (1984).
6. K. Smith, W. Sibbett, J. R. Taylor, *Opt. Commun.* 49(5), 359 (1984).
7. Cheng-Huei Lin, B. Marshall, *Appl. Optics* 23(14), 2228 (1984).
8. J. Hofnagle et al., *Opt. Commun.* 42(4), 267 (1982).
9. J. J. L. Mulders, L. W. G. Steenhuysen, *Opt. Commun.* 54(5), 295 (1985).

References (HITCI)

1. Lambda Physik, *Wall Chart* 1996.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 403 (1981).
3. F. Bos, *Appl. Optics* 20(10), 3553 (1981).
4. Lambda Physik, *Data Sheet.*
5. F. Bos, *Appl. Optics* 20(20), 1886 (1981).
6. A. Hirth, K. Vollrath, J. Faure, D. Lougnot, *Opt. Commun.* 7(4), 339(1973).
7. Coherent, *CW Dye Laser Fact Sheets.*
8. T. F. Johnston, R. H. Brady, W. Proffitt, *Appl. Optics* 21(13), 2307 (1982).

References (IR 140)

1. Lambda Physik, *Wall Chart* 6/83.
2. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
3. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B30, 109 (1983).
4. Lambda Physik, *Data Sheet.*
5. F. Bos, *Appl. Optics* 20(10), 1886 (1981).
6. C. A. Moore, C. D. Decker, *J. Appl. Phys.* 49(1), 47 (1978).
7. C. D. Decker, *Appl. Phys. Letters* 27(11), 607 (1975).
8. J. P. Webb et al., *IEEE J. Quantum Electr.* QE-11, 114 (1975).
9. Coherent, *CW Dye Laser Fact Sheets.*
10. Lambda Physik.

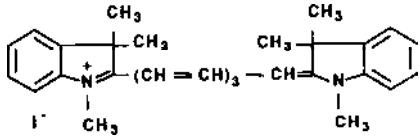

HITCl
HITCl
LC 8500
$C_{29}H_{33}N_2I$ 536.50
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
20
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
750
800
WAVELENGTH [NM] --->

HITCI (LC 8500)

Constitution

1,1',3,3,3',3'-Hexamethylindotricarbocyanine Iodide
Hexacyanine 3

$C_{29}H_{33}N_2I$ · MW: 536.50



Characteristics

Lambdachrome® number:	8500
CAS registry number:	19764-96-6
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	741 nm
Molar absorptivity:	21.5 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	778 nm

For research and development purposes only.

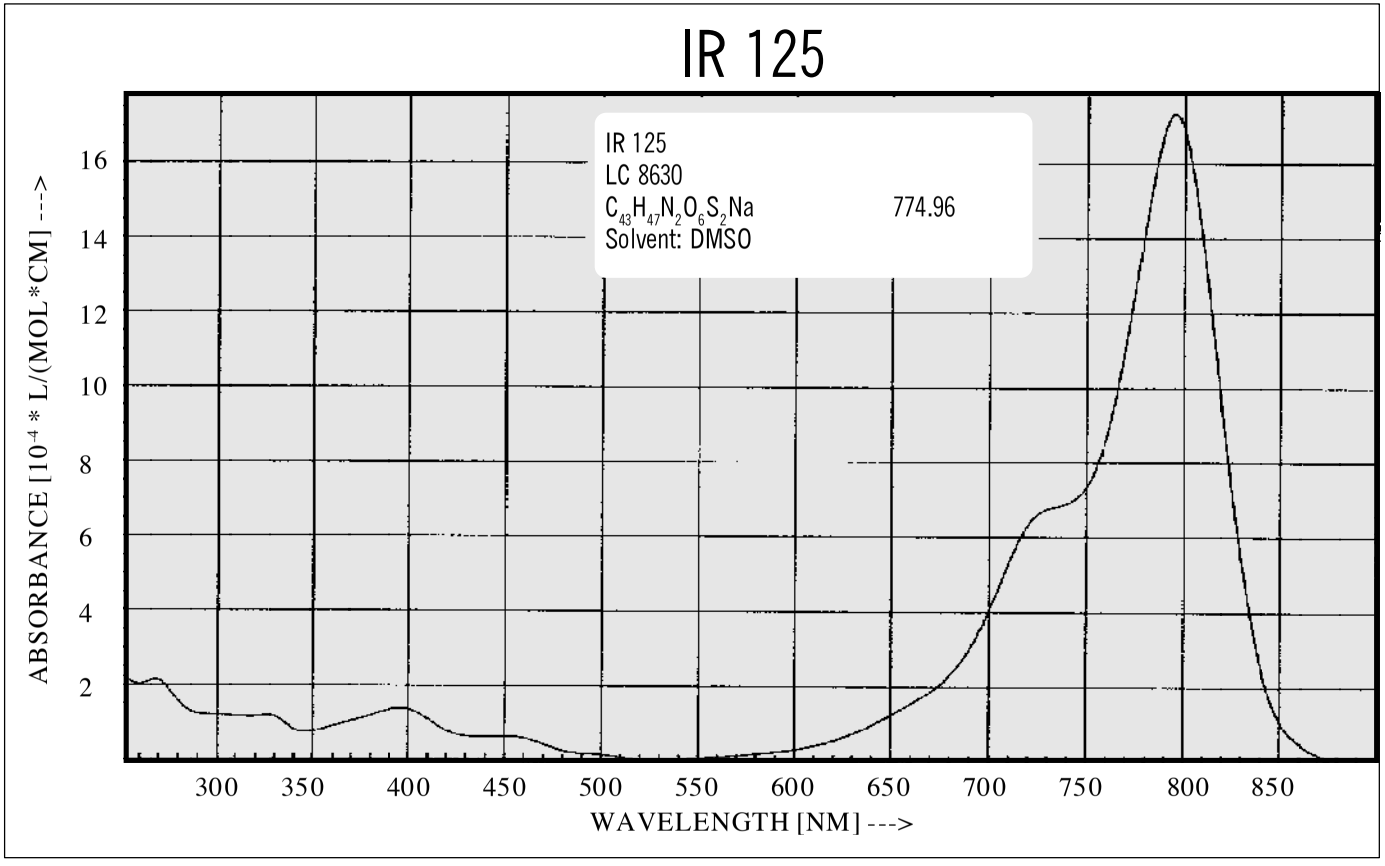
Lasing Performance

Laser dye for pulsed and CW operation; tunable around 860 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*868*	*837 - 905*	*4*	*1.20*	*DMSO*	*1, 2, 3*
Nitrogen	*337*	*846*	*828 -891*	*rel.*	*1.06*	*DMSO*	*3, 4*
Nd:YAG, 2nd	*532*	*815*	*-*	*-*	*-*	*Ethanol*	*5*
Flashlamp	*-*	*879*	*-*	*-*	*0.11*	*DMSO*	*6*
CW, Kr^+	*ir*	*880*	*815 - 920*	*10*	*0.3*	*DMSO/Eg.*	*7, 8*

References

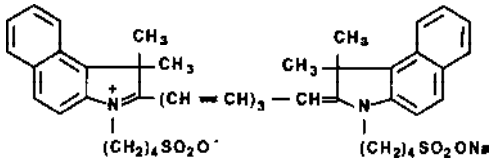
See page 236.


IR 125
IR 125
LC 8630
$C_{43}H_{47}N_2O_6S_2Na$ 774.96
Solvent: DMSO
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
16
14
12
10
8
6
4
2
300
350
400
450
500
550
600
650
700
750
800
850
WAVELENGTH [NM] --->

IR 125 (LC 8630)

Constitution

$C_{43}H_{47}N_2O_6S_2Na$ · MW: 774.96



Characteristics

Lambdachrome® number:	8630
CAS registry number:	3599-32-4
Appearance:	bronze, crystalline solid
Absorption maximum (in DMSO):	795 nm
Molar absorptivity:	17.3 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in chloroform):	838

For research and development purposes only.

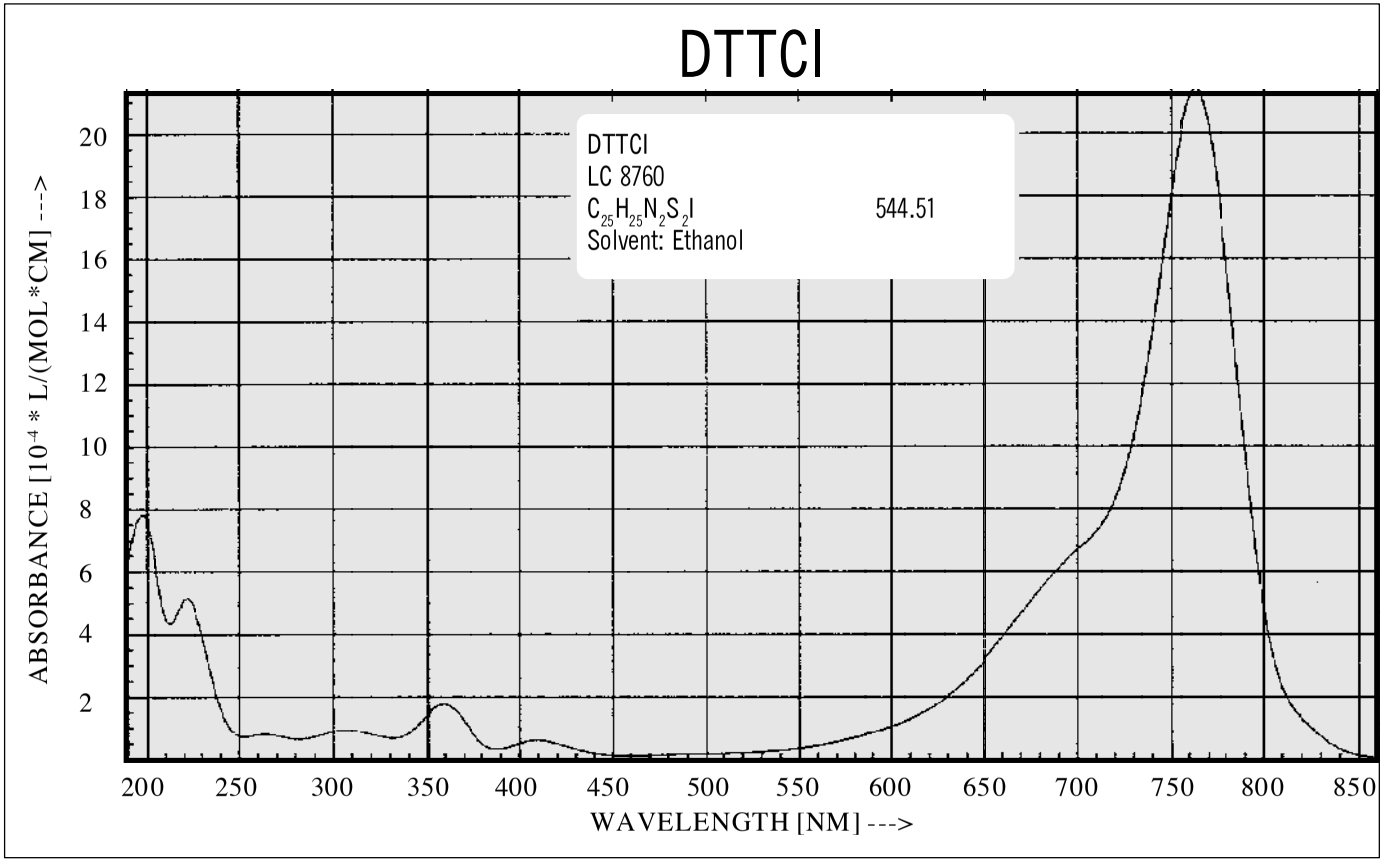
Lasing Performance

Laser dye for pulsed operation; tunable around 920 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*920*	*890 - 960*	*4*	*2.0*	*DMSO*	*1*
Nitrogen	*337*	*918*	*893 - 958*	*rel.*	*1.94*	*DMSO*	*2, 3*
Nd:YAG, 2nd	*532*	*913*	*-*	*3*	*0.39*	*DMSO*	*4*
Flashlamp	*-*	*940*	*-*	*-*	*0.08*	*DMSO*	*5*

References

1. Lambda Physik, *Wall Chart* 6/90.
2. Lambda Physik, *Data Sheet.*
3. B. M. Pierce, R. R. Birge, *IEEE J. Quantum Electr.* QE-18(7), 1164 (1982).
4. C. D. Decker, *Appl. Phys. Letters* 27(11), 607 (1975).
5. J. P. Webb et al., *IEEE J. Quantum Electr.* QE-11, 114 (1975).

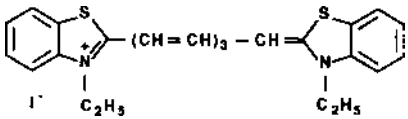

DTTCI
DTTCI
LC 8760
$C_{25}H_{25}N_2S_2I$ 544.51
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
20
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
750
800
850
WAVELENGTH [NM] --->

DTTCI (LC 8760)

Constitution

3,3'-Diethylthiatricarbocyanine Iodide

$C_{25}H_{25}N_2S_2I$ · MW: 544.51



Characteristics

Lambdachrome® number:	8760
CAS registry number:	3071-70-3
Appearance:	blue, crystalline solid
Absorption maximum (in ethanol):	760 nm
Molar absorptivity:	21.0 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in chloroform):	815

For research and development purposes only.

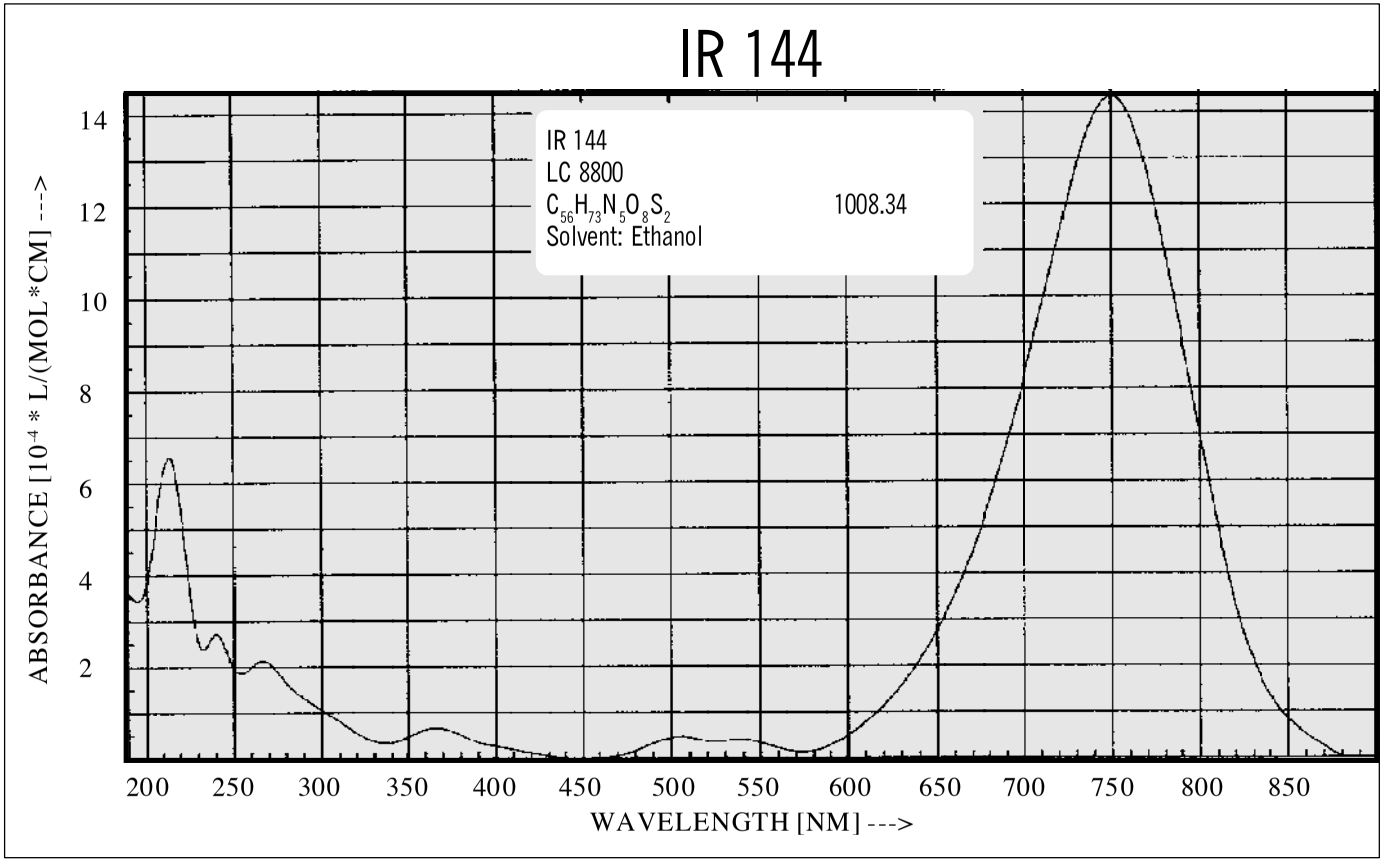
Lasing Performance

Laser dye for pulsed operation; tunable around 850 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*849*	*828 - 883*	*1*	*0.42*	*DMSO*	*1*
Nitrogen	*337*	*852*	*834 - 892*	*rel.*	*0.60*	*DMSO*	*1, 2*
Flashlamp	*-*	*889*	*-*	*-*	*0.11*	*Methanol*	*3, 4*

References

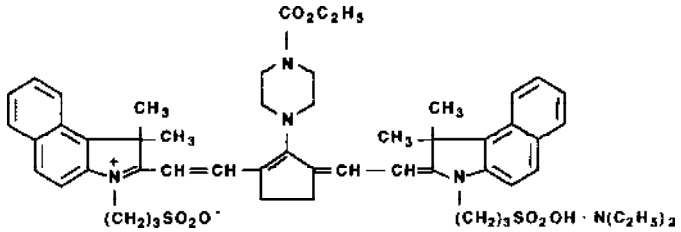
1. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
2. B. M. Pierce, R. R. Birge, *IEEE J. Quantum Electr.* QE-18(7), 1164 (1982).
3. M. Maeda, Y. Miyazoe, *Jap. J. Appl. Phys.* 11(5), 692 (1972).
4. A. Hirth, K. Vollrath, J. Faure, D. Lougnot, *Opt. Commun.* 7(4), 339 (1973).


IR 144
IR 144
LC 8800
$C_{56}H_{73}N_5O_8S_2$ 1008.34
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
14
12
10
8
6
4
2
200 250 300 350 400 450 500 550 600 650 700 750 800 850
WAVELENGTH [NM] --->

IR 144 (LC 8800)

Constitution

$C_{56}H_{73}N_5O_8S_2$ · MW: 1008.34



Characteristics

Lambdachrome® number:	8800
CAS registry number:	54849-69-3
Appearance:	bronze, crystalline solid
Absorption maximum (in DMSO):	750 nm
Molar absorptivity:	14.1 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	848

For research and development purposes only.

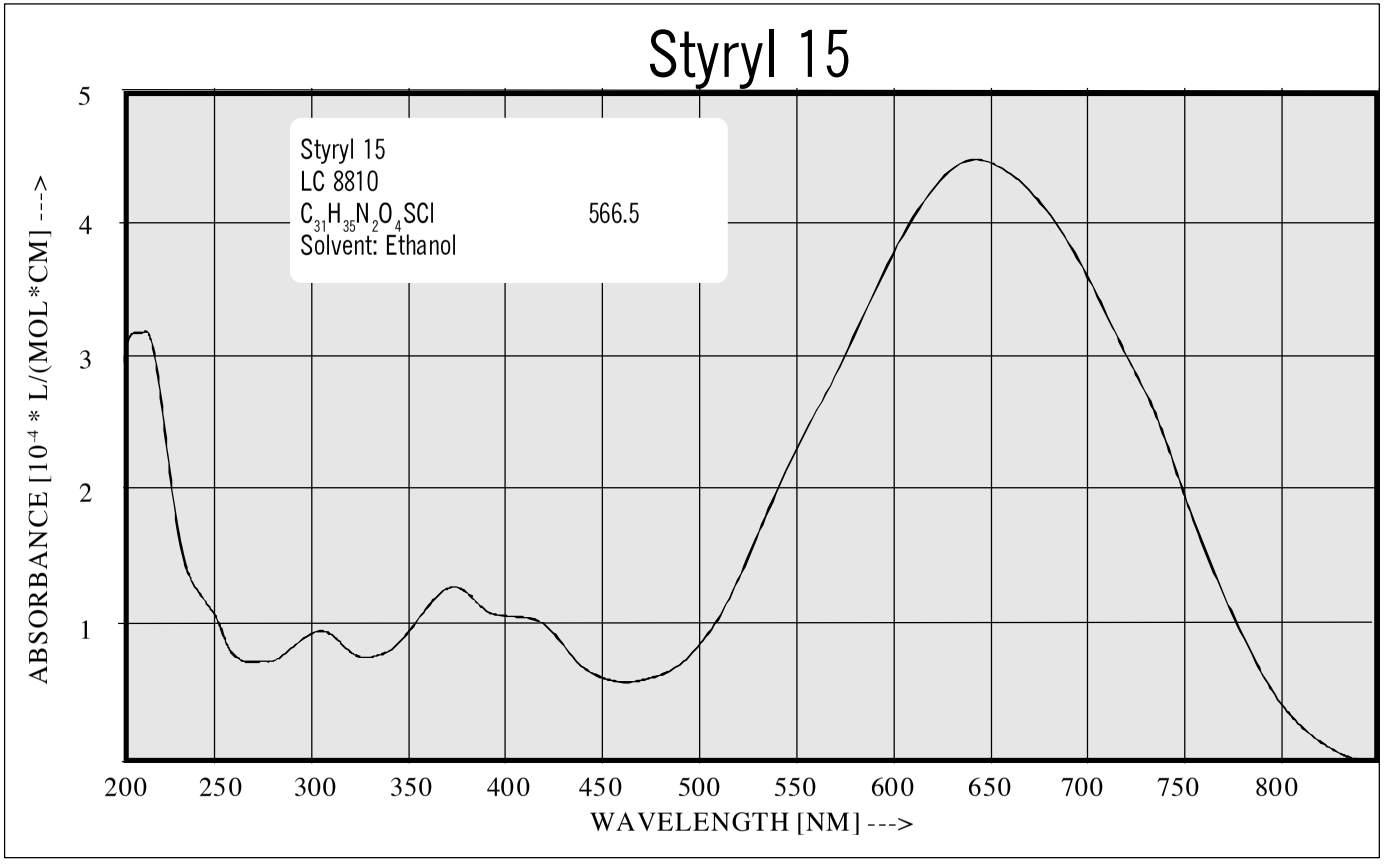
Lasing Performance

Laser dye for pulsed operation; tunable around 880 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*869*	*856 - 879*	*3*	*1.08*	*DMSO*	*1, 2*
Nitrogen	*337*	*874*	*862 - 892*	*rel.*	*1.61*	*DMSO*	*1, 3, 4*
Nd:YAG, 2nd	*532*	*867*	*-*	*6*	*0.30*	*DMSO*	*5, 6*
Flashlamp	*-*	*880*	*-*	*-*	*0.10*	*DMSO*	*7*

References

1. F. Bos, *Appl. Optics* 20(20), 3553 (1981).
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B30, 109 (1983).
3. Lambda Physik, *Data Sheet.*
4. B. M. Pierce, R. R. Birge, *IEEE J. Quantum Electr.* QE-18(7), 1164 (1982).
5. F. Bos, *Appl. Optics.* 20(10), 1886 (1981).
6. C. A. Moore, C. D. Decker, *J. Appl. Phys.* 49(1), 47 (1978).
7. J. P. Webb et al., *IEEE J. Quantum Electr.* QE-11, 114 (1975).

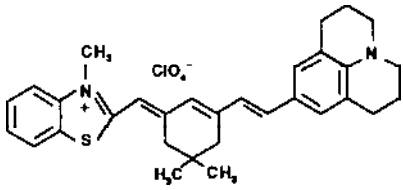

Styryl 15
Styryl 15
LC 8810
$C_{31}H_{35}N_2O_4SCl$ 566.5
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
5
4
3
2
1
200
250
300
350
400
450
500
550
600
650
700
750
800
WAVELENGTH [NM] --->

Styryl 15 (LC 8810)

Constitution

2-(6-(9-(2,3,6,7-Tetrahydro-1H,5H-benzo(i,j)-chinolizinium))-2,4-neopentylene-1,3,5-hexatrienyl)-3-methylbenzothiazolium Perchlorate

$C_{31}H_{35}N_2O_4SCl$ · MW: 566.5



Characteristics

Lambdachrome® number:	8810
CAS Registry number:	-
Appearance:	dark green, crystalline solid
Absorption maximum (in ethanol):	648 nm
Molar absorptivity:	4.42 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	-

For research and development purposes only.

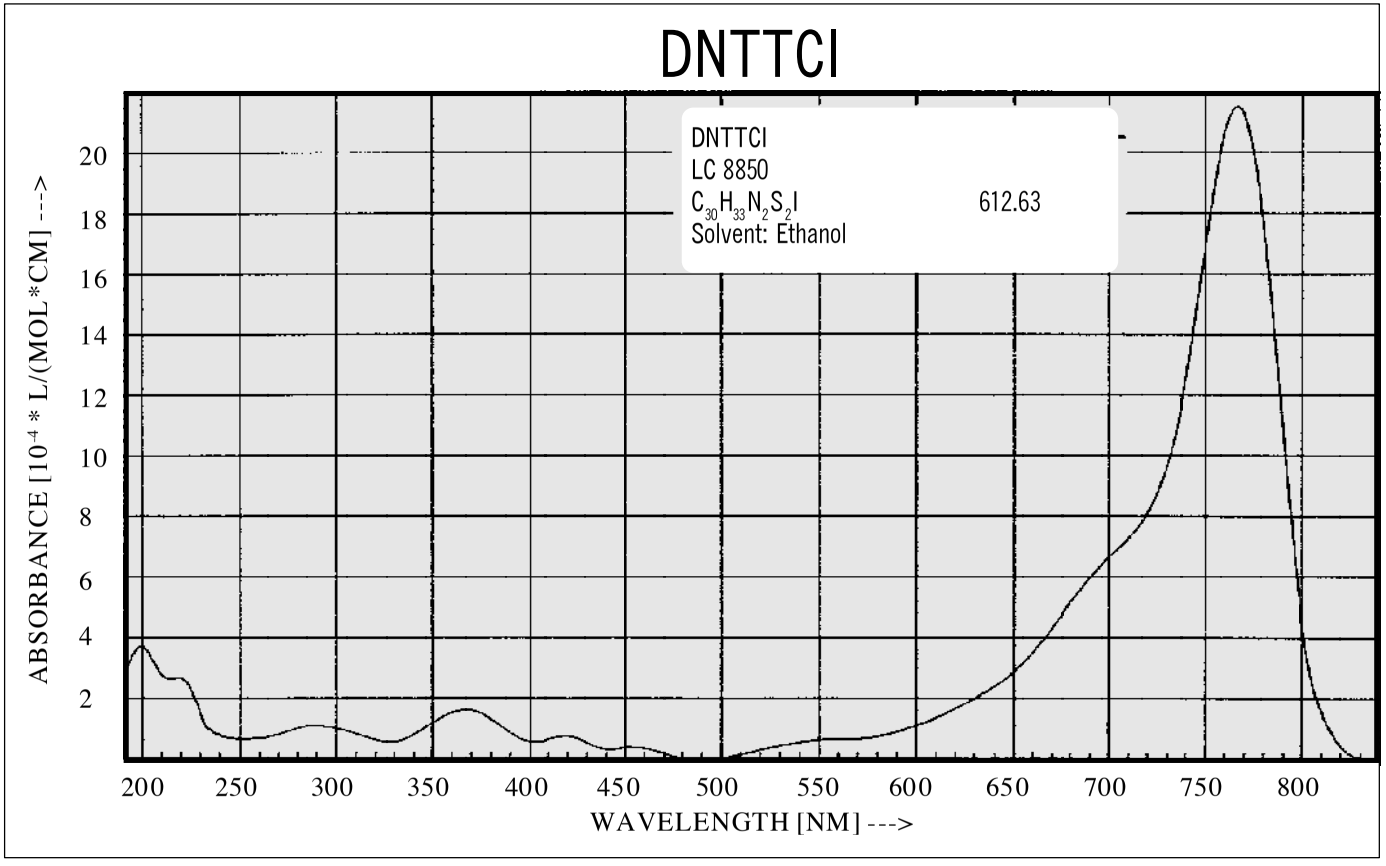
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 880 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*880*	*856 - 918*	*7*	*1.15*	*DMSO*	*1*
Nd:YAG, 2nd	*532*	*880*	*856 - 918*	*7*	*0.62*	*Pc.*	*1*

References

1. Lambda Physik, *Wall Chart* 1996.

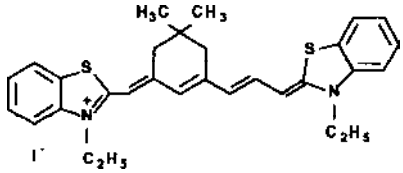

DNTTCI
DNTTCI
LC 8850
$C_{30}H_{33}N_2S_2I$ 612.63
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
20
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
750
800
WAVELENGTH [NM] --->

DNTTCI (LC 8850)

Constitution

3,3'-Diethyl-9,11-neopentylenethiatricarbocyanine Iodide

$C_{30}H_{33}N_2S_2I$ · MW: 612.63



Characteristics

Lambdachrome® number:	8850
CAS registry number:	-
Appearance:	brass colored, crystalline solid
Absorption maximum (in ethanol):	765nm
Molar absorptivity:	22.5 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum :	-

For research and development purposes only.

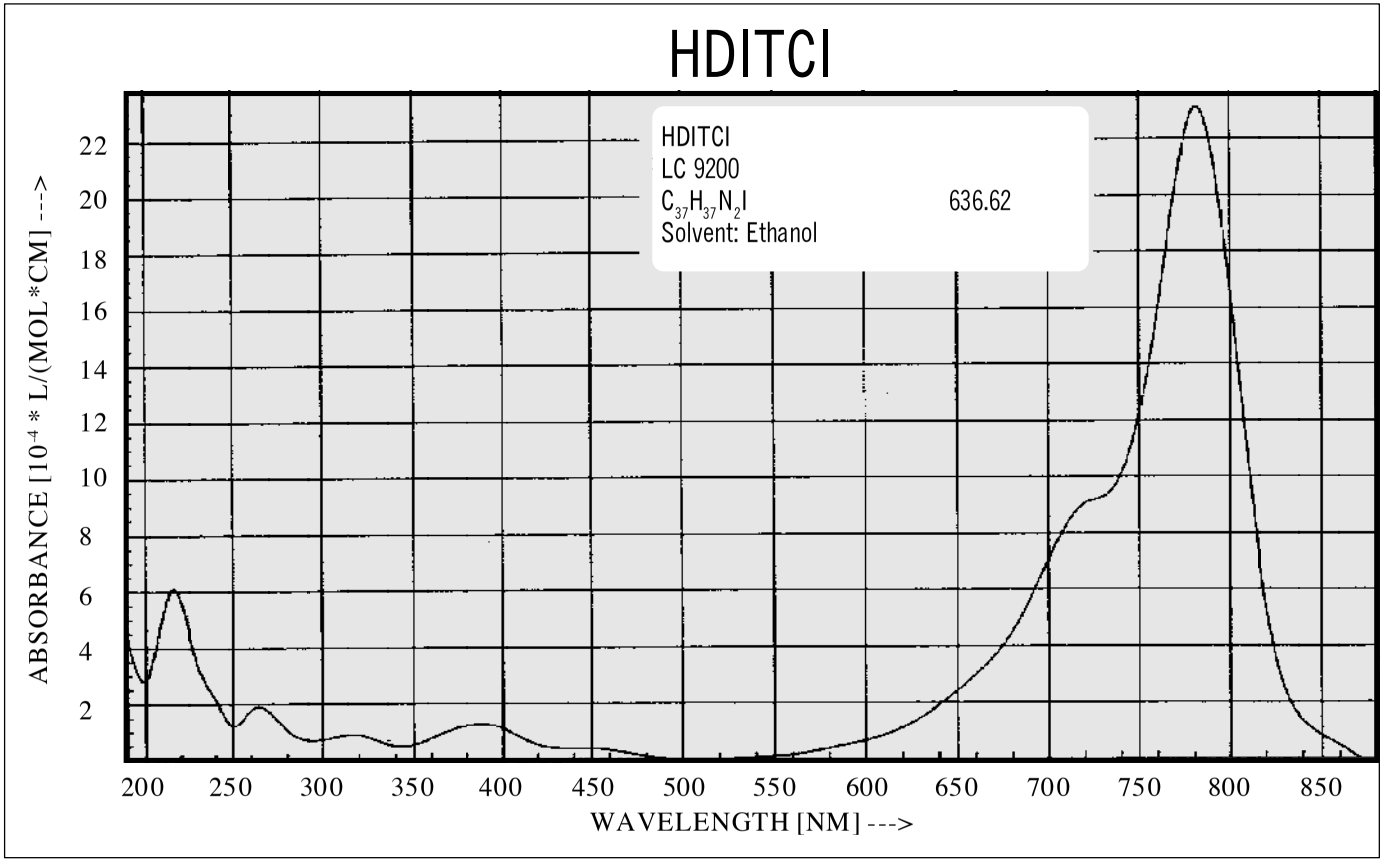
Lasing Performance

Laser dye for pulsed operation; tunable around 880 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Flashlamp	-	*880*	-	-	*0.12*	*DMSO*	*1*

References

1. A. Hirth, K. Vollrath, J. Faure, D. Lougnot, *Opt. Commun.* 7(4), 339 (1973).

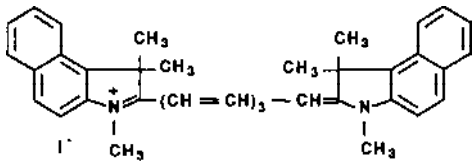

HDITCI
HDITCI
LC 9200
$C_{37}H_{37}N_2I$ 636.62
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
22
20
18
16
14
12
10
8
6
4
2
200 250 300 350 400 450 500 550 600 650 700 750 800 850
WAVELENGTH [NM] --->

HDITCI (LC 9200)

Constitution

1,1',3,3,3',3'-Hexamethyl-4,4',5,5'-dibenzo-2,2'-indotricarbocyanine Iodide
Hexadibenzocyanin 3

$C_{37}H_{37}N_2I$ · MW: 636.62



Characteristics

Lambdachrome® number:	9200
CAS registry number:	23178-67-8
Appearance:	bronze colored, crystalline solid
Absorption maximum (in ethanol):	780 nm
Molar absorptivity:	23.1 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in chloroform):	824

For research and development purposes only.

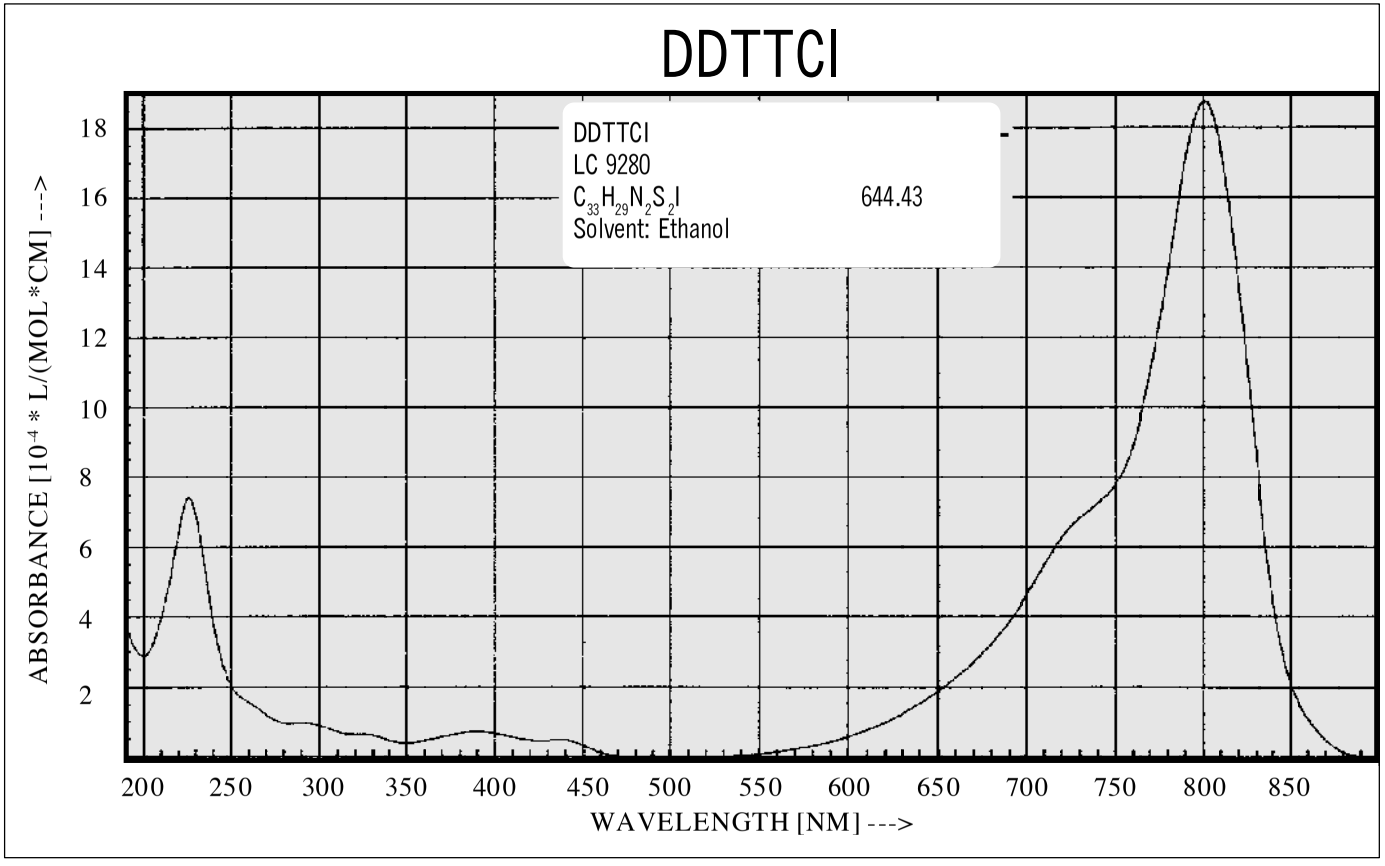
Lasing Performance

Laser dye for pulsed and CW operation; tunable around 920 nm. Saturable absorber for CW pumped Oxazine 170 dye lasers; applicable around 780 nm [1.].

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*932*	*899-975*	*4*	*0.90*	*DMSO*	*1, 2*
CW, Kr^+	*red*	*920*	*880 - 960*	*2*	*0.95*	*DMSO/Eg.*	*3*

References

1. G. W. Fehrenbach et al., *Appl. Phys. Letters* 33(2), 159 (1978).
2. V. S. Antonov, K. L. Hohla, *Appl. Phys.* B30, 109 (1983).
3. K. M. Romanek et al., *Opt. Commun.* 21(1), 16 (1977).

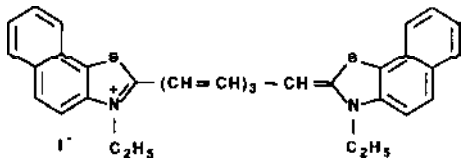

DDTTCI
DDTTCI
LC 9280
$C_{33}H_{29}N_2S_2I$ 644.43
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
750
800
850
WAVELENGTH [NM] --->

DDTTCI (LC 9280)

Constitution

3,3'-Diethyl-4,4',5,5'-dibenzothiatricarbocyanine Iodide
Hexadibenzocyaini 45

$C_{33}H_{29}N_2S_2I$ · MW: 644.43



Characteristics

Lambdachrome® number:	9280
CAS registry number:	-
Appearance:	bronze colored, crystalline solid
Absorption maximum (in ethanol):	798 nm
Molar absorptivity:	19.6 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

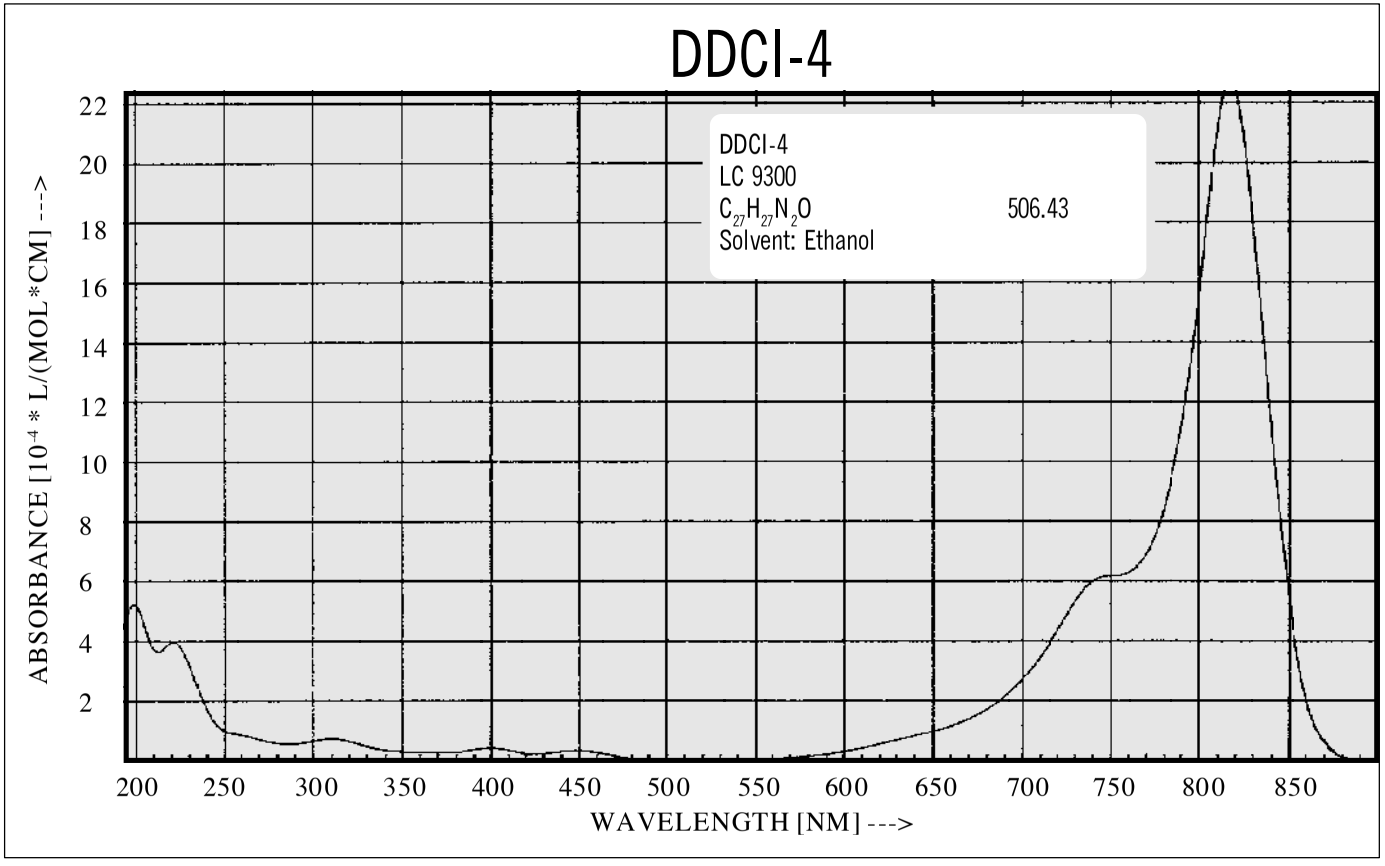
Lasing Performance

Laser dye for pulsed operation; tunable around 930 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*932*	*899 - 975*	*5*	*0.92*	*DMSO*	*1, 2*
Nitrogen	*337*	*870*	*-*	*rel.*	*0.32*	*Acetone*	*3*
Flashlamp	*-*	*946*	*-*	*-*		*Pc./DMSO*	*4*

References

1. Lambda Physik.
2. H. Telle, W. Hüffer, D. Basting, *Opt. Commun.* 38(5,6), 402 (1981).
3. Chinlon Lin, *IEEE J. Quantum Electr.* QE-11, 61 (1975).
4. A. Hirth, J. Faure, D. Lougnot, *Opt. Commun.* 8(4), 318 (1973).

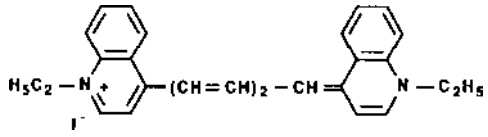

DDCI-4
DDCI-4
LC 9300
$C_{27}H_{27}N_2O$ 506.43
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
22
20
18
16
14
12
10
8
6
4
2
200
250
300
350
400
450
500
550
600
650
700
750
800
850
WAVELENGTH [NM] --->

DDCI-4 (LC 9300)

Constitution

1,2'-Diethyl-4,4'-dicarbocyanine Iodide
NK 1144

$C_{27}H_{27}N_2O$ · MW: 506.43



Characteristics

Lambdachrome® number:	9300
CAS registry number:	-
Appearance:	green, crystalline solid
Absorption maximum (in ethanol):	815 nm
Molar absorptivity:	23.6 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	850 nm

For research and development purposes only.

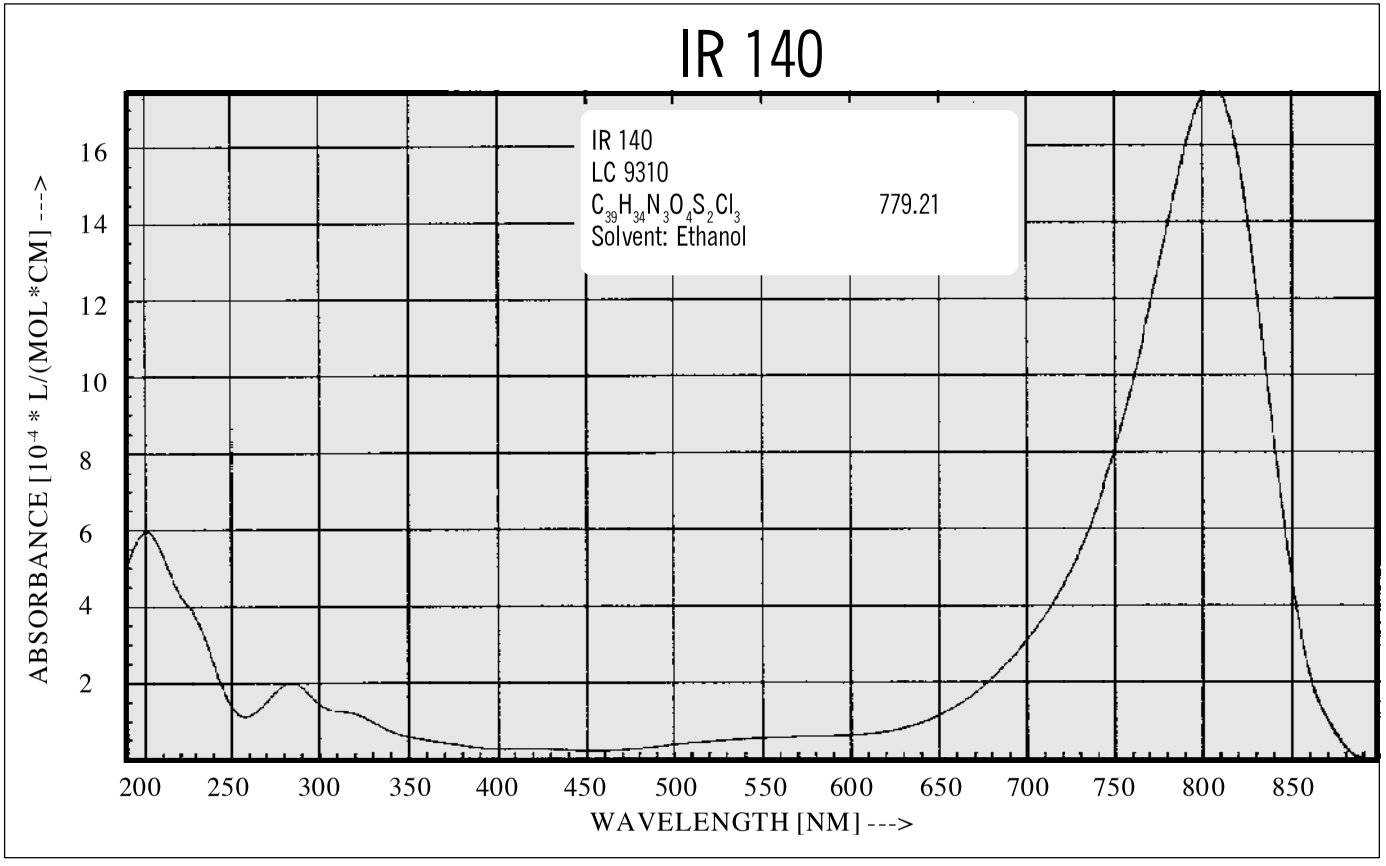
Lasing Performance

Laser dye for pulsed operation; tunable around 930 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nitrogen	*337*	*930*	*-*	*rel.*	*0.50*	*Acetone*	*1*

References

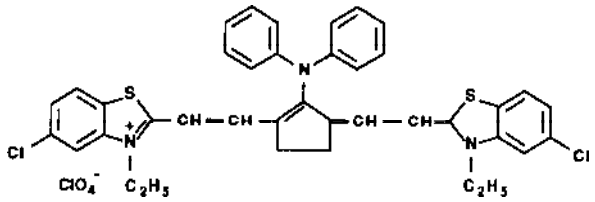
1. Chinlon Lin, *IEEE J. Quantum Electr.* QE-11, 61 (1975).


IR 140
IR 140
LC 9310
$C_{39}H_{34}N_3O_4S_2Cl_3$ 779.21
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
2
4
6
8
10
12
14
16
200
250
300
350
400
450
500
550
600
650
700
750
800
850
WAVELENGTH [NM] --->

IR 140 (LC 9310)

Constitution

$C_{39}H_{34}N_3O_4S_2Cl_3$ · MW: 779.21



Characteristics

Lambdachrome® number:	9310
CAS registry number:	53655-17-7
Appearance:	brown, crystalline solid
Absorption maximum (in ethanol):	810 nm
Molar absorptivity:	15.0 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	860 nm

For research and development purposes only.

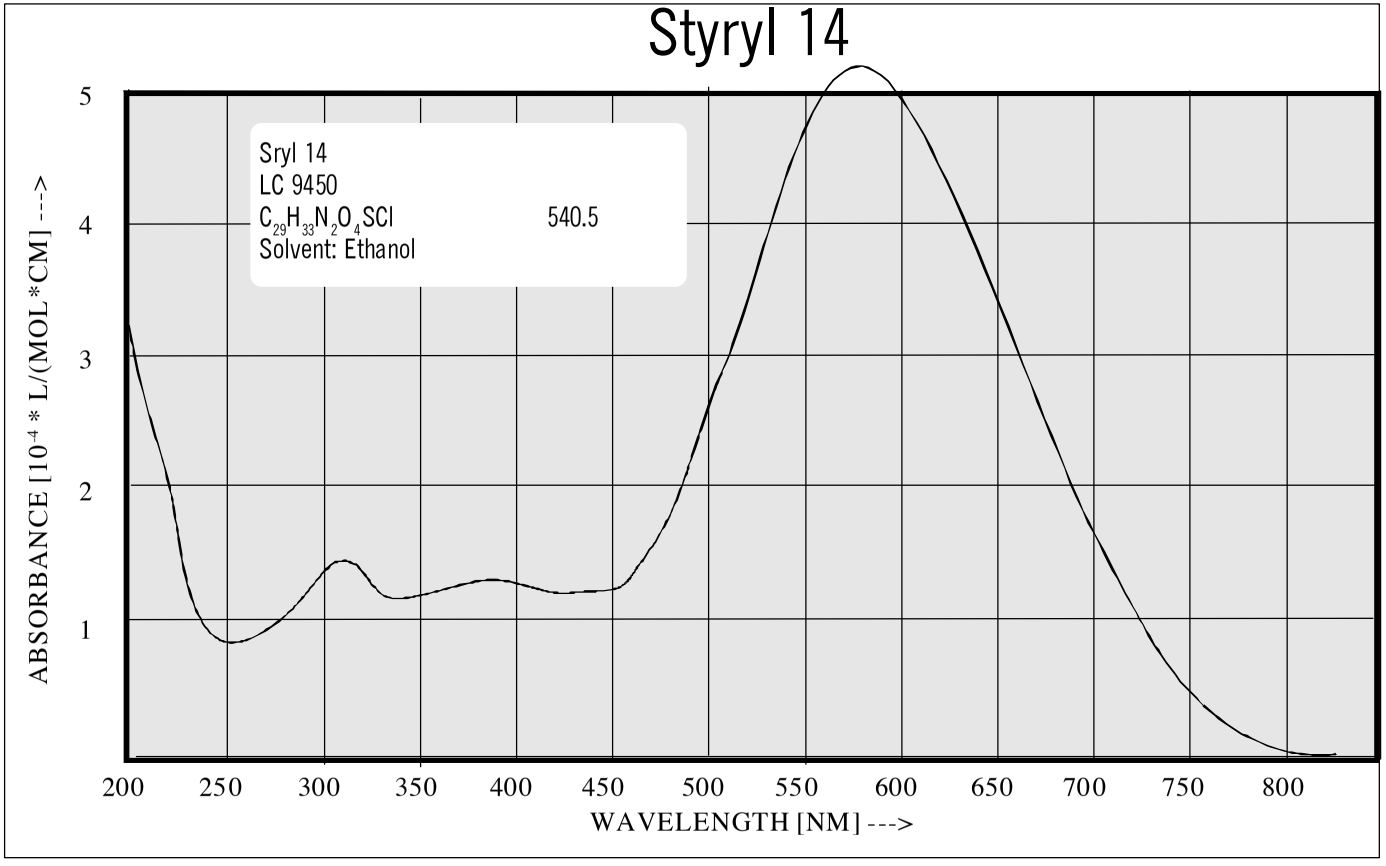
Lasing Performance

Laser dye for pulsed operation; tunable around 950 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*950*	*882 - 985*	*3*	*1.10*	*DMSO*	*1, 2, 3*
Nitrogen	*337*	*910*	*900 - 936*	*rel.*	*0.78*	*DMSO*	*3, 4*
Nd:YAG, 2nd	*532*	*890*	*-*	*5*	*0.31*	*DMSO*	*5, 6, 7*
Flashlamp	*-*	*950*	*-*	*-*	*0.08*	*DMSO*	*8*
CW, Kr^+	*VIS*	*970*	*880 - 1010*	*14*	*0.71*	*DMSO/Eg.*	*9, 10*

References

See page 236.

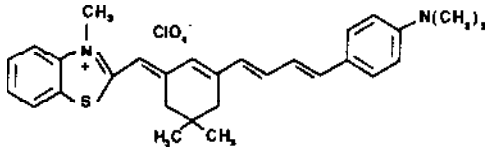

Styryl 14
Sryl 14
LC 9450
$C_{29}H_{33}N_2O_4SCl$ 540.5
Solvent: Ethanol
ABSORBANCE [10^{-4} * L/(MOL*CM)] --->
1
2
3
4
5
200
250
300
350
400
450
500
550
600
650
700
750
800
WAVELENGTH [NM] --->

Styryl 14 (LC 9450)

Constitution

2-(8-(4-p-Dimetyhlaminophenyl)-2,4-neopentylene-1,3,5,7-octatetraenyl)-3-methylbenzothiazolium Perchlorate

$C_{29}H_{33}N_2O_4SCl$ · MW: 540.5



Characteristics

Lambdachrome® number:	9450
CAS Registry number:	-
Appearance:	dark green, crystalline solid
Absorption maximum (in ethanol):	588 nm
Molar absorptivity:	5.17×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in ethanol):	-

For research and development purposes only.

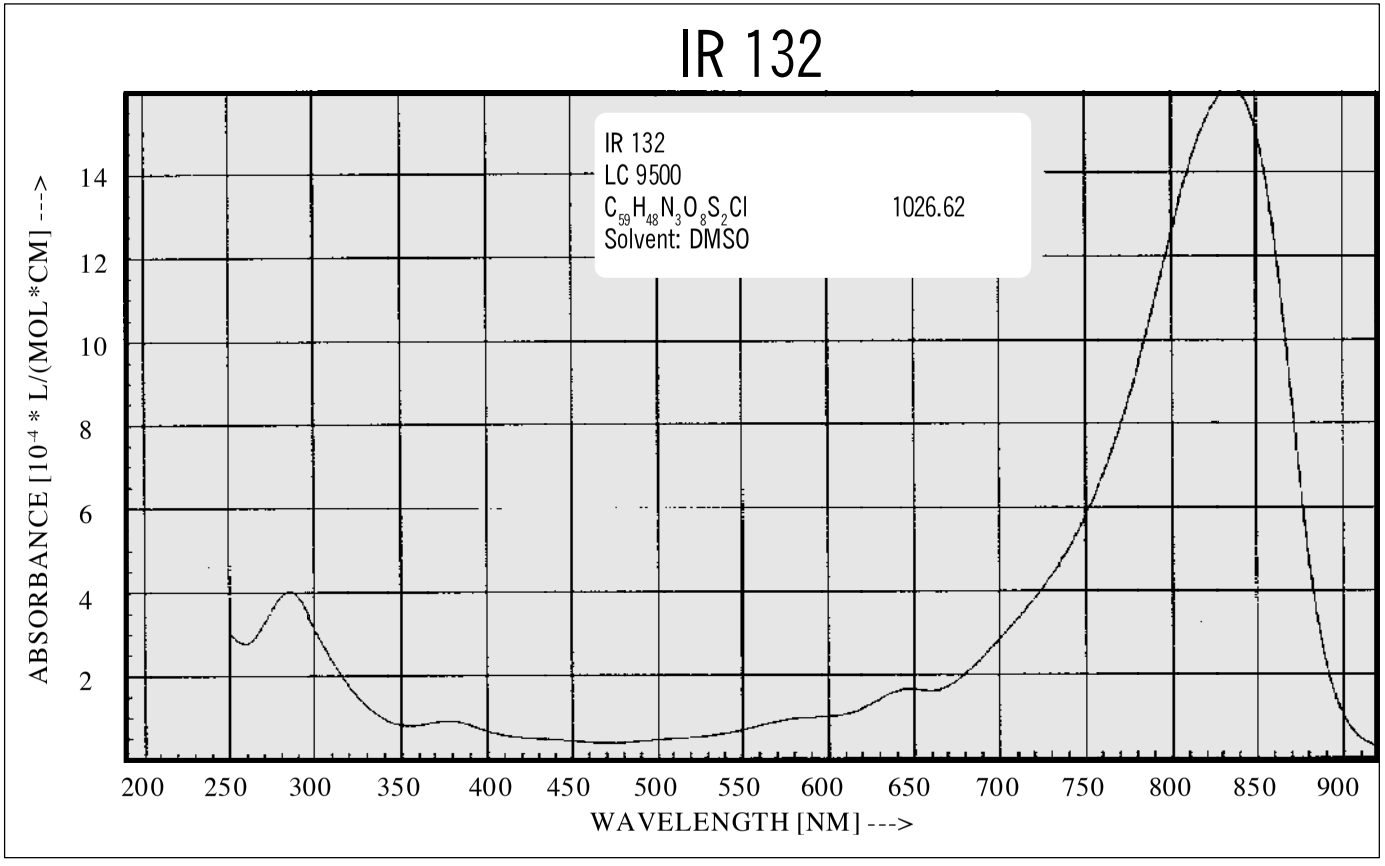
Lasing Performance

Efficient laser dye for pulsed and CW operation; tunable around 950 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*945*	*904 - 992*	*9*	*1.10*	*DMSO*	*1*
Nd:YAG, 2nd	*532*	*945*	*904 - 990*	*9*	*0.27*	*Pc.*	*1*

References

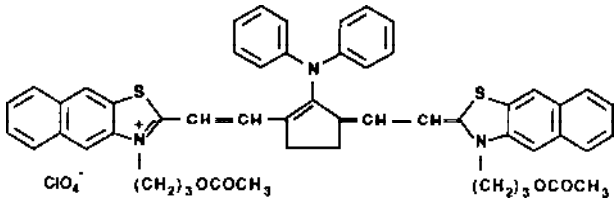
1. Lambda Physik, *Wall Chart* 1996.


IR 132
IR 132
LC 9500
$C_{59}H_{48}N_3O_8S_2Cl$ 1026.62
Solvent: DMSO
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
2
4
6
8
10
12
14
200 250 300 350 400 450 500 550 600 650 700 750 800 850 900
WAVELENGTH [NM] --->

IR 132 (LC 9500)

Constitution

$C_{59}H_{48}N_3O_8S_2Cl$ · MW: 1026.62



Characteristics

Lambdachrome® number:	9500
CAS registry number:	62669-62-9
Appearance:	red, crystalline solid
Absorption maximum (in DMSO):	830 nm
Molar absorptivity:	15.9 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in chloroform):	861 nm

For research and development purposes only.

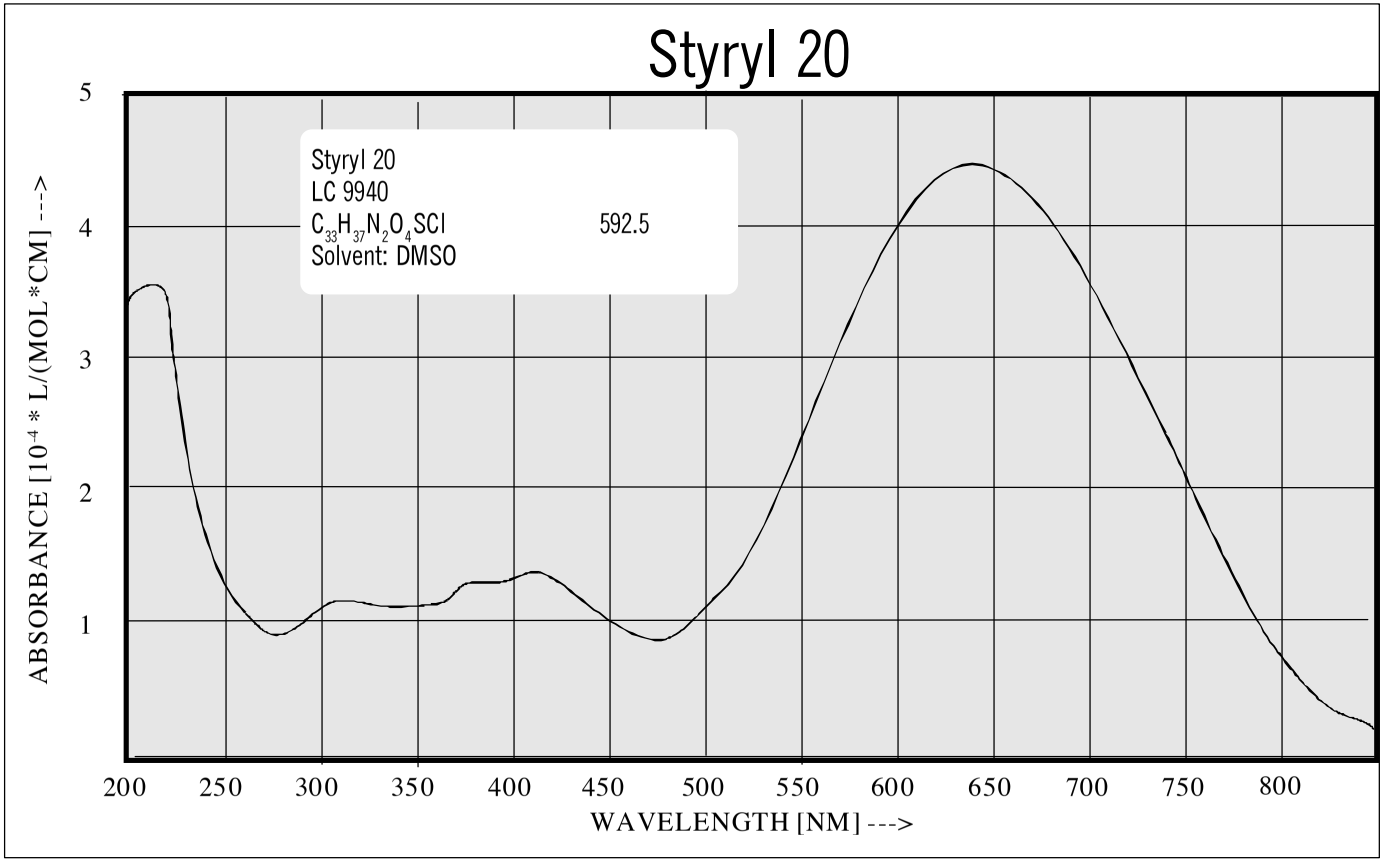
Lasing Performance

Laser dye for pulsed operation; tunable around 950 nm

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG, 2nd	*532*	*909*	*-*	*1*	*0.51*	*DMSO*	*1*
Flashlamp	*-*	*972*	*-*	*-*	*0.10*	*DMSO*	*2*
ML, Kr^+	*VIS*	*-*	*863 - 1048*	*-*	*0.80*	*DMSO*	*3*

References

1. C. D. Decker, *Appl. Phys. Letters* 27(11), 607 (1975).
2. J. P. Webb et al., *IEEE J. Quantum Electr.* QE-11, 114(1975).
3. M. Leduc, *Opt. Commun.* 31(1), 66(1979).

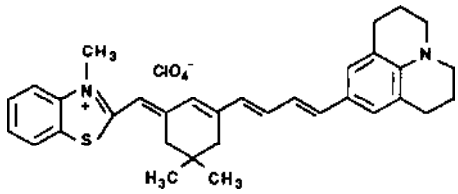

Styryl 20
Styryl 20
LC 9940
$C_{33}H_{37}N_2O_4SCl$ 592.5
Solvent: DMSO
ABSORBANCE [10^{-4} * L/(MOL *CM] --->
5
4
3
2
1
200
250
300
350
400
450
500
550
600
650
700
750
800
WAVELENGTH [NM] --->

Styryl 20 (LC 9940)

Constitution

2-(8-(9-(2,3,6,7-Tetrahydro-1H,5H-benzo(i,j)chinolizinium))-2,4-neopentylene-1,3,5,7-octatetraenyl)-3-methylbenzothiazolium Perchlorate

$C_{33}H_{37}N_2O_4SCl$ · MW: 592.5



Characteristics

Lambdachrome® number:	9940
CAS registry number:	-
Appearance:	dark green, crystalline solid
Absorption maximum (in ethanol):	645 nm
Molar absorptivity:	4.70×10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

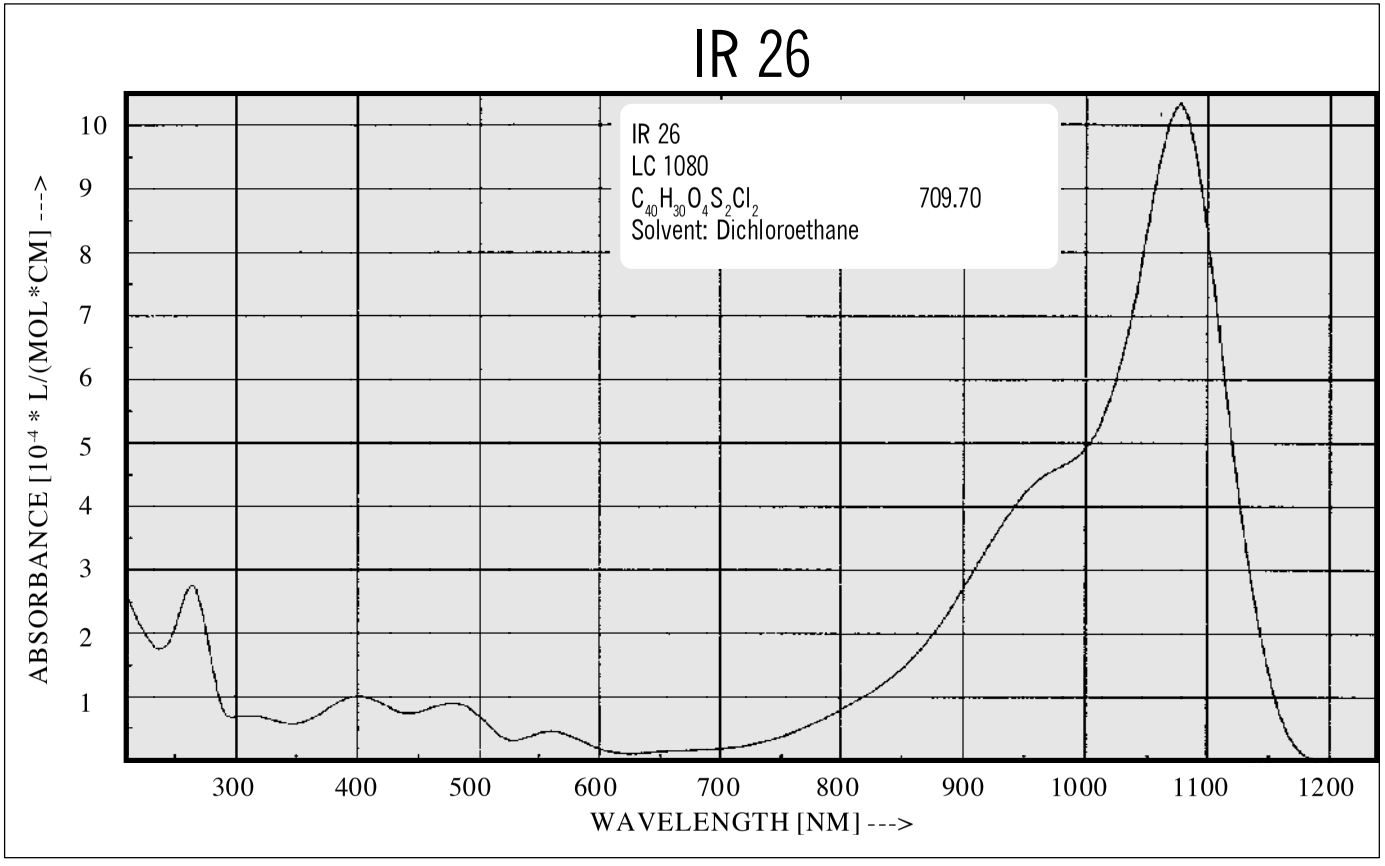
Lasing Performance

Efficient IR laser dye for pulsed and CW operation; tunable around 990 nm.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
XeCl-Excimer	*308*	*994*	*970 - 1036*	*4*	*1.10*	*DMSO*	*1*
Nd:YAG, 2nd	*532*	*994*	*970 - 1036*	*4*	*0.68*	*Pc.*	*1*

References

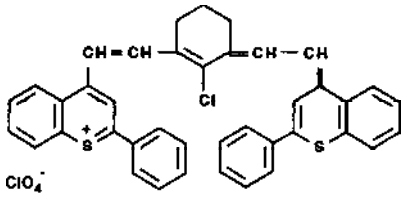
1. Lambda Physik, *Wall Chart* 1996.


IR 26
IR 26
LC 1080
$C_{40}H_{30}O_4S_2Cl_2$ 709.70
Solvent: Dichloroethane
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
10
9
8
7
6
5
4
3
2
1
300
400
500
600
700
800
900
1000
1100
1200
WAVELENGTH [NM] --->

IR 26 (LC 1080)

Constitution

$C_{40}H_{30}O_4S_2Cl_2$ · MW: 709.70



Characteristics

Lambdachrome® number:	1080
CAS registry number:	76871-75-5
Appearance:	dark green, crystalline solid
Absorption maximum (in dichloroethane):	1080 nm
Molar absorptivity:	10.3 x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum (in benzyl alcohol):	1180 nm

For research and development purposes only.

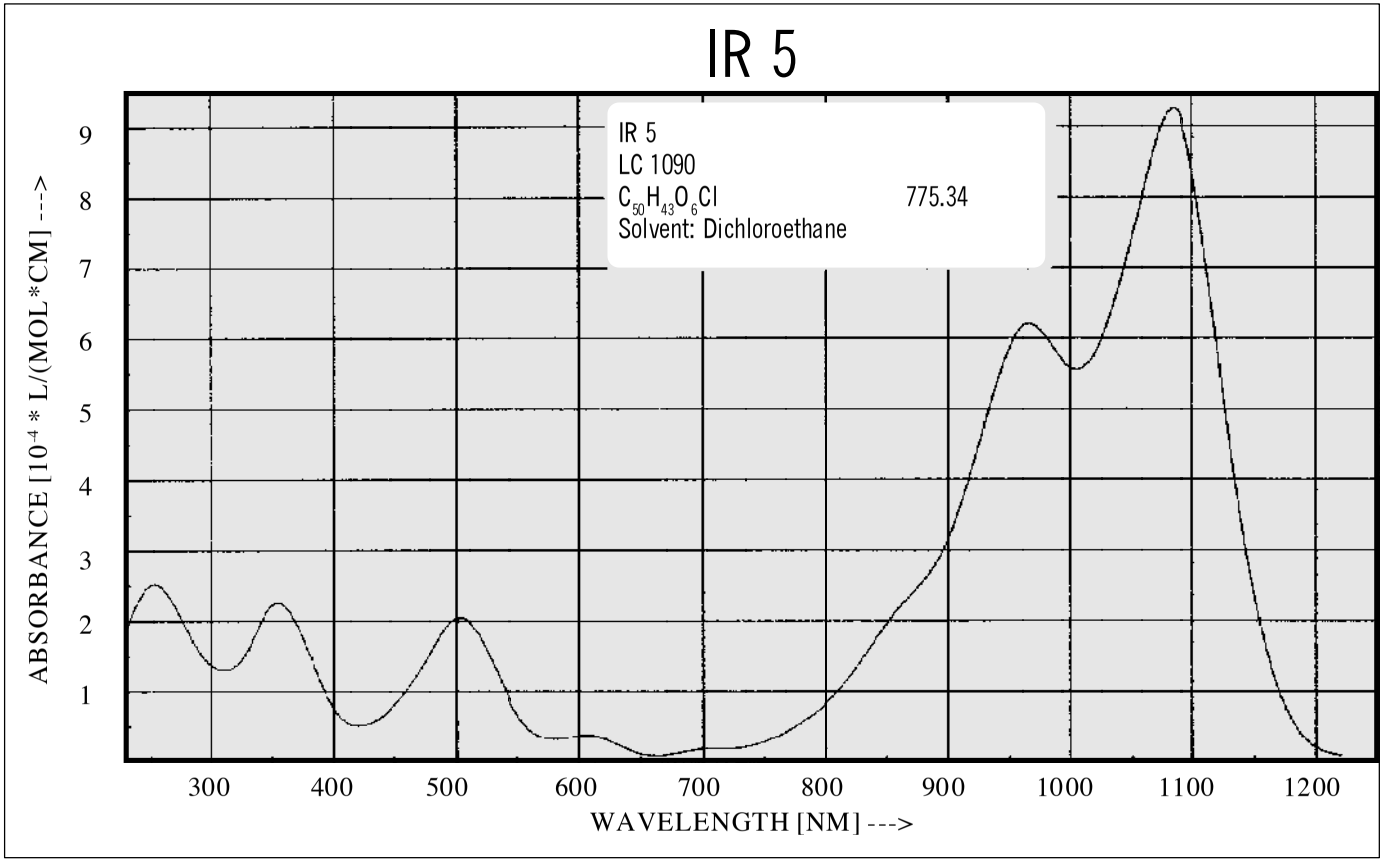
Lasing Performance

Efficient laser dye for synchronously pumped (Nd:YAG) dye lasers; tunable around 1030 nm. Saturable absorber for Nd:YAG lasers.

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG	*1064*	*1290*	*1200 - 1320*	*4*	*0.71*	*Bz.*	*1, 2, 3, 4*

References

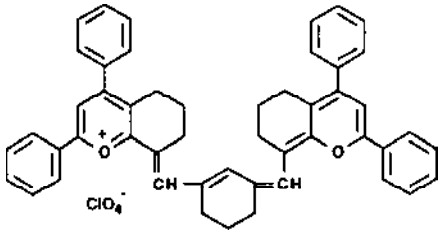
1. W. Kranitzky et al., *Opt. Commun.* 36(2), 149 (1981).
2. A. Seilmeier et al., *Optics. Letters* 8(4), 205 (1983).
3. A. Seilmeier, *Opt. Quantum Electr.* 16, 89 (1984).
4. K. Kato, *IEEE J. Quantum Electr.* QE-20(7), 698 (1984).


IR 5
IR 5
LC 1090
$C_{50}H_{43}O_6Cl$ 775.34
Solvent: Dichloroethane
ABSORBANCE [10^{-4} * L/(MOL *CM)] --->
1
2
3
4
5
6
7
8
9
300
400
500
600
700
800
900
1000
1100
1200
WAVELENGTH [NM] --->

IR 5 (LC 1090)

Constitution

$C_{50}H_{43}O_6Cl$ · MW: 775.34



Characteristics

Lambdachrome® number:	1090
CAS registry number:	61010-01-3
Appearance:	dark green, crystalline solid
Absorption maximum (in dichloroethane):	1090 nm
Molar absorptivity:	9.30x 10^4 L mol^{-1} cm^{-1}
Fluorescence maximum:	-

For research and development purposes only.

Lasing Performance

Laser dye for synchronously pumped (Nd:YAG) dye lasers; tunable around 1300 nm. Saturable absorber for Nd:glass lasers[2.].

Pump		*Dye Laser Characteristics*					
Source	*Wavelength [nm]*	*Peak [nm]*	*Range [nm]*	*Effic. [%]*	*Conc. [g/l]*	*Solvent*	*Ref.*
Nd:YAG	*1064*	*1320*	*1180 - 1400*	*10*	*0.64*	*DCE*	*1, 2,*

References

1. T. Elsaesser et al., *IEEE J. Quantum Electr.* QE-20(3), 191 (1984).
2. R. R. Alfano et al., *IEEE J. Quantum Electr.* QE-17(3), 290 (1981).

Saturable Absorbers

a: Dye/LC #
b: Application
c: Literature

a: DASPI/LC 4660
b: s.a. for FL-pumped C1-, C102-, C466-, C6H-dye laser
applicable in the 480 - 500 nm range
c: Sibbett et al., *Opt. Commun.* 46(1), 32 (1983)

a: DASBTI/LC 5280
b: s.a. for FL-pumped C6-, C522-, C153-, Rh110-dye laser
applicable in the 500 - 540 nm range
c: W. Sibbett et al., *Opt. Commun.* 44(2), 121 (1982)
W. Sibbett et al., *Appl. Phys.* B29, 191 (1982)
W. Sibbett et al., *IEEE J. Quantum Electr.* QE-19(4), 558 (1983)

a: DOCI/LC 5410
b: s.a. for FL-pumped C102-, C500-, XeCl-pumped C102-dye laser
applicable in the 480 - 500 nm range
c: J.C. Mialocq et al., *Appl. Phys. Lett.* 33(9), 819 (1978)
R. Wyatt, *Opt. Commun.* 38(1), 64 (1981)
Th. Varghese, *Opt. Commun.* 44(5), 353 (1983)
M. Watanabe et al., *Appl. Phys. Lett.* 45(9), 929 (1984)

a: DMETCI/LC 5460
b: s.a. for FL-pumped C153-dye laser
applicable in the 530 - 550 nm range
c: W. Sibbett et al., *Opt. Commun.* 43(1), 50 (1982)

a: DQOCI/LC 5920
b: s.a. for FL-pumped Fluorol 7GA-, Rh6G-dye laser
applicable in the 550 - 590 nm range
c: E. Lill et al., *Opt. Commun.* 20(2), 223 (1977)
R.S. Adrain et al., *Opt. Commun.* 12(2), 140 (1974)

a: DCI-2/LC 5950
b: s.a. for FL-pumped Rh6G-dye laser
applicable in the 560 - 600 nm range
c: M. Maeda et al., *Japan J. Appl. Phys.* 13(1), 193 (1974)

a: Malachit Green/LC 6220
b: additive for CW-pumped Rh6G-dye laser
applicable in combination with DODCI as s.a.
c: M. Young, *Appl. Optics* 18(19), 3212 (1979)
A. Watanabe et al., *IEEE J. Quant. Electr.* QE-19(4), 533 (1983)

a: DTCI/LC 6250
b: s.a. for FL-pumped Rh6G-dye laser
applicable in the 580 nm range
c: M. Maeda et al., *J. Appl. Phys.* 13(1), 193 (1974)

a: DQTCI/LC 6290
b: s.a. for FL-pumped RhB-dye laser
applicable in the 600 - 620 nm range
c: E. G. Arthurs et al., *Appl. Phys. Lett.* 20(3), 125 (1972)
E. Lill et al., *Opt. Commun.* 22(1), 107 (1977)

a: DODCI/LC 6550
b: "state of the art"-s.a. for CW- and FL-pumped Rh6G-dye laser
applicable in the 570 - 600 nm range
c: elsewhere

a: DTDCI/LC 7260
b: s.a. for FL-pumped Rh101-, CV/Rh6G-dye laser
applicable in the 630 - 650 nm range
c: J. Negran et al., *Appl. Optics* 17(17), 2812 (1978)
E.G. Arthurs et al., *Appl. Phys. Lett.* 20(3), 125 (1972)

a: Cryptocyanine/LC 7450
b: s.a. for Ruby-lasers
c: I.K. Krasyuk et al., *JETP Letters* 7(4), 89 (1968)
H.W. Mocker et al., *Appl Phys. Lett.* 7(10), 270 (1965)
V.I. Malyshev et al., *JETP Letters* 6(2), 34 (1967)

a: DDI/LC 7700
b: s.a. for FL-pumped CV/Rh6G-, Rh700-dye laser, Ruby-laser
applicable in the 680 - 710 nm range
c: E.G. Arthurs et al., *Appl. Phys. Lett.* 20(3), 125 (1972)
M.E. Mack, *IEEE J. Quant. Electr.* QE-4, 1015 (1968)
W. Sibbett et al., *IEEE J. Quant. Electr.* QE-20(2), 108 (1984)

a: DOTCI/LC 7880
b: s.a. for FL-pumped CV-dye laser
applicable in the 680 - 700 nm range
c: E.G. Arthurs et al., *Appl. Phys. Lett.* 20(3), 125 (1972)

a: HITCI/LC 8500
b: s.a. for FL-pumped DOTCI-dye laser
applicable in the 750 - 800 nm range
c: A. Hirth et al., *Opt. Commun.* 7(4), 339 (1973)

a: HDITCI/LC 9200
b: s.a. for CW-pumped Oxazine 750-dye laser
applicable in the 750 - 830 nm range
c: G.W. Fehrenbach et al., *Appl. Phys. Lett.* 33(2), 159 (1978)

a: IR 140/LC 9310
b: s.a. for FL- and CW-pumped Styryl 9-dye laser
applicable in the 840 nm range
c: K. Smith et al., *Opt. Commun.* 49(5), 359 (1984)

a: IR 26/LC 1080
b: s.a. for Nd:YAG-laser
c: B. Kopainsky et al., *Appl. Phys.* B-29, 15 (1982)

a: IR 5/LC 1090
b: s.a. for Nd:glass-laser
c: R.R. Alfano et al., *IEEE J. Quant. Electr.* QE-17(3), 290 (1981)

Abbreviations used:

C Coumarin
CV Cresyl Violet
CW continuous wave
FL flashlamp
LC Lambdachrome®
Rh Rhodamine
s.a. saturable absorber

Reference List

LC No.	Lambdachrome® Dye	corresponds to
3300	BM-Terphenyl	DMT
3400	PTP	p-Terphenyl
3500	TMQ	TMQ
3570	BMQ	-
3590	DMQ	-
3600	Butyl-PBD	BPBD-365
3640	PBD	PBD
3650	TMI	-
3690	QUI	-
3700	PPO	PPO
3720	PPF	-
3740	PQP	p-Quaterphenyl
3780	BBD	-
3800	Polyphenyl 1	-
3810	Polyphenyl 2	-
3860	BiBuQ	BBQ
3900	Quinolon 390	LD 390
3950	a-NPO	a-NPO
3990	Furan 2	-
4000	PBBO	PBBO
4090	DPS	DPS
4100	Stilbene 1	-
4150	BBO	BBO
4200	Stilbene 3	Stilbene 420
4220	Carbostyryl 7	Carbostyryl 124
4230	POPOP	POPOP
4240	Coumarin 4	Umbelliferon 47
4250	Bis-MSB	Bis-MSB
4300	BBOT	-
4350	Carbostyryl 3	Carbostyryl 165
4400	Coumarin 120	Coumarin 440
4500	Coumarin 2	Coumarin 450
4650	DASPI	-
4660	Coumarin 466	LD 466, C1H

LC No.	Lambdachrome® Dye	corresponds to
4700	Coumarin 47	Coumarin 460, Coumarin 1
4800	Coumarin 102	Coumarin 480
4810	Coumarin 152A	Coumarin 481, Coumarin 35
4850	Coumarin 152	Coumarin 485
4900	Coumarin 151	Coumarin
4910	Coumarin 6H	LD 490
5000	Coumarin 307	Coumarin 503
5010	Coumarin 500	Coumarin 500
5040	Coumarin 314	Coumarin 504
5100	Coumarin 510	Coumarin 510
5150	Coumarin 30	Coumarin 515
5210	Coumarin 334	Coumarin 521
5220	Coumarin 522	Coumarin 522
5280	DASBTI	-
5350	Coumarin 7	Coumarin 535
5360	Brillant Sulfaflavine	Brillant Sulfaflavin
5370	Coumarin 6	Coumarin 540
5400	Coumarin 153	Coumarin 540A
5410	DOCI	DOC, NK 85
5460	DMETCI	-
5520	Uranin	Disodium Fluorescein
5530	Fluorescein 27	Fluorescein 548
5700	Rhodamine 110	Rhodamine 560
5750	Rhodamine 19	Rhodamine 575
5900	Rhodamine 6G	Rhodamine 590
5901	Rhodamine 6G (Perchl.)	Rhodamine 590 (Perchl.)
5920	DQOCI	-
5950	DCI-2	-
6100	Rhodamine B	Rhodamine 610
6101	Rhodamine B (Perchl.)	Rhodamine 610 (Perchl.)
6200	Sulforhodamine B	Kiton Red 620
6220	Malachit Green	-
6250	DTCI	NK 76
6290	DQTCI	-
6400	Rhodamine 101	Rhodamine 640
6500	DCM	DCM

LC No.	Lambdachrome® Dye	corresponds to
6501	DCM-spec.	-
6550	DODCI	DODC-Iodide
6600	Sulforhodamine 101	Sulforhodamine 640
6700	Cresyl Violet	Cresyl Violet 670
6900	Nile Blue	Nile Blue 690
6950	Oxazine 4	LD 690
7000	Rhodamine 700	LD 700
7100	Pyridin 1	LDS 698
7210	Oxazine 170	Oxazine 720
7250	Oxazine 1	Oxazine 725
7260	DTDCI	DTDC-Iodide, NK 136
7270	Oxazine 750	Oxazine 750
7300	Pyridin 2	LDS 722
7400	HIDCI	Hexacyanine 2, NK 529
7500	Styryl 6	LDS 730
7550	Styryl 8	LDS 751
7700	DDI	NK 1456
7710	Pyridin 4	-
7800	Methyl-DOTCI	DMOTC-Iodide, NK 199
7880	DOTCI	DEOTC-Iodide
7950	Styryl 11	LDS 798
8000	Rhodamine 800	-
8410	Styryl 9 (M)	LDS 820 (821)
8500	HITCI	Hexacyanine 3, NK 125
8630	IR 125	IR 125
8760	DTTCI	DTTC-Iodide, NK 126
8800	IR 144	IR 144
8810	Styryl 15	-
8850	DNTTCI	-
9300	DDCI-4	NK 1144
9310	IR 140	IR 140
9500	IR 132	IR 132
9940	Styryl 20	-
10600	IR 25	-
10800	IR 26	IR 26
10810	IR 26 (HFB)	-
10900	IR 5	IR 5

Tuning Curves

Tuning curves of excimer-, nitrogen-, Nd:YAG-, and CW-laser pumped dye lasers are shown on the following pages. Parameters given are defined as follows:

Peak
Output maximum of the tuning curve, in nanometers.

Tuning Range
The tuning range is defined as the range, in nanometers, giving an efficiency larger than 10 percent of the maximum. All tuning ranges are restricted to broadband operation.

Efficiency
Dye laser output at the maximum of the tuning range relative to pump laser input, in percent. Efficiency may change in other configurations or pump power levels.

Pump Wavelength
Pump wavelength used in nanometers.

Solvent
BZ=Benzyl Alcohol, EG=Ethylene Glycol, CH=Cyclohexane, DI=Dioxane, ME=Methanol, DMSO=Dimethylsulfoxide, PC=Propylene Carbonate.

Concentration
Amount of dye, in grams, for 1 liter stock solution. There is an optimum concentration for a given dye, wavelength and input power. In case of continuously pumped dye lasers this optimum concentration generally lies between 60 percent and 80 percent absorption of the pump power, and in the case of transversally pumped pulsed dye lasers, at 99 percent absorption of the pump energy within 1 millimeters of the dye solution. Higher concentration causes the tuning curves to be shifted slightly to the red, while lower concentrations will result in blue shift. Optimization of the dye concentration is accomplished by adding either pure solvent or a solution of higher concentration than that recommended to the solution in the dye circulation system, until optimum power is at maximum.

Stability

The accumulated pump energy t, in Wh, causing a decrease in dye laser output to 50 percent of the initial value for 1 liter dye solution (resp. 1 liter amplifier solution in the case of excimer pumped dye laser), measured at 10 Hz. The following classification has been used in the case of excimer laser pumped dye lasers: -: τ 10-30 Wh, +: τ 30-50 Wh, ++: τ > 50 Wh. In the case of Nd:YAG-pumped lasers: -: τ< 50Wh, +: τ 50-100 Wh, ++: τ 100-300 Wh, +++: τ > 300 Wh. The stability of dyes being continuously pumped is classified as: -: τ < 100 Wh, +: τ 100-500Wh, ++: τ > 500 Wh.

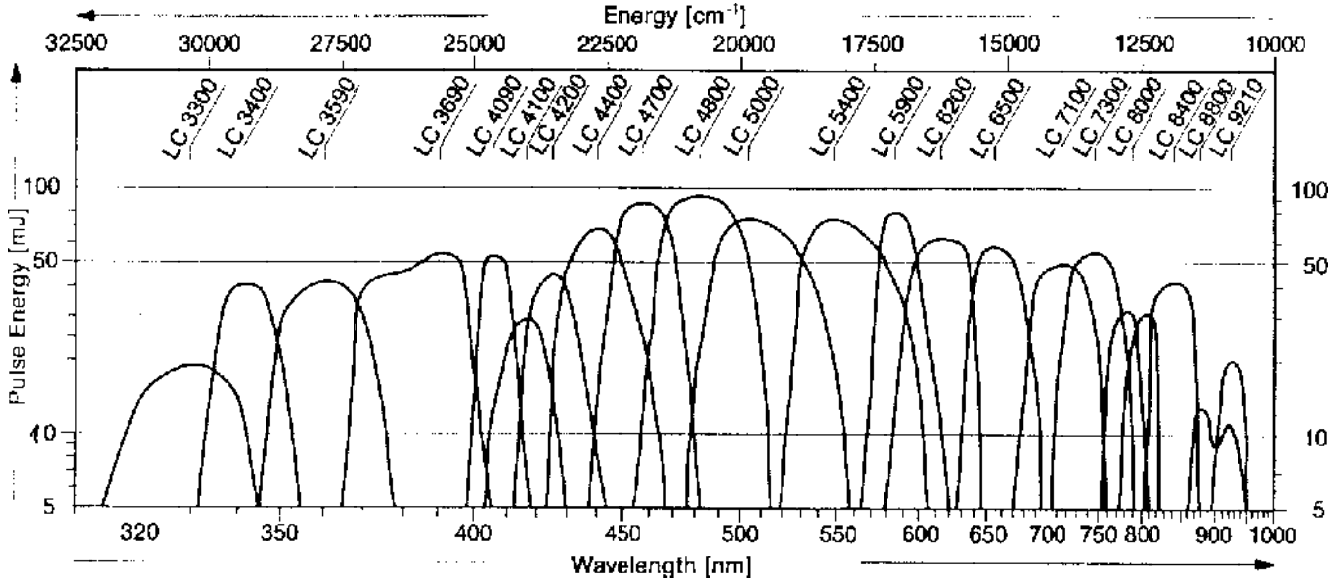
General Remarks

The output power of dye lasers is strongly dependent on the quality of the dye used. To overcome reduced quantum efficiency and instability due to impurities, Lambdachrome® laser dyes are examined by experienced chemist for their chemical and spectral properties and purified by specially developed techniques.

Lambda Physik reserves the right to modify any information given herein. Every effort is made to ensure utmost accuracy; no liability, however, is assumed for errors occurring. Nothing here is to be constructed as recommending any practice or any product in violation of any patent.

Cautious handling of dyes and dye solutions is advised, since the exact toxicity in most cases is not well known. The responsibility for the safe use of our laser dyes must rest in all cases with the user.

Dyes for EXCIMER LASER Pumped Dye Lasers



Lambdachrome Dye		Peak (nm)	Tuning Range (nm)	Effic. (%)	Pump Source Wavelength (nm)	Char. Energy (mJ)	Solvent	Conc. (g/l)	Stability*
LC 3300	BM-Terphenyl	334	312-343	4	248	150	CH	0.50	-
LC 3400	p-Terphenyl	343	332-360	8	308	400	DI	0.24	+
LC 3590	DMQ	360	346-377	9	308	400	DI	0.23	++
LC 3600	Butyl-PBD	363	356-385	5	308	400	DI	0.30	++
LC 3690	QUI	390	368-402	11	308	400	DI	0.20	++
LC 3800	Polyphenyl 1	381	363-408	12	308	400	EG	0.20	++
LC 3860	BiBUQ	388	367-405	11	308	400	DI	0.25	++
LC 3810	Polyphenyl 2	397	386-418	10	308	400	EG	0.25	+
LC 3990	Furan 2	399	388-426	8	308	400	ME	0.50	+
LC 4000	PBBO	396	386-420	7	308	400	DI	0.40	++
LC 4090	DPS	406	399-415	11	308	400	DI	0.25	-
LC 4200	Stilbene 3	425	412-443	9	308	400	ME	0.65	-
LC 4400	Coumarin 120	441	423-462	15	308	400	ME	0.82	+
LC 4500	Coumarin 2	448	432-475	15	308	400	ME	1.50	+
LC 4700	Coumarin 47	456	440-484	18	308	400	ME	1.59	+
LC 4800	Coumarin 102	480	460-510	18	308	400	ME	2.30	+
LC 5000	Coumarin 307	500	479-553	16	308	400	ME	3.40	-
LC 5400	Coumarin 153	540	522-600	15	308	400	ME	4.20	++
LC 5900	Rhodamine 6G	581	569-608	16	308	400	ME	1.20	+
LC 6100	Rhodamlne B	600	588-644	12	308	400	ME	0.91	+
LC 6400	Rhodamine 101	623	614-672	12	308	400	ME	0.75	-
LC 6500	DCM	658	632-690	12	308	400	DMSO	0.71	-

*Values are as follows: -: τ 10-30 Wh, +: τ 30-50 Wh, ++: τ >50 Wh

Dyes for EXCIMER LASER Pumped Dye Lasers (cont.)

Lambdachrome Dye		Peak (nm)	Tuning Range (nm)	Effic. (%)	Pump Source Wavelength (nm)	Char. Energy (mJ)	Solvent	Conc. (g/l)	Stability*
LC 7000	Rhodamine 700	723	701-768	11	308	400	ME	0.85	-
LC 7100	Pyridine 1	710	670-760	10	308	400	DMSO	0.84	++
LC 7300	Pyridine 2	740	695-790	11	308	400	DMSO	0.72	+
LC 7710	Pyridine 4	771	744-812	7	308	400	DMSO	0.75	++
LC 8000	Rhodamine 800	810	776-823	6	308	400	DMSO	1.00	+
LC 8400	Styryl 9	840	810-875	9	308	400	DMSO	1.10	-
LC 8500	HITCI	868	837-905	4	308	400	DMSO	1.20	-
LC 8810	Styryl 15	880	856-918	7	308	400	DMSO	1.15	-
LC 9210	IR125	920	890-960	4	308	400	DMSO	2.00	-
LC 9450	Styryl 14	945	904-992	9	308	400	DMSO	1.10	-
LC 9940	Styryl 20	994	970-1036	4	308	400	DMSO	1.10	-

*Values are as follows: -: τ 10-30 Wh, +: τ 30-50 Wh, ++: τ >50 Wh

Dyes for Nd:YAG LASER Pumped Dye Lasers

Lambdachrome Dye		Peak	Tuning Range	Effic.	Pump geometry	Pump Source Char. Wavelength	Energy	Solvent	Conc.	Stability**
		(nm)	(nm)	(%)		(nm)	(mJ)		(g/l)	
LC 3900	Quinolon 390	390	384-394	4	transv.	355	200	ME	0.25	-
LC 3990	Furan 2	402	392-422	15		355	200	ME	0.50	+
LC 4260	Furan 1	421	410-435	10		355	200	ME	0.26	+
LC 4200	Stilbene 3	428	415-439	15	transv	355	200	ME	0.25	-
LC 4400	Coumarin 120	440	420-470	16	transv.	355	200	ME	0.25	+
LC 4700	Coumarin 47	460	444-476	15	transv	355	200	ME	0.30	+
LC 4800	Coumarin 102	480	462-497	15	transv	355	200	ME	0.40	+
LC 5000	Coumarin 307	508	485-546	15	transv	355	200	ME	0.70	-
LC 5100	Coumarin 500	518	498-546	10		355	200	ME	0.70	-
LC 5400	Coumarin 153	540	516-575	18		355	200	ME	2.36	+
LC 5530	Fluorescein 27	550	540-575	28	long.	532	200	ME	0.64	++
LC 5750	Rhodamine 19	567	556-586	31	long.	532	200	ME	0.22	+++
LC 5900	Rhodamine 6G	566	555-585	32	long.	532	200	ME	0.10	+++
LC 6100	Rhodamine B	594	584-619	29	long.	532	200	ME	0.22	+++
LC 6200	Sulforhodamine B	588	579-600	29	long.	532	200	ME	0.27	++
LC 6400	Rhodamine 101	621	611-662	26	long.	532	200	ME	0.50	++
LC 6600	Sulforhodamine101	628	619-673	15	long.	532	200	PC	0.30	++
LC 6500	DCM	639	615-666	27	long.	532	200	PC	0.50	++
LC 7100	Pyridine I	697	667-736	32	transv	532	200	PC	0.36	+++
LC 7300	Pyridine 2	750	725-776	21		532	200	PC	0.22	+++

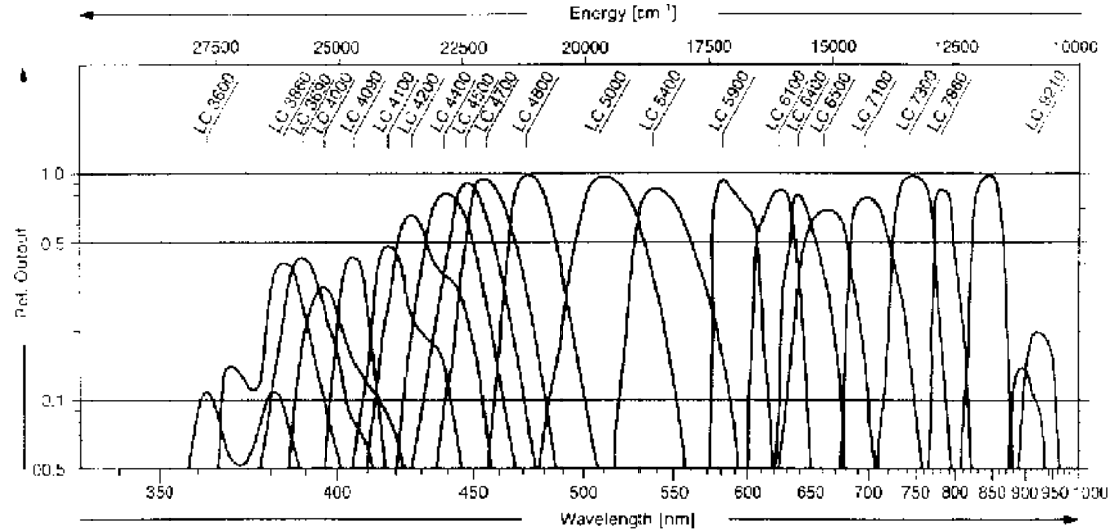
**Values are as follows: -: τ <50, =: τ 50-100 Wh, ++: τ 100-300 Wh, +++: τ >300Wh

Dyes for Nd:YAG LASER Pumped Dye Lasers (cont.)

Lambdachrome Dye		Peak (nm)	Tuning Range (nm)	Effic. (%)	Pump geometry	Pump Source Char. Wavelength (nm)	Energy (mJ)	Solvent	Conc. (g/l)	Stability**
LC 7500	Styryl 6	721	708-735	16		532	200	PC	0.28	++
LC 7600	Styryl 7	720	701-749	16	transv	532	200	ME	0.12	+++
LC 7550	Styryl 8	750	717-780	13	transv.	532	200	ME	0.15	+++
LC 8400	Styryl 9M	824	797-851	15	transv.	532	200	PC	0.26	++
LC 8810	Styryl 15	880	856-918	7		532	200	PC	0.62	++
LC 9450	Styryl 14	945	904-990	9		532	200	PC	0.27	++
LC 9940	Styryl 20	994	970-1036	4		532	200	PC	0.68	++

**Values are as follows: -: τ <50, =: τ 50-100 Wh, ++: τ 100-300 Wh, +++: τ >300Wh

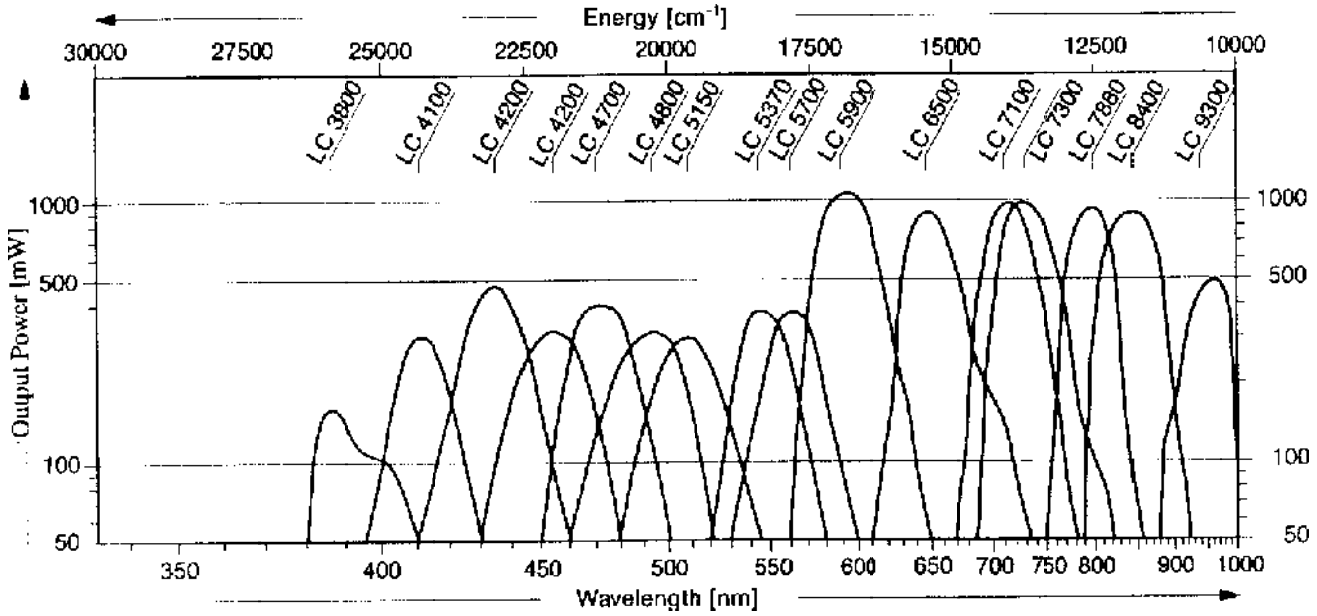
Dyes for NITROGEN LASER Pumped Dye Lasers



Lambdachrome Dye		Peak (nm)	Tuning Range (nm)	Rel. Efficiency	Solvent	Concentration (g/l)
LC 3600	Butyl-PBD	362	356-390	0.12	DI	1.60
LC 3690	QUI	387	372-412	0.43	DI	0.52
LC 3860	BiBuQ	383	364-405	0.41	DI	0.60
LC 4000	PBBO	395	385-420	033	DI	0.15

Lambdachrome Dye		Peak (nm)	Tuning Range (nm)	Rel. Efficiency	Solvent	Concentration (g/l)
LC 4090	DPS	404	394-416	0.43	DI	0.12
LC 4100	Stilbene I	417	405-446	0.49	EG	0.20
LC 4200	Stilbene 3	424	408-457	0.66	ME	0.22
LC 4250	Bis-MSB	421	412-435	0.59	DI	0.14
LC 4400	Coumarin 120	438	418-465	0.83	ME	0.25
LC 4500	Coumarin 2	444	426-475	0.94	ME	0.40
LC 4700	Coumarin 47	453	436-486	0.95	ME	0.66
LC 4800	Coumarin 102	470	454-506	1.00	ME	1.44
LC 5000	Coumarin 307	504	478-547	1.00	ME	1.60
LC 5400	Coumarin 153	537	517-590	0.87	ME	3.10
LC 5900	Rhodamine 6G	581	573-618	0.93	ME	1.63
LC 6100	Rhodamine B	622	600-646	0.91	ME	2.85
LC 6200	Sulforhodamine B	622	600-646	0.91	ME	2.85
LC 6400	Rhodamine 101	648	623-676	0.82	ME	2.36
LC 6500	DCM	659	626-703	0.69	DMSO	0.50
LC 7100	Pyridine I	703	675-750	0.78	DMSO	0.88
LC 7210	Oxazine 170	705	672-727	0.35	ME	0.79
LC 7300	Pyridine 2	743	710-790	1.00	DMSO	0.85
LC 7800	Methyl-DOTC	780	768-820	0.86	DMSO	0.51
LC 7880	DOTC/HITC	823	794-867	0.74	DMSO	1.23/0.03
LC 8400	Styryl 9	840	803-875	1.00	DMSO	1.03
LC 8760	DTTC/IR 144	871	859-886	0.18	DMSO	0.65/2.52
LC 8800	IR 144/IR 125	887	872-935	0.14	DMSO	2.52/1.94
LC 9210	IR 125	918	893-958	0.21	DMSO	1.94
LC 9301	IR 140	910	900-963	0.11	DMSO	0.78

Dyes for ION LASER Pumped Dye Lasers



Lambdachrome Dye		Peak (nm)	Tuning Range (nm)	Pump source char. Wavelength (nm)	Power (W)	SoLCent	Conc. (g/l)	Stability***
LC 3810	Polyphenyl 2	384	370-406	Ar+, UV, 300-336nm	2.0	EG	2.0	+
LC 4100	Stilbene 1	415	403-428	Ar+, all lines UV	3.0	EG	0.75	+
LC 4200	Stilbene 3	435	410-485	Ar+, all lines UV	5.0	EG	1.0	+
LC 4800	Coumarin 102	482	463-515	Ar+, UV, 350-386nm	3.0	BZ/EG	2.0	
LC 5370	Coumarin. 6	535	510-550	Ar+, 488 nm	6.0	BZ	2.0	+
LC 5700	Rhodamine 110	550	530-580	Ar+, 514.5 nm	6.0	EG	0.75	+
LC 5900	Rhodamine 6G	575	560-625	Ar+, 514.5 nm	6.0	EG	0.75	++
LC 6200	Sulforhodamine B	625	598-650	Ar+, 514.5 nm	6.0	EG	2.5	++
LC 6500	DCM Special	645	610-695	Ar+, 514.5 nm	6.0	BZ/EG	2.0	+
LC 7000	Rhodamine 700	740	690-785	Kr+, all lines red	4.6	EG	1.0	++
LC 7300	Pyridine 2	720	675-783	Ar+, 514.5 nm	7.5	PC/EG	1.5	++
LC 8400	Styryl 9	830	785-900	Ar+, 514.5 nm	6.0	PC/EG	2.0	+

***Vaules are as follows: -: τ <100 Wh, +: τ 100-500 Wh, ++: τ >500 Wh