



SPIE—The International Society for Optical Engineering

PROCEEDINGS

Polarimetry and Ellipsometry

Maksymilian Pluta
Tomasz R. Woliński
Chairs/Editors

Mariusz Szyjer
Co-Editor

20–23 May 1996
Kazimierz Dolny, Poland

Organized by
SPIE Poland Chapter
Institute of Applied Optics, Warsaw (Poland)

Sponsored by
SPIE—The International Society for Optical Engineering
State Committee for Scientific Research (Poland)

Published by
SPIE—The International Society for Optical Engineering



Volume 3094

SPIE is an international technical society dedicated to advancing engineering and scientific applications of optical, photonic, imaging, electronic, and optoelectronic technologies.

Contents

vii	<i>Conference Committees</i>
ix	<i>Preface</i>
xvii	<i>Welcome Address</i>

PHYSICS AND ANALYSIS OF POLARIZED LIGHT

- 2 **Polarization characteristics of quantum-well semiconductor structures** [3094-01]
I. S. Manak, Belorussian State Univ.; D. V. Karasev, V. K. Kononenko, B.I. Stepanov Institute of Physics (Belarus); S. V. Nalivko, Belorussian State Univ.; A. A. Romanenko, Institute of Applied Optics (Belarus); A. A. Vitalisov, Belorussian State Univ.
- 18 **Polarization properties of light emission of AlGaAs double heterostructure injection lasers** [3094-02]
I. S. Manak, Yu. L. Zhuravskii, M. T. Klokova, Belorussian State Univ.; V. L. Kasyutich, Institute of Molecular and Atomic Physics (Belarus)
- 25 **Analysis of polarized light in multilayers** [3094-03]
J. Pištora, R. Kantor, Technical Univ. Ostrava (Czech Republic); N. Negre, INSA (France); K. Postava, R. Anýžová, J. Seidl, Technical Univ. Ostrava (Czech Republic)
- 30 **Stokes-Mueller formalism and Poincaré sphere representation applied to studies of monomode optical fibers** [3094-04]
P. Olivard, P.-Y. Gerligand, B. Le Jeune, J. Cariou, J. Lotrian, Univ. de Bretagne Occidentale (France)
- 41 **Weakly twisted optically anisotropic media: is there an analogy between Hi-Bi fibers and liquid crystals? (Invited Paper)** [3094-05]
T. R. Woliński, Warsaw Univ. of Technology (Poland)
- 47 **Depolarization behavior of multiple scattered light from an optically dense random medium (Invited Paper)** [3094-06]
C. Brosseau, Univ. de Bretagne Occidentale (France); D. Bicut, Institut de Biologie Structurale (France); A. S. Martinez, Lab. d'Expérimentation Numérique (France); J. M. Schmitt, National Institutes of Health (USA)
- 52 **Static phase conjugator for pseudodepolarized laser beams** [3094-07]
P. V. Polyanskii, Chernivtsy State Univ. (Ukraine)
- 59 **Associative data reconstruction for nonuniformly polarized optical fields** [3094-08]
P. V. Polyanskii, Chernivtsy State Univ. (Ukraine)

POLARIMETERS: ACCESSORIES AND APPLICATIONS

- 66 **Polarization modulation polarimeter for an HPLC detector (Invited Paper)** [3094-09]
Y. Shindo, M. Yazawa, M. Izuka, H. Aoyama, M. Kinnbara, S. Maeda, Fukui Univ. (Japan)
- 88 **Universal null polarimeter for crystal optics** [3094-10]
O. S. Kushnir, Lviv State Univ. (Ukraine); O. G. Vlokh, Institute of Physical Optics (Ukraine)

- 100 **Computer-aided automatic polarimeter** [3094-11]
A. Kieżun, L. R. Jaroszewicz, R. Świłło, Military Univ. of Technology (Poland)
- 105 **Electrically switched compensator in high-accuracy polarimeter** [3094-12]
Ya. Shopa, M. Kravchuk, Lviv State Univ. (Ukraine)
- 112 **Nonmechanical azimuth change of a linear polarizer preceding a photodetector** [3094-13]
C. Ye, Univ. of Oulu (Finland)
- 118 **Compensation detector of birefringence** [3094-14]
M. I. Shribak, V. L. Kolpashchikov, Heat and Mass Transfer Institute (Belarus)
- 121 **Magneto-optical modulators and isolators of partially polarized light (Invited Paper)** [3094-15]
A. W. Domański, Warsaw Univ. of Technology (Poland)
- 131 **Overcoated wide-angle window designed for selected light wavelength** [3094-16]
J. Ciosek, Military Univ. of Technology (Poland)
- 136 **Two-frequency He-Ne laser for heterodyne polarimetry and ellipsometry** [3094-17]
V. G. Gudelev, V. M. Yasinskii, Institute of Physics (Belarus)
- 140 **Null-polarimetric studies of waveplate parameters** [3094-18]
O. S. Kushnir, Lviv State Univ. (Ukraine); O. G. Vlokh, Institute of Physical Optics (Ukraine)
- 147 **Polarimetric investigations of residual stresses in Czochralski-grown LiNbO₃ single crystals** [3094-19]
A. L. Bajor, Z. Gałązka, Institute of Electronic Materials Technology (Poland)
- 159 **Methods for determining optical parameters in gyrotropic crystals** [3094-20]
A. F. Konstantinova, E. A. Evdischenko, Institute of Crystallography (Russia)
- 169 **Application of polarimetry in optical computerized tomography of anisotropic media** [3094-21]
S. Yu. Berezhna, I. V. Berezhnyi, O. M. Krupych, O. G. Vlokh, Institute for Physical Optics (Ukraine)
- 175 **Optical rotatory power of trigonal quartz and germanium dioxide single crystals** [3094-22]
T. M. Glushkova, D. F. Kiselev, M. M. Firsova, A. P. Stykova, Moscow Univ. (Russia)
- 178 **Peculiarities of the optical anisotropy in lead-germanate-type crystals** [3094-23]
Ya. Shopa, M. Kravchuk, Lviv State Univ. (Ukraine); O. G. Vlokh, Institute of Physical Optics (Ukraine)
- 184 **Polarimetry of semiconductor exciton spectra** [3094-24]
Z. B. Nitsovich, C. Yu. Zenkova, B. M. Nitsovich, Chernivtsy State Univ. (Ukraine)
- 188 **Numerical and experimental study of corneal birefringence** [3094-25]
J. W. Jaroński, H. T. Kasprzak, E. B. Jankowska-Kuchta, Technical Univ. of Wrocław (Poland)

POLARIMETRIC FIBER OPTIC SENSORS

- 194 **Distributed polarimetric fiber optic sensors using a wavelength-scanning technique** [3094-26]
S. V. Miridonov, M. G. Shlyagin, A. V. Khomenko, D. Tentori, Ctr. de Investigación Científica y de Educación de Ensenada (Mexico)
- 204 **Polarization role in fiber optic interferometers (Invited Paper)** [3094-27]
L. R. Jaroszewicz, Military Univ. of Technology (Poland)
- 218 **Multiplexed polarimetric sensors with highly birefringent optical fibers for smart structures** [3094-28]
T. R. Woliński, Univ. Marie Curie-Skłodowska Lublin (Poland); P. Gałazka, Warsaw Univ. of Technology (Poland); J. Wójcik, Univ. Marie Curie-Skłodowska Lublin (Poland)

ELLIPSOMETRY: INSTRUMENTATION AND APPLICATIONS

- 226 **Nonlinear polarization-modulated ellipsometry** [3094-29]
V. B. Taranenko, V. Yu. Bazhenov, O. A. Kulikovskaya, Institute of Physics (Ukraine)
- 239 **Possibilities of ellipsometry with surface plasmon excitation in the investigation of thin films in comparison to separated ellipsometry and surface plasmon spectroscopy (Invited Paper)** [3094-30]
E. G. Bortchagovsky, Institute of Semiconductor Physics (Ukraine)
- 250 **Characterization of thin metal films with overlayers by transparency and multiangle including surface plasmon excitation reflectance ellipsometry method** [3094-31]
O. Yu. Borkovskaya, N. L. Dmitruk, O. V. Fursenko, Institute for Physics of Semiconductors (Ukraine)
- 255 **Application of generalized ellipsometry to complex optical systems** [3094-32]
M. Schubert, B. Rheinländer, Univ. of Leipzig (FRG); J. A. Woollam, Univ. of Nebraska (USA); B. D. Johs, C. M. Herzinger, J.A. Woollam Co. (USA)
- 266 **Accuracy of traditional ellipsometry and complex ellipsometry-transmission photometry techniques for absorptive-film/transparent-substrate systems** [3094-33]
A. M. Kostruba, O. G. Vlokh, Institute of Physical Optics (Ukraine)
- 272 **Comparison of the precision of a null-ellipsometer to an ellipsometer with a rotating analyzer** [3094-34]
E. G. Bortchagovsky, O. M. Getsko, Institute of Semiconductor Physics (Ukraine)
- 276 **Ellipsometric studies of photochromic ultrathin polymer films** [3094-35]
H. Knobloch, S. Katholy, H. Orendi, J. Hesse, D. Prescher, L. Brehmer, Univ. Potsdam (FRG); R. Ruhmann, Institut für Angewandte Chemie eV (FRG)
- 281 **Ellipsometry for determining the refractive index profiles of thin films (Invited Paper)** [3094-36]
V. A. Tolmachev, S.I. Vavilov State Optical Institute (Russia)
- 288 **Ellipsometry for correctly determining the void fraction and true refractive index of thin films** [3094-37]
V. A. Tolmachev, S.I. Vavilov State Optical Institute (Russia)
- 295 **Manifestation of optical activity in light reflection from gyrotropic uniaxial film** [3094-38]
B. V. Nabatov, A. F. Konstantinova, A. Yu. Tronin, Institute of Crystallography (Russia)

- 301 **Real-time monitoring and control during MBE growth of GaAs/AlGaAs Bragg reflectors using multiwave ellipsometry [3094-39]**
T. Wagner, LOT-Oriel GmbH (FRG); B. D. Johs, C. M. Herzinger, P. He, S. Pittal, J. A. Woollam, J.A. Woollam Co. (USA)
- 308 **Ellipsometric investigation of implanted GaAs [3094-40]**
M. Kulik, Univ. Marie Curie-Skłodowska Lublin (Poland)
- 317 **Determination of the optical model of the MOS structure with spectroscopic ellipsometry [3094-41]**
A. Kudła, D. Brzezinska, Institute of Electron Technology (Poland); T. Wagner, LOT-Oriel GmbH (FRG); Z. Sawicki, Institute of Electron Technology (Poland)
- 322 **Research of oxidation processes of a cadmium telluride film surface by ellipsometric method [3094-42]**
L. A. Zabashta, A. S. Opanasyuk, V. I. Kharchenko, Sumy State Univ. (Ukraine)
- 328 **Ellipsometric studies of the effect of a metal island structure on the optic properties of a semiconductor surface [3094-43]**
N. L. Dmitruk, Institute of Semiconductor Physics (Ukraine); L. A. Zabashta, Sumy State Univ. (Ukraine)
- 333 **Practical aspects of multiple-angle ellipsometry of semiconductor structures [3094-44]**
L. A. Zabashta, Sumy State Univ. (Ukraine); O. I. Zabashta, Institute of Applied Physics (Ukraine); N. L. Dmitruk, Institute of Semiconductor Physics (Ukraine)

MEASURING TECHNIQUES RELATED TO POLARIMETRY AND ELLIPSOMETRY

- 340 **Polarization interference metrology for statistical parameters of optical fields (Invited Paper) [3094-45]**
O. V. Angelsky, P. P. Maksimyak, Chernivtsy State Univ. (Ukraine)
- 349 **Determination of anisotropic film thickness, complex reflective indices, and their dispersion from reflectance spectra [3094-46]**
V. V. Filippov, V. P. Kutavichus, Institute of Physics (Belarus)
- 354 **Thin-film analysis based on the ratio of envelopes of the reflectance spectra measured at two incident angles [3094-47]**
V. V. Filippov, Institute of Physics (Belarus)
- 360 **Effect of matching layer on polarization photosensitivity of an AlIBV Schottky-barrier photodetector monolithically integrated with an optical waveguide [3094-48]**
N. L. Dmitruk, O. V. Fursenko, O. I. Mayeva, Institute for Physics of Semiconductors (Ukraine)
- 367 *Author Index*
- 370 *Subject Index*