ZemaxGlassReader user manual

(05-Jul-13)

Nomenclature:

AR (alkali resistance class) The ability of a glass to resist contact with warm, alkaline liquids. Values range from 1 (very resistant) to 4 (very vulnerable).

CR (climatic resistance class) The ability of a glass to resist climatic effects such as humidity and high temperature. Values can range from 1 (very resistant) to 4 (very vulnerable).

D (distance between two glasses) $D = \left[w_\mathrm{n}(n_{\mathrm{d},1} - n_{\mathrm{d},2})^2 + w_\mathrm{a}(v_{\mathrm{d},1} - v_{\mathrm{d},2})^2 + w_\mathrm{p}(\Delta P_{\mathrm{g,F},1} - \Delta P_{\mathrm{g,F},2})^2\right]^{1/2}$ where the w_i's are weight terms, with default values $w_\mathrm{n} = 1.0$, $w_\mathrm{a} = 1.0 \times 10^{-4}$, and $w_\mathrm{p} = 1.0 \times 10^2$.

Density the density of the glass in units of g/cc.

Dispersion_formula an integer indicating which dispersion formula to use (see Table).

dPgF (differential partial dispersion) is $\Delta P_{\mathrm{g,F}} = P_{\mathrm{g,F}} - (0.6438 - 0.001682 v_\mathrm{d})$.

Exclude_substitution an integer flag, indicating 0:no, 1:yes. If yes, then this glass will not be selected during global optimization, converted from model to real glasses, or be considered by the RGLA optimization operand.

FR (stain resistance class) The ability of a glass to resist stain formation under the influence of slightly acidic water. Values range from 0 (very resistant) to 5 (very vulnerable).

Ignore_thermal_expansion an integer flag, indicating 0:no, 1:yes.

IT (internal transmittance) the transmittance of a material after removing the effects of Fresnel reflections.

LD (lambda data) the wavelength range over which the dispersion coefficients provide an accurate estimate of the dispersion curve.

melt_freq (mel frequency) how commonly a glass is manufactured. Values range from 1 (melted very frequently) to 5 (melted infrequently).

MIL (military glass number) the military number was once a common method for describing glasses using a six-digit integer, such as 517640 for BK7. The first three integers are given by $1000 \cdot (n_\mathrm{d} - 1)$, while the second three integers are given by $10 \cdot (v_\mathrm{d})$.

n (refractive index) n_d is the refractive index at λ_d.

P (partial dispersion) $P_{\mathrm{g,F}} = \frac{n_\mathrm{g} - n_\mathrm{F}}{n_\mathrm{F} - n_\mathrm{C}}$.

PR (phosphate resistance class) The ability of a glass to resist washing solutions (detergents) that contain phosphates. Values range from 1 (very resistant) to 4 (very vulnerable).

Relative_cost the approximate relative cost of the glass as compared to BK7 (*i.e.* 3.5 indicates a glass that costs about 3.5 times as much as BK7 per kg).

SR (acid resistance class) The ability of a glass to resist damage due to acid exposure. Values range from 1 (very resistant) to 5 (vulerable), with values 51, 52, and 53 indicating increasing vulerability beyond that of class 5.

status the "status" of a glass, where 0:standard, 1:preferred, 2:obsolete, 3:special, 4:melt.

TCE (thermal coefficient of expansion) dn/dT in units of $10^{-6}\,\mathrm{K}^{-1}$.

v (dispersion, or Abbé number).

The special wavelengths used here are:

$$\lambda_g = 435.8\,\text{nm}$$
$$\lambda_F = 486.1\,\text{nm}$$
$$\lambda_d = 587.6\,\text{nm}$$
$$\lambda_C = 656.3\,\text{nm}$$

The general format of the Zemax glass catalog (`*.agf`) file is

```
CC <Catalog_comment>
NM <glass_name> <dispersion_formula_number> <MIL> <N(d)> <V(d)> <Exclude_sub> <status> <melt_freq>
GC <Individual glass comment>
ED <TCE_(-30_to_70)> <TCE_(100_to_300)> <density> <dPgF> <Ignore_thermal_exp>
CD <dispersion_coeffs>
TD <D0> <D1> <D2> <E0> <E1> <Ltk> <Temp>
OD <rel cost> <CR> <FR> <SR> <AR> <PR>
LD <min lambda> <max lambda>
IT <lambda> <transmission> <thickness>
IT <lambda> <transmission> <thickness>
... multiple IT lines may follow
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Formula		*Expression*
#	*Name*	
1	Schott	$n^2 = c_0 + c_1\lambda^2 + c_2\lambda^{-2} + c_3\lambda^{-4} + c_4\lambda^{-6} + c_5\lambda^{-8}$
2	Sellmeier1	$n^2 = 1 + \frac{c_0\lambda^2}{\lambda^2 - c_1} + \frac{c_2\lambda^2}{\lambda^2 - c_3} + \frac{c_4\lambda^2}{\lambda^2 - c_5}$
3	Herzberger	$n = c_0 + c_1 L + c_2 L^2 + c_3\lambda^2 + c_4\lambda^4 + c_5\lambda^6$, where $L = 1/(\lambda^2 - 0.028)$
4	Sellmeier2*	$n^2 = 1 + c_0 + \frac{c_1\lambda^2}{\lambda^2 - c_2^2} + \frac{c_3\lambda^2}{\lambda^2 - c_4^2}$
5	Conrady	$n = c_0 + c_1\lambda^{-1} + c_2\lambda^{-7/2}$
6	Sellmeier3	$n^2 = 1 + \frac{c_0\lambda^2}{\lambda^2 - c_1} + \frac{c_2\lambda^2}{\lambda^2 - c_3} + \frac{c_4\lambda^2}{\lambda^2 - c_5} + \frac{c_6\lambda^2}{\lambda^2 - c_7}$
7	Handbook of Optics 1	$n^2 = c_0 + \frac{c_1}{\lambda^2 - c_2} - c_3\lambda^2$
8	Handbook of Optics 2	$n^2 = c_0 + \frac{c_1\lambda^2}{\lambda^2 - c_2} - c_3\lambda^2$
9	Sellmeier4	$n^2 = c_0 + \frac{c_1\lambda^2}{\lambda^2 - c_2} + \frac{c_3\lambda^2}{\lambda^2 - c_4}$
10	Extended	$n^2 = c_0 + c_1\lambda^2 + c_2\lambda^{-2} + c_3\lambda^{-4} + c_4\lambda^{-6} + c_5\lambda^{-8} + c_6\lambda^{-10} + c_7\lambda^{-12}$
11	Sellmeier5	$n^2 = 1 + \frac{c_0\lambda^2}{\lambda^2 - c_1} + \frac{c_2\lambda^2}{\lambda^2 - c_3} + \frac{c_4\lambda^2}{\lambda^2 - c_5} + \frac{c_6\lambda^2}{\lambda^2 - c_7} + \frac{c_8\lambda^2}{\lambda^2 - c_9}$
12	Extended2	$n^2 = c_0 + c_1\lambda^2 + c_2\lambda^{-2} + c_3\lambda^{-4} + c_4\lambda^{-6} + c_5\lambda^{-8} + c_6\lambda^4 + c_7\lambda^6$

* Note that this formula is untested. (Zemax's user manual does not provide the order in which the coefficients in the glass files map to coefficients in the formulae).