APG-1 Phosphate Laser Glass

For High Power Applications

Neodymium Laser Properties	
Emission Peak, λ [nm]	1053.9
Emission Width, $\Delta\lambda_{em}$ [nm]	27.8
Radiative Lifetime, τ_{Rad} [µsec]	361
Emission Cross Section, σ_{em} [10^{-20} cm^2]	3.4
*Quenching Constant-Zero Concentration Lifetime, τ_o [µsec]	375
*Quenching Constant-Q Factor, Q [10^{20} cm^{-3}]	6.8

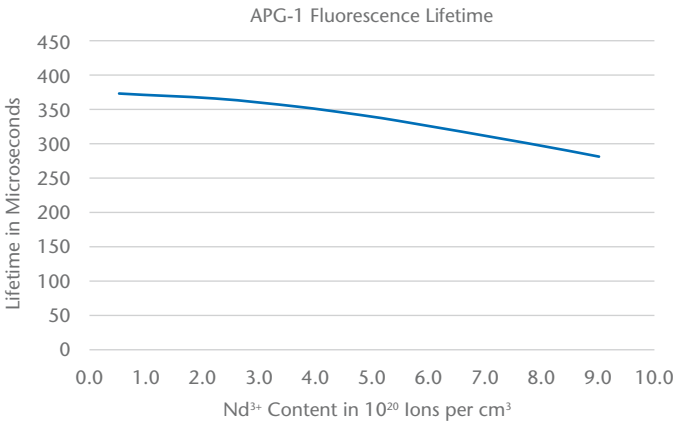
*Lifetime as a function of neodymium content is approximated by: $T=T_o/(1+(Nd/Q)^2)$, Nd=Nd concentration in 10^{20} ions/cm^3

Optical Properties	
n_d	1.5370
v_d	67.70
$n_{633\ nm}$	1.5350
$n_{1054\ nm}$	1.5260
Nonlinear Refractive Index at 1054 nm, n_2 [10^{-13} esu]	1.13
Stress-Optic Coefficient, K (588 nm, 22°C) [10^{-6} mm^2/N]	2.20
Stress-Optic Coefficient, $-K_{par}$ (632.8 nm, 25°C) [10^{-6} mm^2/N]	1.00
Stress-Optic Coefficient, $-K_{per}$ (632.8 nm, 25°C) [10^{-6} mm^2/N]	3.10
Temperature Coefficient of Refractive Index, dn/dT_{rel} (1060 nm, 20-40° C) [10^{-6}/° C]	1.2
Temperature Coefficient of Optical Pathlength, $W = \alpha_{20\text{-}40°C}$ (n-1) + dn/dT [10^{-6}/°C]	5.2

Sellmeier Coefficients			
B1	1.01260752	C1	0.01079807
B2	0.32028946	C2	0.00000000
B3	1.02870062	C3	107.148538

Attenuation Coefficient [cm^{-1}]			
400 nm	≤ 0.20	3000 nm	≤ 0.80
1054 nm	≤ 0.0015	3333 nm	≤ 2.00

APG-1 is an advanced phosphate laser glass developed to offer thermo-mechanical properties desirable in the active material of high repetition rate laser systems. APG-1 is an aluminum-phosphate based glass initially developed for the US DOE High Average Power laser program. The development and the advantages of this glass are discussed in "Advances in glasses for high average power laser systems" Proc SPIE, Vol 1021, 36-41 (1988).



Physical Properties	
Density, ρ [g/cm^3]	2.633
Thermal Conductivity (25°C), κ [W/m•K]	0.78
Thermal Conductivity (90°C), κ [W/m•K]	0.83
Young's Modulus, E [GPa]	70.00
Poisson's Ratio, ν	0.238
Fracture Toughness, K_{1c} [MPa•m$^{1/2}$]	0.61
Knoop Hardness, $HK_{0.1/20}$	450
Heat Capacity (25°C), C_p [J/g°C]	0.84
Thermal Diffusivity (25°C), σ [10^{-7} m^2/sec]	3.54
Thermal Expansion, $\alpha_{20\text{-}300°C}$ [10^{-7}/°C]	99.6
Thermal Expansion, $\alpha_{20\text{-}40°C}$ [10^{-7}/°C]	76.0
Transformation Temperature, T_g 450 [°C]	450

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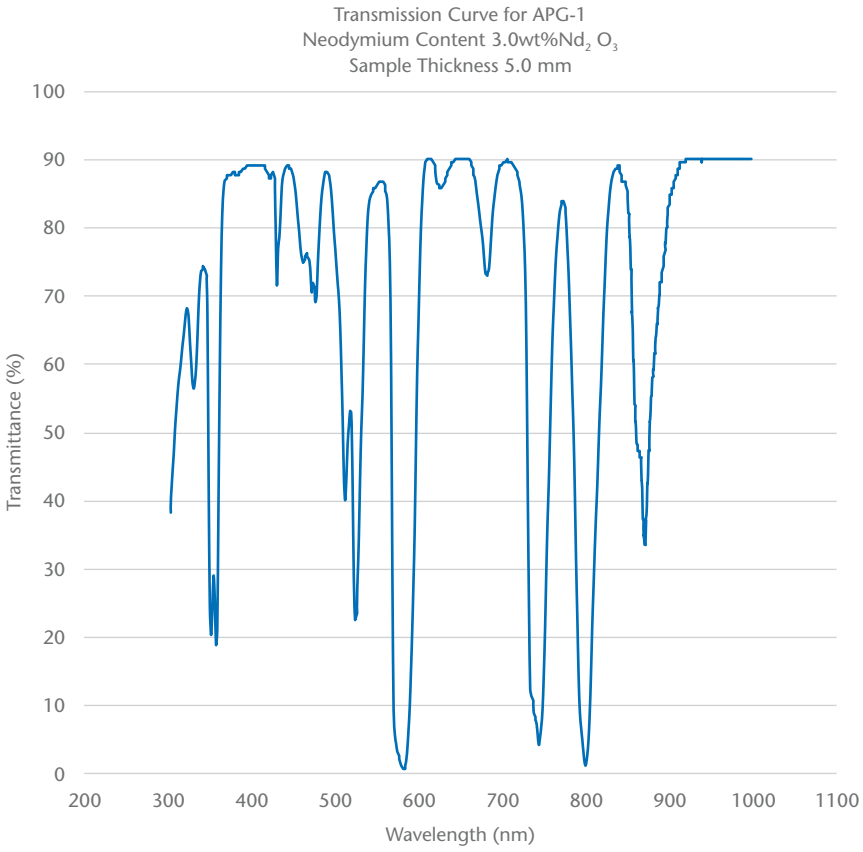
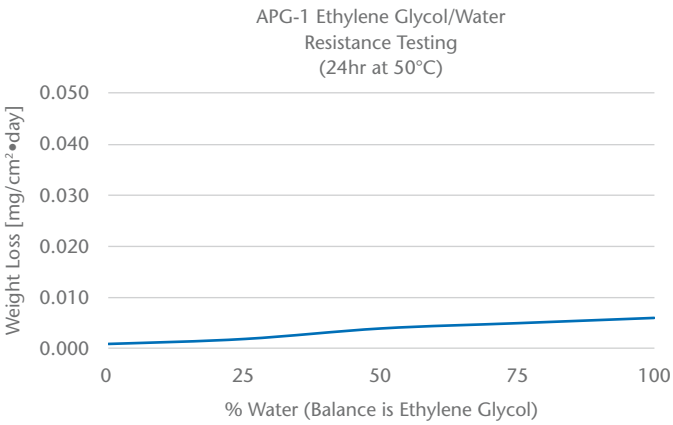


Chemical Properties	
Weight Loss in 50°C Water [mg/(cm²•day)]	0.006
Acid Resistance SR pH = 0.3 at 25°C	3.3
Alkali Resistance AR pH = 12 at 50°C	4.0
Staining Resistance FR pH = 4.6 100 h at 25°C	0
Climatic Resistance CR Water Vapor at 40-50°C for 30 h	1



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Advanced Optics
SCHOTT North America, Inc.
400 York Avenue
Duryea, PA 18642
USA
Phone +1 570/457-7485
Fax +1 570/457-7330
info.optics@us.schott.com

www.schott.com

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