IOG-1 Phosphate Laser Glass

For Ion Exchange Applications

IOG-1 is a chemically durable, sodium-aluminophosphate glass developed for use in active and passive waveguide devices, which are fabricated by ion exchange in a molten KNO_3 or $AgNO_3$ salt bath. Cumulative Er_2O_3 and Yb_2O_3 doping levels can be selected anywhere from 0 to 20wt%. IOG-1 devices are discussed in "Arrays of distributed-Bragg-reflector waveguide lasers at 1536 nm in Yb/Er codoped phosphate glass," Appl. Phys. Lett., Vol 74(6), 789-791 (1999).

Optical Properties

n_d	1.523
v_d	67.5
$n_{1000\ nm}$ (calculated)	1.515
$n_{1540\ nm}$ (calculated)	1.513

Erbium Laser Properties

Emission Maxima, λ (nm)	1534
Emission Cross Section at 1534 nm (10^{-21} cm²)	6.6
Excited State Lifetime for the 1534 nm Band (ms)	10.7
Max Absorption Cross Section for 980 nm Pump Band (10^{-21} cm²)	2.0

Ytterbium Laser Properties

Emission Maxima, λ (nm)	1002
Emission Cross Section at 1002 nm (10^{-21} cm²)	5.4
Excited State Lifetime for the 1002 nm Band (ms)	1.4
Max Absorption Cross Section for 980 nm Pump Band (10^{-21} cm²)	14.5

• Properties will vary slightly with doping content

Chemical Properties

Weight Loss in 50 °C Water [mg/(cm² x day)]	0.012
Acid Resistance SR pH = 0.3 at 25 °C	3.0
Alkali Resistance AR pH = 12 at 50 °C	4.3
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

Physical Properties

Density, ρ [g/cm³]	2.74
Thermal Conductivity (25 °C), κ [W/m x K]	0.67
Young's Modulus, E [GPa]	61.2
Poisson's Ratio, ν	0.24
Fracture Toughness, K_{1c} [MPa x $m^{1/2}$]	0.54
Knoop Hardness, $HK_{0.1/20}$	380
Heat Capacity (25 °C), C_p [J/g x K]	0.78
Thermal Diffusivity (25 °C), σ [10^{-7} m²/sec]	3.2
Thermal Expansion, $\alpha_{20-300°C}$ [10^{-7}/K]	112
Thermal Expansion, $\alpha_{20-40°C}$ [10^{-7}/K]	93
Glass Transformation Temperature, T_g (°C)	474

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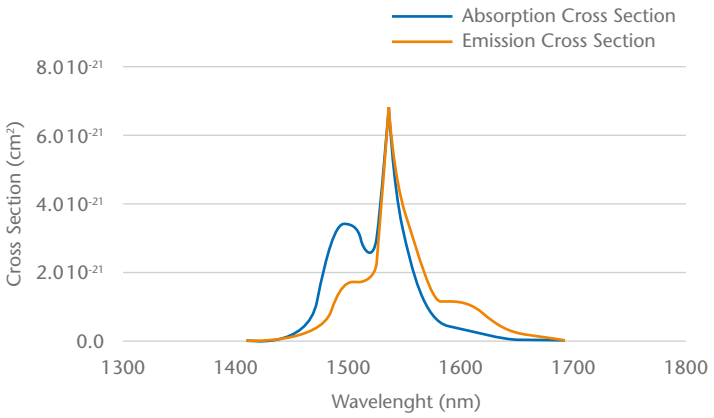
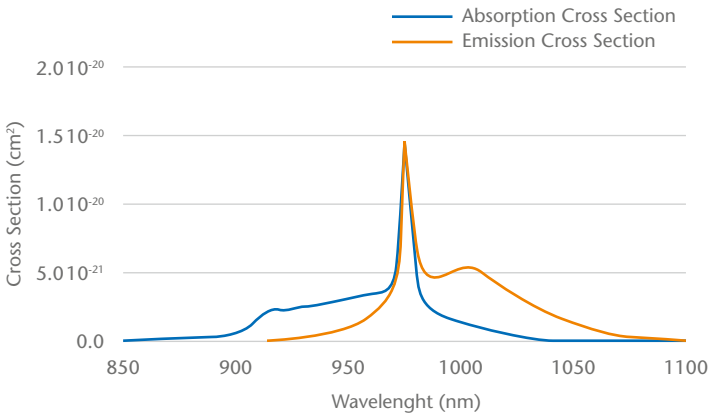
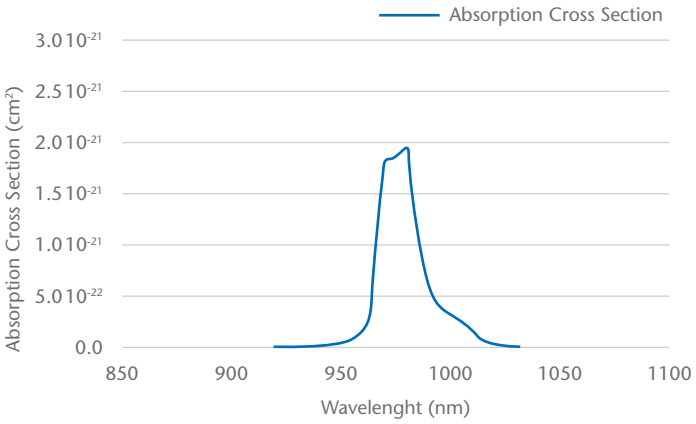
Erbium Absorption and Emission Cross Sections around 1540 nm



Ytterbium Absorption and Emission Cross Sections around 980 nm



Erbium Absorption Cross Section around 980 nm



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