MM-2 High Gain Short Length

KIGRE, INC.

WAVEGUIDE, WDM, & FIBER 1.54um ERBIUM AMPLIFIER GLASS FOR TELECOMMUNICATIONS APPLICATIONS

Kigre's MM-2 has become a world standard 1.54um laser material for use in the next generation of EDWAs and EDFAs. It is only natural that this high performance athermal phosphate glass laser material be utilized in the evolution of the optical communications component industry. Designed specifically for telecommunications applications, this patented ion-exchangeable material is now available for use in the fabrication of miniature, monolithic, high performance C-band power splitters, EDWAs, EDFAs, gain blocks, pre-amplifiers, and (WDM) wavelength-division multiplexing integrated optical devices.

Demonstrated internal gain (waveguide configuration)	0.5 to >3.0 dB/cm
Laser Wavelength Peak (nm)	1535
Tunable Output Range (nm)	1520 to 1575
Emission Cross Section ($x10^{-20}cm^2$) Er^{3+}@1.535 & Yb^{3+}@1025	0.8 & 1.4
Absorption Cross Section ($x10^{-20}cm^2$) Er^{3+}@1.54 & Yb^{3+}@975	0.7 & 1.7
Fluorescence Lifetime (us)	7900
Fluorescence Linewidth (nm) FWHM	55
Index of Refraction (nD)	1.54
Index of Refraction (laser line)	1.53
dn/dt (20-40 ^oC.) ($x10^{-7}/^oC$.)	-3.8
Temperature Coeff. of Optical Path ($x10^{-6}/K$)	3.3
Transformation Temperature (^oC.)	506
Deformation Temperature (^oC.)	535
Coeff. of Thermal Expansion (20-40 ^oC) ($x10^{-7}/^oC$)	72
(20-100 ^oC)	84
Density (g/cc)	2.70
Thermal Conductivity (W/mK)	0.85
Young's Modulus ($x10^{+3}N/mm^2$)	. 71
Poisson's Ratio	0.24
Stress Optical Coeff. ($x10^{-6}$ mm2/N)	2.1
Knoop Hardness (kgf/mm^2)	435
Durability (Wt. loss $x10^{-5}$ g/cm2,H_2O,100^oC,1Hr)	5.0

Note: Standard Silicate glasses have a 5.5 x $10^{-5}g/cm^2$ durability rating

Custom Fiber Preforms & Fiber Pulling Also Available

Ph# (843) 681-5800 Fax# (843) 681-4559
E-Mail: kigreinc@cs Web Site: www.kigre.com

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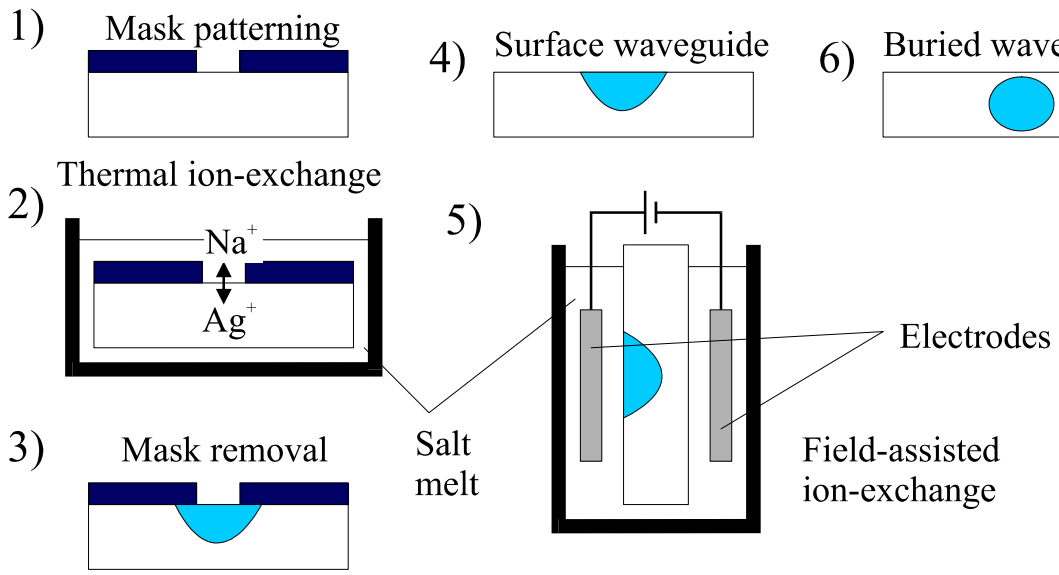
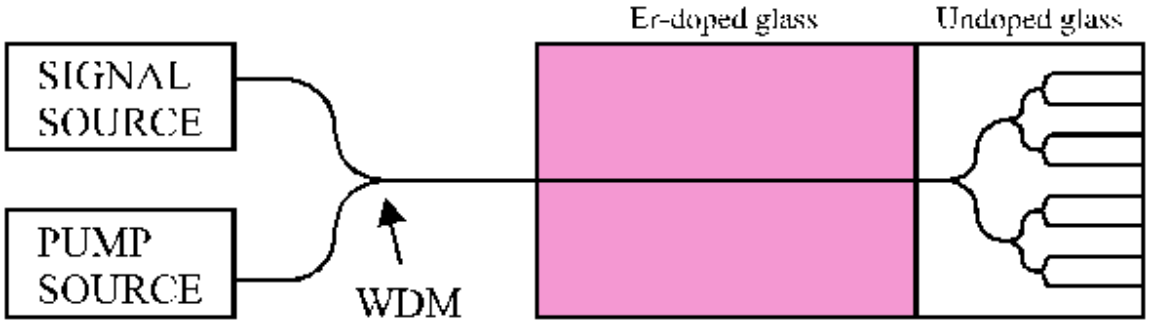
MM-2 HIGH GAIN SHORT LENGTH ERBIUM WAVEGUIDE GLASS



EXAMPLE WAVEGUIDE FABRICATION



EXAMPLE POWER SPLITTER ARCHETECTURE

It has been shown that gain coefficients of up to 5 dB/cm are obtainable utilizing optimized waveguides & fiber amplifiers manufactured from MM-2 phosphate glasses. For example an internal gain of 3dB was achieved in a 6 mm long waveguide using a pump power of 50 mW. Other configurations have resulted in gains of 20 dB in a 4 ~ 5 cm long MM-2 waveguides.

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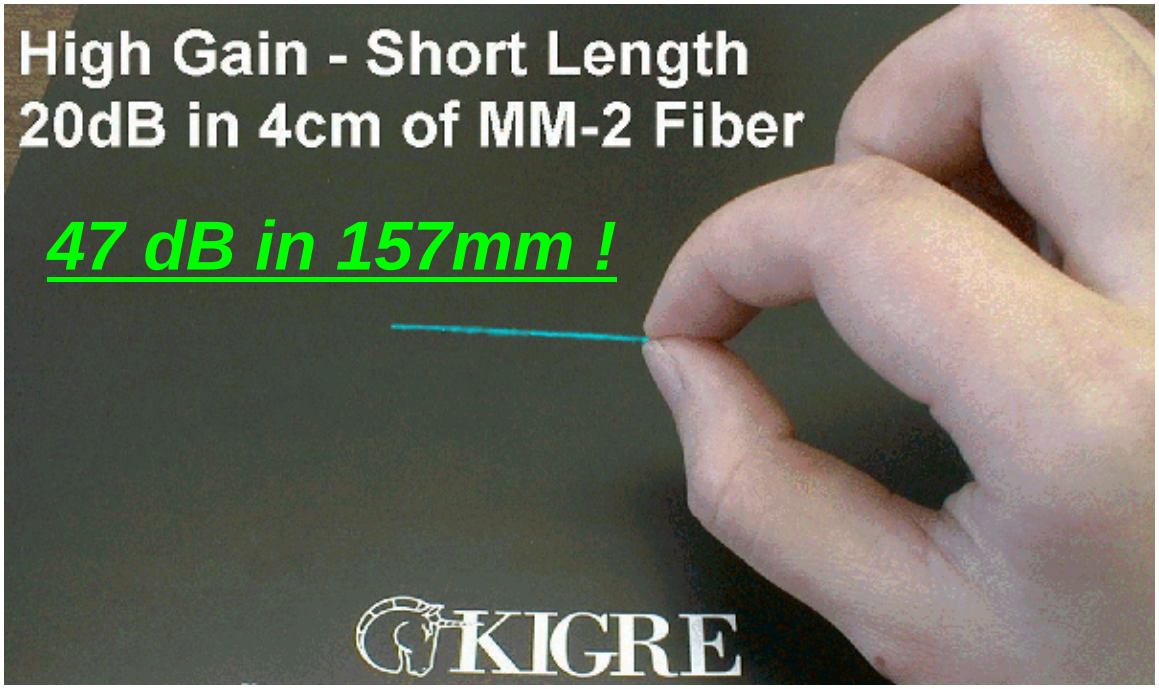

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*** Protected under one or more of the following U.S. Patents:**
No. 4,770,811 No. 4,875,920 No. 5,053,360 No. 5,164,343
No. 5,322,820

KIGRE, INC.

41+ dB Gain
350 mw Pump
147 mm Long

HARRIS

Fiber supplied by Kigre, Inc.
Data measured by Harris, Corp.

MM2 Fiber
Small Signal Gain Spectrum