

Neodymium: Yttrium Lithium Fluoride - Nd:YLF

SYNOPTICS currently manufactures Nd:YLF as a standard product and produces YLF doped with other rare earths as required. YLF offers an alternative to the more common YAG host for near IR operation. YLF is grown utilizing a modified Czochralski technique. The as-grown crystals are then processed into laser rods or slabs, coated in house, and inspected per customer specifications.

Advantages Of YLF Include:

- High power, low beam divergence, efficient single mode operation.
- High average power Q-switched at a moderate repetition rate.
- Linear polarized resonators for Q-switching and frequency doubling.
- Potential uniform mode for large diameter rods or slabs.
- Stimulated emission cross section and lifetime product is favorable for low CW threshold.
- 1.053 μm output matches gain curves of Nd:Glass and performs well as an oscillator and pre-amplifier for this host.

The combination of weak thermal lensing, large fluorescence line width and naturally polarized oscillation makes Nd:YLF an excellent material for CW, modelocked operation.



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Standard Specifications

- A)** Material to be LiYF_4 doped with Nd or other rare earth ions ± 0.2 atomic percent of specified amount.
- B)** Wavefront distortion is determined by use of a Zygo interferometer system. Wavefront distortion shall be within $\lambda / 4$ per inch of rod length ($\lambda = 0.633 \mu\text{m}$).
- C)** Extinction ratio 25 db minimum.
- D)** Orientation of rod axis to crystal "a" axis is within 5° . For rods other than flat / flat, specify wavelength of operation, as this is "c" axis orientation dependent.
- E)** Dopant specifications:
 - Nd doped lasing wavelengths include 1053, 1047, and 1313 nm
 - 1.0% dopant is standard with 1.5 and 2.0 atomic % available
 - Fluorescent lifetime at 1053 nm is 520 μsec
- F)** Available dopants include Er, Tm, Ho, Pr, as well as other rare earths upon request.
- G)** Rod end faces are anti-reflection coated for a reflectivity of less than 0.25%, durability per MIL-C-48497. Total reflective or partial reflective coatings available upon request.

Table I

Dimensional/Mechanical Specifications

<u>Parameter</u>	<u>Tolerance</u>
Diameter	+0.000" / -0.002"
Length	+0.040" / -0.000"
End Figure	\ddot{e} / 10 wave @ 633 nm
Parallelism	within 10 arc seconds
Perpendicular	within 5 arc minutes
Surface Quality	10 - 5 scratch-dig
Chamfer	0.005" \pm 0.003" @ 45°
Rod OD	fine ground to 25 ± 5 μinches

Table II

Properties Of YLF Host (LiYF4)

Growth Direction:	a-axis [100]
Crystal Structure:	Tetragonal
Molecular Weight:	171.8
Density:	3.95
Moh Hardness:	4 - 5
Melting Point:	825°C
Refractive Index:	@ 0.633 μm @ 1.06 μm
	n_o 1.443 1.448
	n_e 1.464 1.470
Thermal Conductivity:	0.06 watts $\text{cm}^{-1}\text{C}^{-1}$
Thermal Expansion:	13 x 10^{-6} / °C along a
	8 x 10^{-6} / °C along c
Youngs Modulus:	7.5 x 10^{11} dynes cm^{-2}
Tensile Strength:	3.3 x 10^8 dynes cm^{-2}
Thermal Heat Capacity:	0.79 J $\text{g}^{-1}\text{K}^{-1}$

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