Konoshima CERAMIC YAG

VLOC

Advantages of Ceramic YAG

- *Enhanced thermo-optical and opto-mechanical properties as compared to single crystal*
- *Larger sizes available than with single crystal*
- *5x higher Nd dopant densities available with no concentration gradient*
- *Reduced insertion loss of bulk ceramic material as compared with single crystal*
- *Unique composite designs possible without bonding processes*
- *Other rare-earth dopants available*
- *Other custom transparent ceramic materials available on a research & development basis*

VLOC
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"Combining Excellence Across the Spectrum"

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Physical Properties

Nd: Doping Level	up to 8% atomic
Chemical formula	$Y_{3-x}Nd_xAl_5O_{12}$
Crystal Structure	Cubic garnet structure in polycrystalline matrix
Melting Point	1970°C
Density	4.55 g/cm^3

Laser Rod Specifications

Diameter	0.5mm to 10.0mm
Length	1.0mm to 300.0mm
Slab	up to 300.0mm
Plate	up to 70mm
Transmitted Wavefront	λ/10 per inch @ 632.8
Surface Flatness	λ/10 @ 632.8
Clear Aperature	95%
Surface Quality	10/5
Parallelism	<10 seconds
Perpendicularity	<5 min
Chamfer	0.13 ±0.08mm @ 45°
Diameter Tolerance	+0/-0.025mm (Std.)
Length Tolerance	± 0.5mm (Std.)
Barrel Finish	Ground or polished

Thin Film Coatings

AR/AR @ 1064nm, R<0.15%
Damage Threshold >20J/cm^2 w/10ns pulse
Dichroics, HR 1064nm, HT 808nm
Damage Threshold >15J/cm^2 w/10ns pulse
Partial Reflecting & Custom Designs Available

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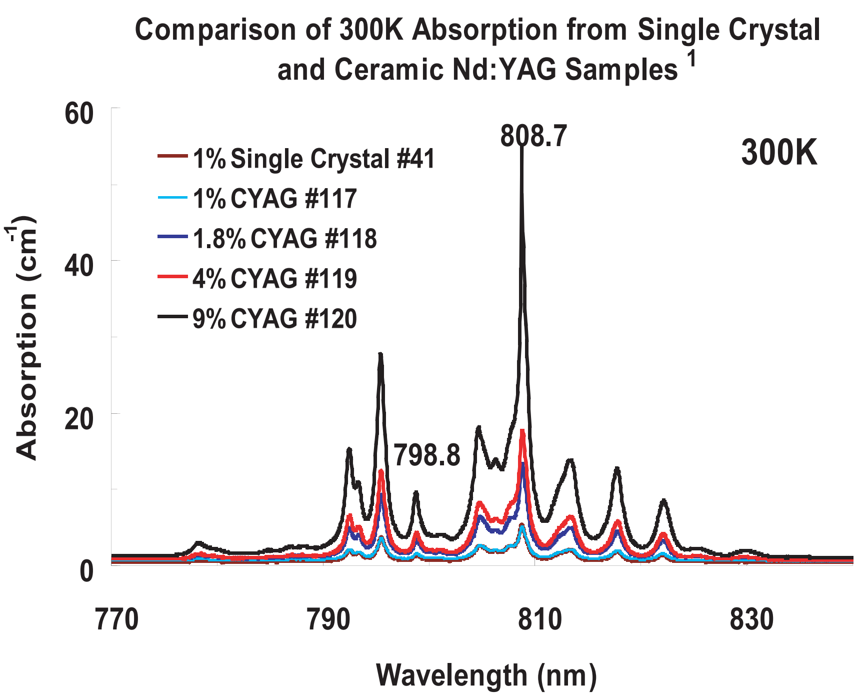

Yttrium Aluminum Garnet (YAG) has emerged as the most widely produced polycrystalline laser gain host and has enjoyed recent popularity as a substrate material for optical components. The YAG host is a stable compound, mechanically robust, physically hard, optically isotropic, and transparent from below 300nm to beyond 4μm. The YAG host is able to accept trivalent rare-earth laser activator ions, with Nd^{3+} being the most common dopant.

While ceramics have been around for many years, it was not until the last decade that sufficient advances in the development of nanopowder preparation and ceramic manufacturing technologies have made transparent, laser-grade ceramics viable.

With the continued efforts in the development of high-energy lasers and the scaling of output energies to the multi-kilowatt regime for DoD applications, the availability of near-net shaped, uniformly doped laser materials with enhanced physical properties open new possibilities for the laser design engineer. In addition, the ceramic technologies allow for the development of "engineered ceramics", i.e., laser geometries with tapered dopant ion gradients, or slabs and rods manufactured with undoped regions for improved thermal management without the need for time-consuming and expensive bonding technologies.

Optical Properties for YAG   Diode pump wavelength 808 and 880nm

	Refractive Index for Nd:YAG at 1.05μm [2]	Fluorescence Lifetimes (μs) [3]	Thermal Conductivity at 20°C [W/(cm°C)] [2]
Single crystal 1%	1.8153	230	0.093
Ceramic 1%	1.8152	236	0.087
Ceramic 2%	1.8158	166	0.085
Ceramic 4%	1.8167	82	0.074
Ceramic 8%	1.8187	16	0.069

Physical Properties for YAG [4]

	Knoop Hardness (GPa)	Fracture Toughness (MPa°m$^{1/2}$)	Young's Modulus (GPa)	Shear Modulus (GPa)	Bulk Modulus (GPa)	Poisson's Ratio
Single crystal, Nd-doped	12.8	1.48	279.9±7.2	113.8±1.1	173.4±16.1	0.230±0.020
Ceramic, Nd-doped	13.5	1.59	283.6±11.0	115.7±4.1	178.2±42.1	0.226±0.044

[1] Measured by K. Schepler, Wright Patterson AFB [2] Measured by D. Zelmon, Wright Patterson AFB.
[3] Measured by M. Dubinskii, Army Research Laboratory, Adelphi, MD. [4] Measured by D. Green, Pennsylvania State University.

Material furnished by Konoshima Chemical Co., Ltd.