

Nd:YAG

Nd:YAG crystal is the most widely used solid-state laser material adopted by industrial, medical, military and scientific customers. Its advantages are: low threshold, high gain, high efficiency, low loss at 1064 nm, as well as high optical quality, good thermal conductivity and thermal shock characteristics and mechanical strength properties, which make Nd:YAG as the most suitable laser material for CW, pulsed, mode locked, Q-switched, and cavity dumped modes of operation. AOTK has a complete product line with facilities for the growth, polishing and coating of Nd:YAG crystal. Now, we are able to stably supply the top quality of finished Nd:YAG laser rods and slabs with high optical homogeneity, consistent performance, high processing accuracy for R&D and OEM requirements. Nd:YAG rods for 946 nm and 1319 nm lasers can be provided by AOTK.



We are developing other various ions doped YAG crystals. Cr^{3+} :YAG, Nd:Ce:YAG, Yb:YAG, Er:YAG crystals are available upon request.

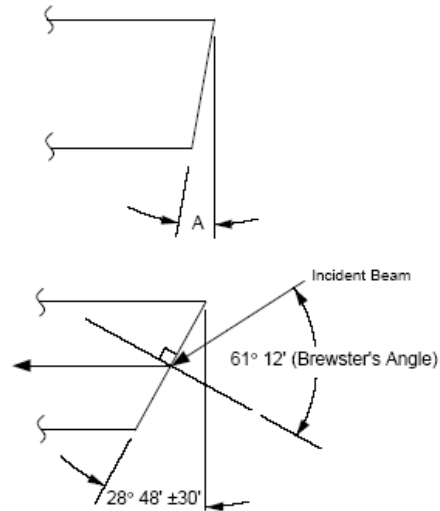
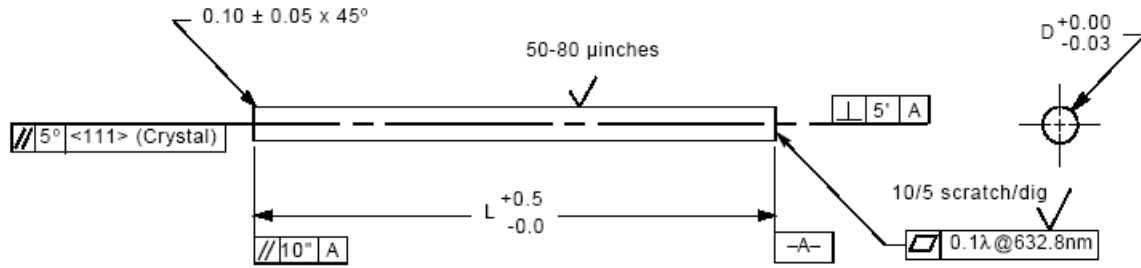
Nd:YAG advanced properties

- High gain
- Low threshold
- High efficiency
- Low loss
- Good thermal conductivity and thermal shock characteristics
- Large mechanical strength
- High optical quality

Basic Properties

Chemical Formula	$\text{Y}_{2.97}\text{Nd}_{0.03}\text{Al}_5\text{O}_{12}$
Crystal Structure	Cubic
Lattice Constants	12.01Å
Mohs Hardness	8.5
Tensile Strength	175-200 Mpa
Melting Point	1950°C
Density	4.56 g/cm ³
Nd Atoms / cm ³	1.38×10^{20} (1.0 at % Nd)
Refractive Index	1.818 at 1064 nm
Thermal Expansion Coefficient	7.0×10^{-6} /K
Thermal Conductivity	14 W/m/K @20°C, 10.5 W/m/K @100 °C
Specific Heat	0.59 Jg ⁻¹ /K
Thermal Shock Resistance	790 W/m
Thermal Optical Coefficient (dn/dt)	7.3×10^{-6} /°C
Lasing System	Four Level
Lasing Upper State	$^4\text{F}_{3/2}$
Lasing Wavelength	1064 nm, 1319.8 nm, 946 nm
Fluorescent Lifetime	230 μs
Loss Coefficient	0.003 cm ⁻¹ @ 1064 nm
Effective Emission Cross Section	2.8×10^{-19} cm ²

Standard Specifications of Nd:YAG Rods



Wedged End

A
 $30' \pm 10'$
 $1^\circ \pm 10'$
 $2^\circ \pm 10'$
 $6^\circ \pm 10'$
 $8^\circ \pm 10'$
 Note: if both ends wedged parallel,
 A-B angle $< 10''$

Brewster End

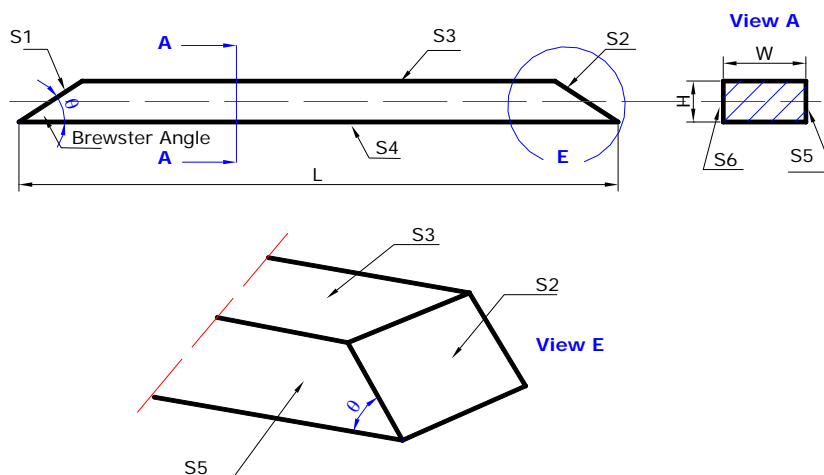
% Reflectivity = .06% for plane
 polarized incident beam at limit
 of angle tolerance.

Nd concentrations	0.6 ± 0.1 at % 0.8 ± 0.1 at % 1.1 ± 0.1 at %
Orientation	$<111>$ within 5°
Rod sizes	Diameter 2~15 mm, Length 0.5~180 mm Upon request of customer
Dimensional Tolerances	Diameter $+0.000"/-0.002"$ Length $+0.02"/-0.00"$
Barrel finish	Fine ground to 50~80microinches (other barrel finishes available upon request)
Parallelism	≤ 10 arc seconds
Perpendicularity	≤ 5 arc minutes
Flatness	$< \lambda/10$ at 632.8 nm
Surface Quality	10-5 scratch-dig per MIL-O-13830A
Chamfer	$0.005" \pm 0.002" \times 45^\circ$
Coatings	I) Both ends AR @ 1064 nm (*) II) S1 - AR @ 1064 nm & HT @ 808 nm (*) III) S1 - HR @ 1064 nm & HT @ 808 nm (*) IV) S1 - HR @ 1064 & 532 nm & HT @ 808 nm (*) V) Other AR, HR coatings upon requests *I) $R_{1064 \text{ nm}} < 0.15\%$ per surface *II) $R_{1064 \text{ nm}} < 0.20\%$, $R_{808 \text{ nm}} < 0.5\%$ *III) $R_{1064 \text{ nm}} > 99.8\%$, $T_{808 \text{ nm}} > 95\%$ *IV) $R_{1064 \text{ nm}} > 99.8\%$, $R_{532 \text{ nm}} > 99.5\%$, $T_{808 \text{ nm}} > 95\%$

Extinction Ratio and Wavefront Distortion of Rods

Diameter of Rod (mm)	Standard Grade	Special Grade
Φ3~Φ6.5	$\leq 0.125 \lambda$ /inch $\geq 28\text{dB}$	$\leq 0.05 \lambda$ /inch $\geq 30\text{dB}$
Φ7~Φ10	$\leq 0.2 \lambda$ /inch $\geq 25\text{dB}$	$\leq 0.08 \lambda$ /inch $\geq 28\text{dB}$
Φ11~Φ13	$\leq 0.3 \lambda$ /inch $\geq 23\text{dB}$	$\leq 0.1 \lambda$ /inch $\geq 26\text{dB}$
Φ14~Φ15	$\leq 0.4 \lambda$ /inch $\geq 20\text{dB}$	$\leq 0.125 \lambda$ /inch $\geq 23\text{dB}$

Standard Specifications of Nd:YAG Slabs



- Standard Dimension:
 - Width: from 3 mm to 20 mm
 - Height: from 3 mm to 12 mm
 - Length: from 20 mm to 150 mm
- Dimension Tolerance: ± 0.02 mm
- Width dimension of slab to extend radially from center of Nd:YAG boule within 5° , when growth axis along $\langle 111 \rangle$
- Surface S1 & S2 perpendicular to Face S5 to within 5 arc minutes
- Surface S1 & S2 polished flat to within $\lambda/10$ @632.8 nm over test region
- Surface S3 & S4 parallel to each other within 5 arc minutes
- Surface S3 & S4 polished flat to within $\lambda/2$ per 1 inch over test region
- Surface S1, S2, S3 & S4 surface finish 10/5 scratch/dig per MIL-0-13830A
- Surface S5 & S6 fine ground
- Protective chamfers to be applied to all edges unless otherwise stated
- Parallelogram-shape slabs also available in AOTK

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