

# New Opportunities with Reliable and Scalable Polycrystalline YAG



High-purity Yttrium Aluminum Garnet (YAG) ceramics enable the development of high-output, solid-state lasers that are essential for many technologies. CoorsTek has developed state-of-the-art transparent YAG optoceramics, which overcome some of the challenges posed by single-crystal YAG and deliver optimal performance at scale.

## Polycrystalline YAG laser media offer significant advantages over single crystal solutions, such as:



Greater control of material properties due to higher and more uniform concentrations of dopants



Higher production yields due to better process control and consistency



Simplified grinding and processing due to near-net-shape forming methods

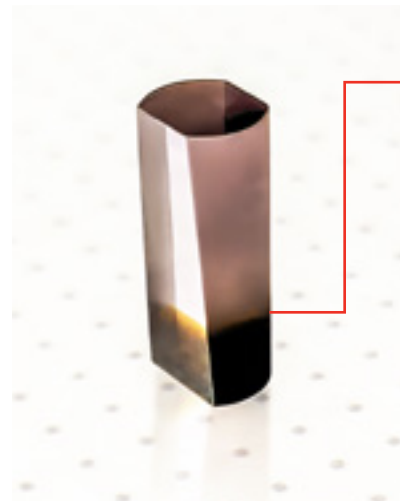


Lower capital costs and greater economies of scale when scaling up manufacturing

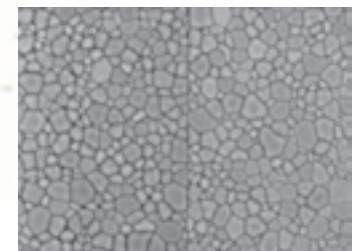
## New Bonding Technology for Q-Switching Applications

Typically, laser gain- and absorber- materials for Q-switching applications need to be bonded with strict requirements of the bonding interface. Single crystal materials require expensive diffusion bonding technology, prohibiting manufacturing at scale.

CoorsTek has developed a reliable, proprietary bonding technology to reduce costs and enable bulk production. Unlike diffusion bonded materials, CoorsTek Polycrystalline YAG bonding technology shows no visible bonding interface. The materials are without the known defects originating from diffusion bonding.



*CoorsTek bonding technology.  
No visible bonding interface.*



*Diffusion bonded materials  
with visible bonding interface.*

**CoorsTek Polycrystalline YAG laser mediums offer unequivocal efficiencies as compared to monocrystal solutions, including increased scalability, greater control of optical properties, higher production yields due to better process controls, and simplified secondary processing.**

## Contact Us

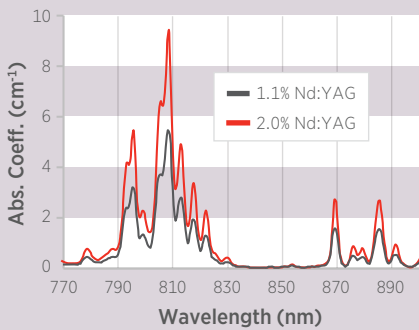
Contact us to speak with an expert regarding our optoceramics solutions. Visit [www.coorstek.com](http://www.coorstek.com) or email [info@coorstek.com](mailto:info@coorstek.com)

# Polycrystalline Ceramic YAG

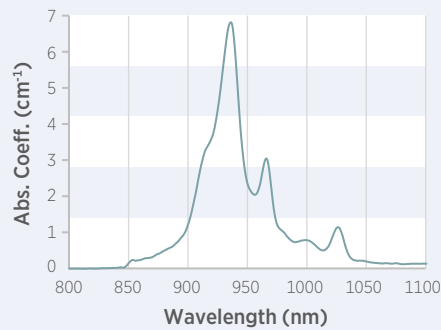
## Material Properties



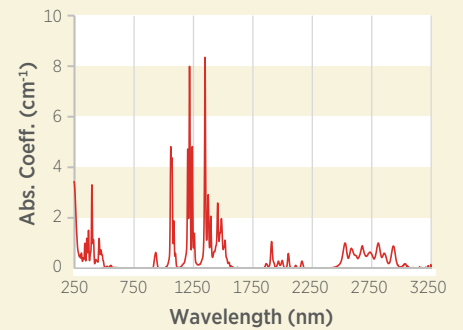
CERAMIC  
**Nd:YAG**



CERAMIC  
**Yb:YAG**



CERAMIC  
**Sm:YAG**



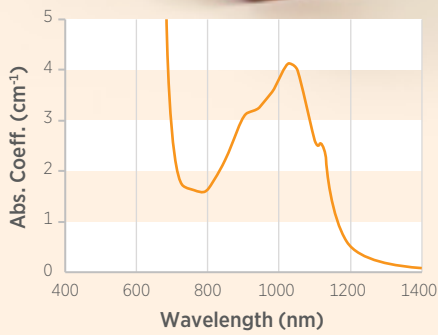
	Single Crystal Nd:YAG	VS	Ceramic Nd:YAG	Single Crystal Yb:YAG	VS	Ceramic Yb:YAG	Single Crystal Sm:YAG	VS	Ceramic Sm:YAG
Host	Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>		Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>	Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>		Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>	Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>		Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>
Max. Concentration	1.3 at% Nd		4 at% Nd	100% Yb		100% Yb	-5% Sm		10-12% Sm
Intrinsic Dopant Gradient	Yes		No	Yes		No	Yes		No
Dopant Concentration Tolerance	+/- 0.1%		+/- 0.01%	+/- 0.1%		+/- 0.01%	+/- 0.1%		+/- 0.01%
Crystal Structure	Cubic		Cubic	Cubic		Cubic	Cubic		Cubic
Density	4.56 g/cm <sup>3</sup>		4.56 g/cm <sup>3</sup>	4.56 g/cm <sup>3</sup>		4.56 g/cm <sup>3</sup>	4.56 g/cm <sup>3</sup>		4.56 g/cm <sup>3</sup>
Refractive Index (1.0 μm)	1.82		1.82	1.83		1.83	1.83		1.83
Fracture Toughness	1.8 MPa m <sup>1/2</sup>		4-9 MPa m <sup>1/2</sup>	1.8 MPa m <sup>1/2</sup>		4-9 MPa m <sup>1/2</sup>	1.8 MPa m <sup>1/2</sup>		4-9 MPa m <sup>1/2</sup>
Thermal Conductivity	11 W/m.K		10 W/m.K	6 W/m.K (10% Yb)		6 W/m.K (10% Yb)	6 W/m.K (10% Sm)		6 W/m.K (10% Sm)
Fluorescence Lifetime	235 μs (1.0% Nd)		235 μs (1.0% Nd)	0.97 ms		0.97 ms	-		-
Main Pumping Wavelength (μm)	0.808		0.808	0.94		0.94	-		-
Lasing Wavelength (μm)	1.064 (1.32, 1.34, 1.44)		1.064 (1.32, 1.34, 1.44)	1.03 (1.05)		1.03 (1.05)	-		-
High Volume Production	Difficult to Scale		Scalable	Difficult to Scale		Scalable	Difficult to Scale		Scalable
Absorption (1064 nm)	-		-	-		-	2.8 cm <sup>-1</sup> (5% Sm)		2.8 cm <sup>-1</sup> (5% Sm)

# Polycrystalline Ceramic YAG

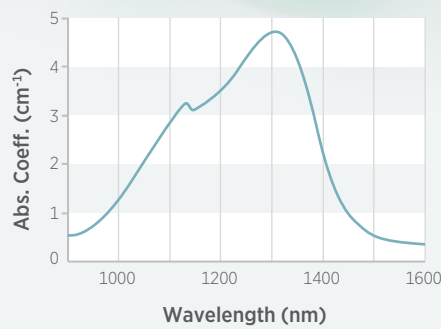
## Tunable Absorber Materials Material Properties



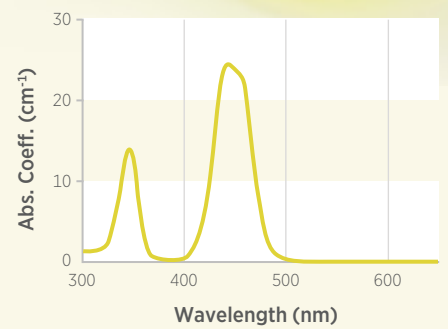
CERAMIC  
**Cr:YAG**



CERAMIC  
**V:YAG**



CERAMIC  
**Ce:LuAG**



	Ceramic Cr:YAG	Ceramic V:YAG	Ceramic Ce:LuAG
Host	Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>	Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>	Lu <sub>2</sub> Al <sub>3</sub> O <sub>12</sub>
Concentration	<b>Cr:</b> 0.05-0.4 at%	<b>V:</b> 0.4-2.0 at%	<b>Ce:</b> 0.05-0.3 at%
Dopant Gradient	No	No	No
Dopant Concentration Tolerance	+/- 0.01%	+/- 0.01%	+/- 0.002%
Crystal Structure	Cubic	Cubic	Cubic
Density	4.56 g/cm <sup>3</sup>	4.56 g/cm <sup>3</sup>	6.73 g/cm <sup>3</sup>
Refractive Index (1.0 μm)	1.82	1.82	1.84
Thermal Conductivity	10 W/m.K	9 W/m.K	10 W/m.K
Charge Compensating Ion	Ca <sup>2+</sup>	-	-
Fluorescence Lifetime	-	-	70 ns
Absorption Coefficient (1.064 μm)	1 cm <sup>-1</sup> - 6 cm <sup>-1</sup>	1 cm <sup>-1</sup> - 5 cm <sup>-1</sup>	1 cm <sup>-1</sup> - 25 cm <sup>-1</sup>
Absorption Range	0.9 - 1.15 μm	1.05 - 1.4 μm	0.33-0.36 / 0.42-0.48 μm
Recovery Time	4 μs	0.022μs	-
Peak Emission Wavelength	-	-	0.532 nm
High Volume Production	Scalable	Scalable	Scalable



Charts intended to illustrate typical properties. Property values vary with method of manufacture, size, and shape of part. Data contained herein is not to be construed as absolute and does not constitute a representation or warranty for which CoorsTek assumes legal responsibility. DuraStrate is a trademark of CoorsTek, Inc. CoorsTek and SuperStrate are registered trademarks of CoorsTek, Inc.

### Americas

+1 303 271 7100 tel  
+1 855 929 7100 toll free in USA  
www.coorstek.com  
info@coorstek.com

### Europe

+49 160 530 3768  
infoeurope@coorstek.com

### Japan

+1 81 3 5437 8411  
japaninfo@coorstek.com

### China

+86 21 6232 1125  
info\_shanghai@coorstek.com

### Korea

+82 31 613 2946  
koreainfo@coorstek.com