

Ruby – Cr³⁺: Al₂O₃

Ruby was the first solid-state laser material-- demonstrated by Ted Maiman in 1960. With two broad absorption bands it is conveniently pumped with flash lamps producing pulsed deep red laser light at 694.3nm. Ruby is one of the most robust solid-state laser materials with a thermal shock resistance three times that of Nd:YAG.

Ruby's wavelength makes it ideal for medical applications such as hair and tattoo removal.

Structural & Thermal Properties

Formula:	Cr ³⁺ : Al ₂ O ₃
Crystal System:	Trigonal
Unit Cell Dimensions (as if hexagonal)	a = 4.785 Å c = 12.99 Å
X-Ray Density:	3.98 g/cm ³
Melting Point:	2040°C
Thermal Expansion: at 323 K	⊥ c 5 x 10 ⁻⁶ K ⁻¹ c 6.7 x 10 ⁻⁶ K ⁻¹
Thermal Conductivity: 300K	28 W / m•K
Hardness:	Mohs: 9, Knoop: 2000 kg mm ⁻²
Young's Modulus:	345 GPa
Specific Heat: at 291K	761 J kg ⁻¹ K ⁻¹
Thermal Stress Resistance parameter, R_T:	34 W / cm

General Specifications

Diameter Tolerance:	+0.000" / -0.002"
Chamfer:	0.005" ± 0.003" @ 45°
Barrel Finish:	30 ± 5 μinches
Perpendicularity:	within 5 arc minutes
Parallelism:	30 arc-seconds or less
Rod End Face Flatness:	within λ / 10 wave at 632 nm wavelength
Surface Quality:	10 - 5 scratch-dig per MIL-O-13830 A
Wave Front Distortion:	less than 1/2 wave per inch of length (measured at 1 micron)
Standard Coating:	Anti-Reflection where R < 0.25% @ 694 nm
Laser rod orientation:	60 ± 5° from the c-axis

Optical Properties

Chrome Concentration Standards:	0.03±0.005 wt% Cr ₂ O ₃ 0.05±0.005 wt% Cr ₂ O ₃
Chrome Ion Density (0.03 wt %):	0.948 x 10 ¹⁹ cm ⁻³
Refractive Indices at 694.3 nm: (Negative, Uniaxial)	Ordinary, E ⊥ c = 1.763 Extraordinary, E c = 1.755
Refractive Index Temperature Coefficient: 633nm	13 x 10 ⁻⁶ K ⁻¹
Brewster angle at 694.3nm	60.62°
Fluorescence lifetime at 300K:	3.0 ms

Specifications and information are subject to change without prior notice.
© 2011 Northrop Grumman Corporation