Ti:Sapphire

For High Performance Lasers

GT ADVANCED TECHNOLOGIES

The GT Crystal Systems Advantage

200 mm

World's largest Ti:Sapphire crystals

Our crystals are grown using the Heat Exchanger Method, (HEM). This unique method of growth allows for growth of the world's largest Ti:Sapphire crystals, with excellent optical properties. The growth of our crystals takes place in a reducing atmosphere in order to maximize Ti3+ ions, thereby reducing parasitic absorption and maximizing FOM values. The superior homogeneity and wave fronts of our laser rods allow laser systems to reach high energy levels without sacrificing beam profile quality.

Ti:Sapphire Applications

Ti:Sapphire's thermal properties, wide emission range, (660 nm to 1180 nm), high-power capability and quality of beam profile are enabling a growing number of applications in the areas of radio therapy, proton therapy, accelerator physics, nuclear physics, infrared spectroscopy and materials characterization. Crystal Systems works closely with its customers to address the individual needs of their applications. This includes scaling-up the size of our crystals, increasing FOM values and providing more uniform crystalline structures to improve transmitted wave fronts.

Manufacturing Laser Rods

We provide many design options; plano-ends, Brewster's angle ends, coated and other configurations. Our material ranges in size from 3 mm to 175 mm finished diameters. Absorption values range from 0.5 to 10+ /em@ alpha 514 nm.

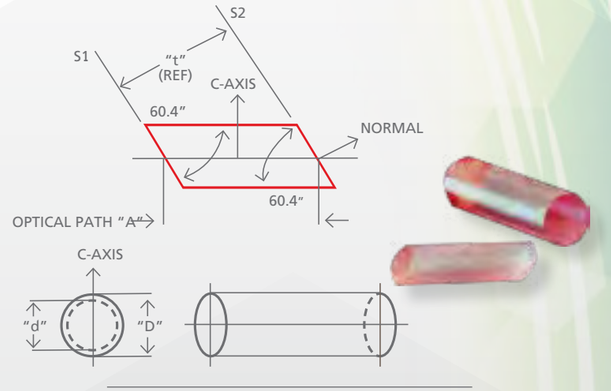
Advanced polishing and coatings

We employ the most advanced polishing techniques in order to create ultra smooth surfaces with low sub-surface damage. Our coatings are engineered to provide maximum efficiency at peak power levels. By combining high quality material, the correct polishing techniques and optimized coatings, we provide the highest performance laser rods available.

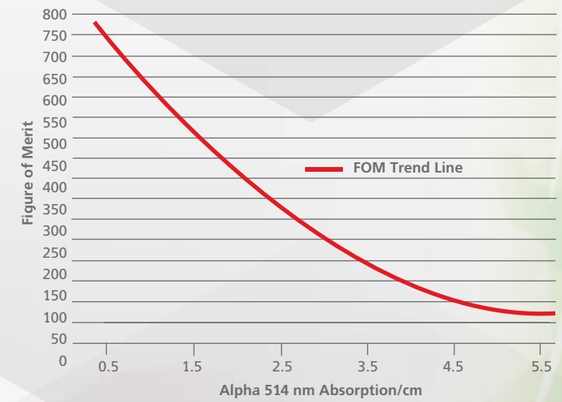
Quality control at all stages of production

Every laser crystal we produce undergoes a multiple-stage, rigorous inspection process, using state-of-the-art test and measurement equipment. We test our rods for absorption values, homogeneity, light scatter, FOM, flatness, and transmitted wave fronts. Each HEM laser rod is examined and verified utilizing advanced interferometry equipment. This guarantees that the crystalline structure of the material meets the high homogeneity standards that today's laser technology platforms require. Figure of Merit, (FOM), is measured at 514 & 800 nm.

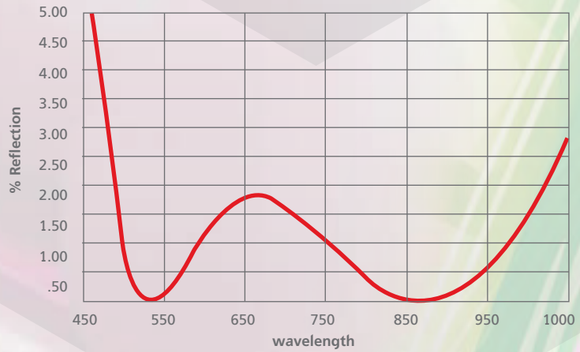
Typical Brewster Cut Configuration



FOM Versus Absorption Line



Sapphire High-power Anti-reflection Coating



Material Properties of HEM Ti:Sapphire

Physical

Chemical Formula	$Ti^{3}+:Al_2O_3$
Crystal Structure	Hexagonal System (Rhombohedral)
Unit Cell	a=4.758 Å, c=12.991 Å
Density	3.98 g/cm^3
Hardness	9 mohs, 1525-2000 Knoop
Melting Point	2040°C (nominal)

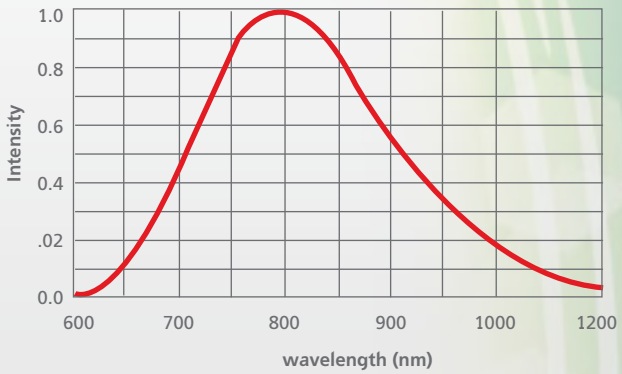
Thermal

Thermal Conductivity	0.105 cal/cm-sec-°C
Thermal Expansion	8.40 X 10^{-6} per °C
Specific Heat	0.10 cal/g
Heat Capacity	18.6 cal/°C-mole @room temperature

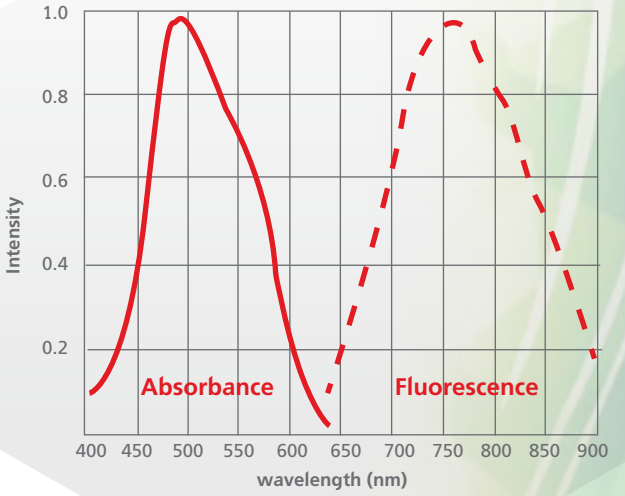
Laser

Laser Action	4-Level Vibronic
Absorption Band	400-600 nm (peak at 490)
Tunable Range	660-1200 nm (peak at 800)
Fluorescence Lifetime	3.2 ms
Peak Cross-Section	3-4 x 10^{-19} cm^2
Refractive Index	1.76 (nominal)

Tunability Range of Ti:Sapphire



∏ Polarization



Worldwide Headquarters
20 Trafalgar Square
Nashua, NH 03063 USA
Phone: +1 603.883.5200
Fax: +1 603.595.6993
www.gtat.com

Sapphire Material Sales & Services
GT Crystal Systems, LLC
35 Congress Street
Salem, MA 01970 USA
Phone: +1 978.745.0088
Fax: +1 978.745.5059
SapphireSales@gtat.com