

# Ti:Sapphire - Titanium Doped Sapphire

## Introduction

Titanium Doped Sapphire (Ti:Sapphire) is the most widely used laser crystal for widely tunable and ultrashort pulsed lasers with high gain and power outputs. CASTECH possesses the advanced growth method of Temperature Gradient Technique (TGT), and it supplies large-sized (Dia.30×30 mm<sup>3</sup>) Ti:Sapphire crystal in high quality free of light scatter, with the dislocation density less than 10<sup>2</sup> cm<sup>-2</sup>. The TGT grown sapphire crystal is characterized by the [0001] oriented growth, high doping level ( $\alpha_{490} = 4.0 \text{ cm}^{-1}$ ), high gain and laser damage threshold.

## Main Applications

- The tunable wavelengths that cover a broad range from 700 to 1000 nm make Ti:Sapphire an excellent substitute for dye lasers in many applications.
- Doubling by NLO crystals such as BBO in an ultra-thin, Ti:Sapphire can be used to generate UV and DUV (up to 193 nm) laser with ultrafast pulses below 10 fs.
- Ti:Sapphire is also widely used as the pump source of OPOs to expand the tunable range.

Table 1. Basic Properties

Chemical Formula	Ti <sup>3+</sup> : Al <sub>2</sub> O <sub>3</sub>
Crystal Structure	Hexagonal
Lattice Parameter	a = 4.758 Å, c = 12.991 Å
Density	3.98 g/cm <sup>3</sup>
Melting Point	2040 °C
Mohs Hardness	9 Mohs
Thermal Conductivity	52 W/m/k
Specific Heat	0.42 J/g/K
Laser Action	4-level Vibronic
Fluorescence Lifetime	3.2 μs (T = 300K)
Tuning Range	660-1050 nm
Absorption Range	400-600 nm
Emission Peak	795 nm
Absorption Peak	488 nm
Refractive Index	1.76 @800 nm
Peak Cross-section	3~4 × 10 <sup>-19</sup> cm <sup>2</sup>
Thermal Expansion	8.40 × 10 <sup>-6</sup> /°C

## Specifications of Ti:Sapphire crystal from CASTECH

Table 2. Specifications

Orientation	Optical axis $c$ normal to rod axis
Ti <sub>2</sub> O <sub>3</sub> concentration	0.06-0.26 at. %
Figure Of Merit (FOM)	100~250 (>250 available upon special requests)
$\alpha_{490}$	1.0-4.0 cm <sup>-1</sup>
Diameter	2~30 mm or specified
Path Length	2~30 mm or specified
End Configurations	Flat/Flat or Brewster/Brewster ends
Surface Quality (Scratch / Dig)	40/20 to MIL-PRF-13830B
Flatness	$\leq \lambda/8$ @633nm
Wavefront Distortion	$\leq \lambda/4$ @633 nm
Parallelism	20 arc sec
Perpendicularity	$\leq 15$ arc min

### Note

AR-Coating is available upon request.