Laser Crystal
Ti:Sapphire

Ti:sapphire crystal product, also known as titanium doped sapphire crystal, with the chemical formula of $Ti^{3+}:Al_2O_3$, is a transition metal doped laser crystal with good comprehensive performance.

As an optically pumped solid-state laser crystal, Ti doped sapphire is widely used in wavelength tunable lasers. The tunable range is 650-1100nm and the peak value is 800nm. It is the widest wavelength tunable laser crystal.

Ti^{3+} ions have very large gain bandwidth, which opens the possibility of obtaining very wide wavelength tunability in short pulse lasers. The upper state lifetime of Ti:sapphire is as short as 3.2 μs. Because of its high saturated power, it is generally used as a lamp, an argon ion laser or a frequency double pumped Nd:YAG laser. Using self mode locking technology, Ti:sapphire laser can directly output laser pulses with a pulse width of less than 6.5 fs, which is the narrowest laser pulse of all lasers directly output from the resonator. Through the dual frequency technology, the wavelength of the laser beam can cover the wide band from blue to deep UV. The 193nm laser produced has been used in the lithography machine.

The product has the characteristics of short service life and high saturation power. It can be used in lamps, argon ion lasers or frequency double pumped Nd:YAG lasers.

Key Features

- High damage threshold
- Wide absorption pump band
- Narrow mode-locked pulse width
- Wide wavelength tunability
- Excellent output efficiency
- Short upper-state lifetime (3.2 μs)

Applications

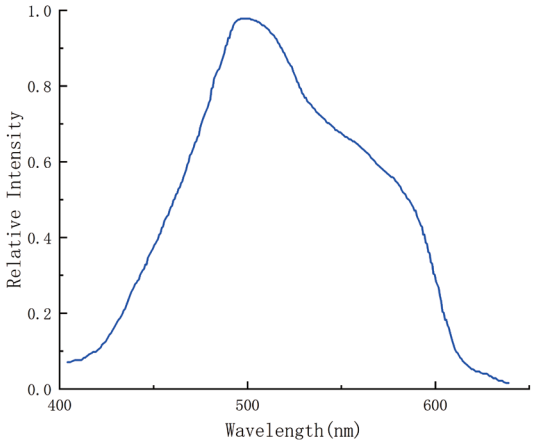
Ti:sapphire amplifier

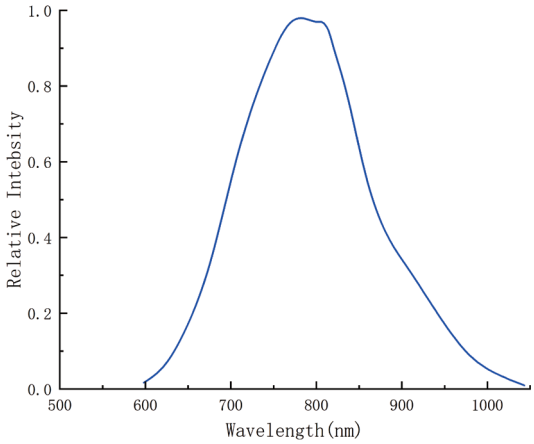
Ti:sapphire tunable laser

Femtosecond titanium sapphire laser

Sapphire oscillator pump parameters

Spectra





Technical Specifications

Material Specifications	
Material	$Ti^{3+}:Al_2O_3$
Concentration	(0.05~0.35) wt%
Orientation	The A-axis is within 5 degrees, and the E-vector is parallel to the C-axis
Parallelism	30″
Vertical	5′
FOM	100~300
Wavefront Distortion	<λ/4@632 nm
Surface Flatness	<λ/8@632 nm
Clear Aperture	>90%
Surface Quality	10^{-5}
Coating	Standard coating is AR with R < 5.0% each face @532 nm and R < 0.5% each face, from 650 nm to 850 nm. Custom coatings
Chamfering	<0.2×45°

Physical and Chemical Properties	
Crystal Structure	Hexagonal System
Density	3.98 g/cm^3
Melting Point	2040 °C
Coefficient of Thermal Conductivity	33 W / (m K)
Refractive Index Temperature Coefficient	$13 \times 10^{-6}K^{-1}$
Thermal Shock Resistance Parameters	790 W/m
Thermal Expansion	$\approx 5 \times 10^{-6}K^{-1}$
Hardness (Mohs)	9
Young modulus/ GPa	335
Specific Heat Capacity	0.1 cal/g
Tensile Strength/ Mpa	400
Diameter	3-100 mm
0.1％Titanium density	$4.56 \times 10^{19}cm^{-3}$

Optical and Spectral Properties	
Laser Transition	$F_{3/2} \rightarrow F_{1/2}$
Fluorescence emission wavelength range	600-1200 nm
Peak emission wavelength	~780 nm
Center	800 nm
Tunable Absorption Band	400-600 nm
Absorption Peak	488 nm
Peak stimulated emission cross-section: parallel to the c-axis	$4.1x10^{-19}$ cm^2
Peak stimulated emission cross-section: perpendicular to the c-axis	$2.0x10^{-19}$ cm^2
Stimulated emission cross-section at 795 nm	$2.8x10^{-19}$ cm^2
Saturation flux at 795 nm	E_s=0.9 J/cm^2
Fluorescence Lifetime	3.2 μs
Emission Line Width	650-1100 nm
Refractive Index	1.77@ 532 nm; 1.76@800 nm; 1.75@1100 nm
Absorption Coefficient	0.8～7.0 cm^{-1}
Damage threshold (10 ns, 1064 nm)	10 J/cm^2