Nd:KGW - Neodymium Doped Potassium Gadolinium Tungstate ($Nd:KGd(WO_4)_2$)

Introduction

Neodymium doped Potassium Gadolinium Tungstate ($Nd:KGd(WO_4)_2$ or Nd:KGW) is an excellent laser gain material which has low laser oscillations threshold and high emission section. The fluorescent concentration quench effect of the Nd^{3+} ion in the KGW crystal may be weakened due to the W-O covalent bond, so this crystal has a higher doping concentration of active ion. Furthermore, the absorption band at 808 nm of Nd^{3+} in the KGW which has 12 nm FWHM is well matched with the emission wavelength of current commercial laser diode.

Table 1. Basic Properties

Crystal Structure	monoclinic
Space Group	C_{2h} (2/c) - C2/c
Lattice Parameter	a = 8.087 Å, b = 10.374 Å, c = 7.588 Å β = 94.41°
Refractive Index, at 1067 nm	n_g = 2.049, n_p = 1.978, n_m = 2.014
Mohs Hardness	5
Density	7.27 g/cm^3
Melting Point	1075°C
Thermal Conductivity at 373 K	$K_{[100]}$ = 0.026 W/cm/K $K_{[010]}$ = 0.038 W/cm/K $K_{[001]}$ = 0.034 W/cm/K
Young's Modulus	$E_{[100]}$ = 115.8 Gpa, $E_{[010]}$ = 152.5 GPa, $E_{[001]}$ = 92.4 Gpa
Thermal Expansion Coefficient, at 373°C	$\alpha_{[100]} = 4\times10^{-6}$/K, $\alpha_{[010]} = 1.6\times10^{-6}$/K, $\alpha_{[001]} = 8.5\times10^{-6}$/K
Lasing Wavelength	911 nm, 1067 nm, 1351 nm
Absorption Band	808 nm (FWHM 12 nm)
Fluorescent Lifetime	110 μs (30% doping), 90 μs (8% doping)

Table 2. Laser Properties

3% Nd:KGW	Emission Wavelength	1070 nm
	Emission Bandwidth	15 nm
	Stimulated Emission Cross-section σ_e	1.48 × 10^{-20} cm^2
	Fluorescent Lifetime	109 μs
	Gain Bandwidth	15 nm
	Absorption Wavelength	810 nm
	Absorption Bandwidth	14 nm
	Absorption Cross-section σ_α	1.28 × 10^{-20} cm^2

Specifications of Nd:KGW crystal from CASTECH

Table 3. Specifications of Nd:KGW

Orientation	[010]
Standard Dopant Concentration	Nd: 3%, 5%, 8% atm%
Maximum Length	50 mm
Dimensional Tolerances	Diameter: ±0.1mm Length: ±0.5 mm
Surface Quality (Scratch/Dig)	20/10 to MIL-PRF-13830B
Flatness	λ/6 @633 nm
Parallelism	20 arc sec
Perpendicularity	≦15 arc min
Coating	AR-coated

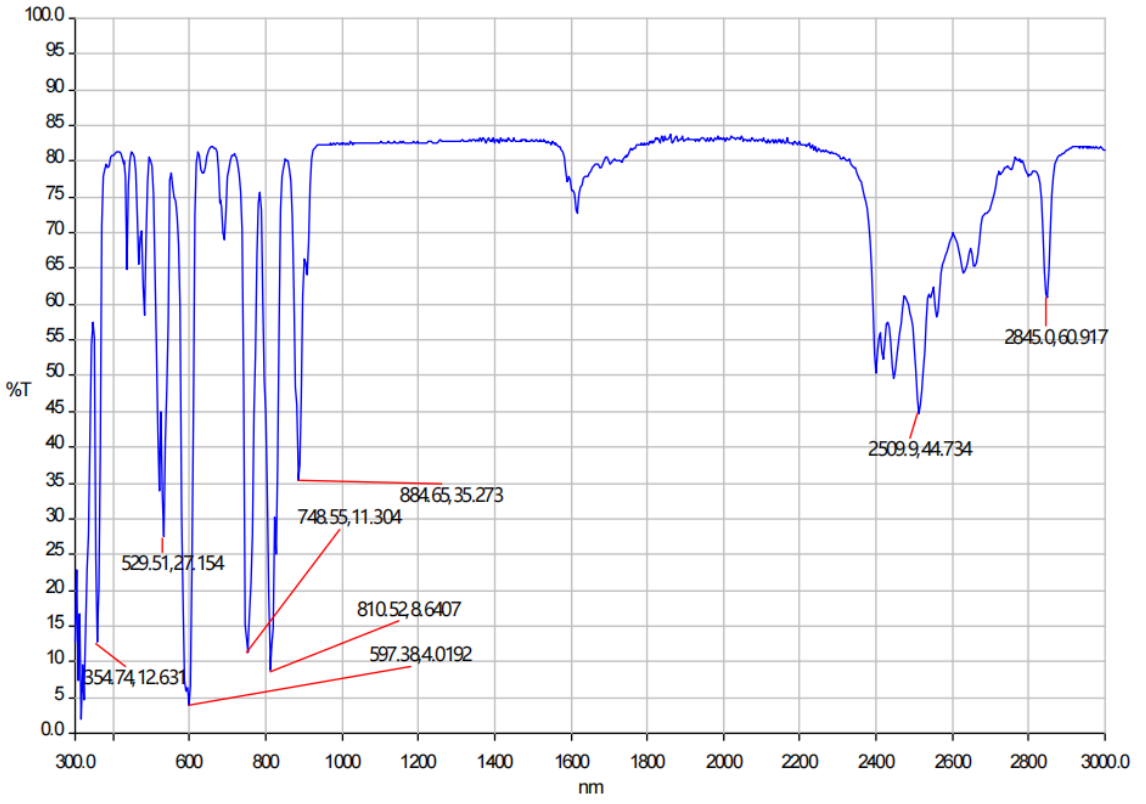

Figure 1. Transparency curve of Nd:KGW

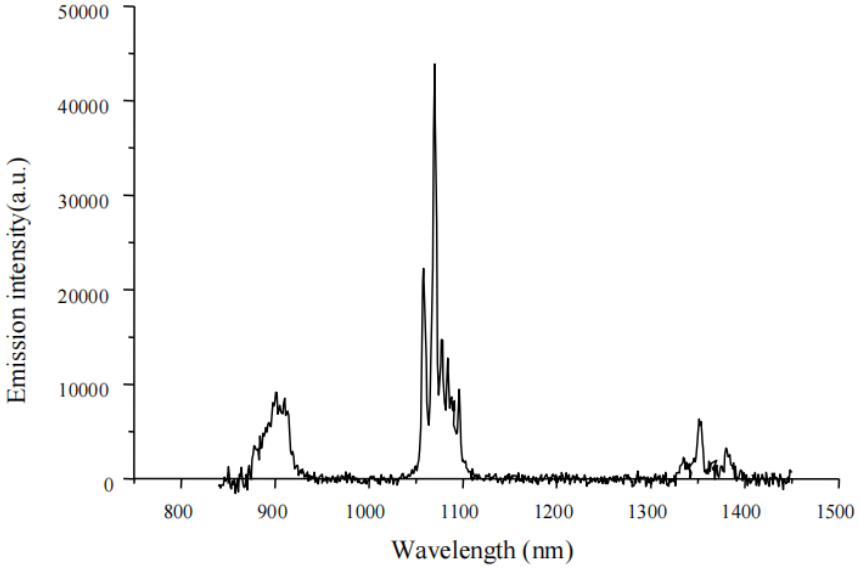

Figure 2. Emission spectra of 3% Nd:KGW

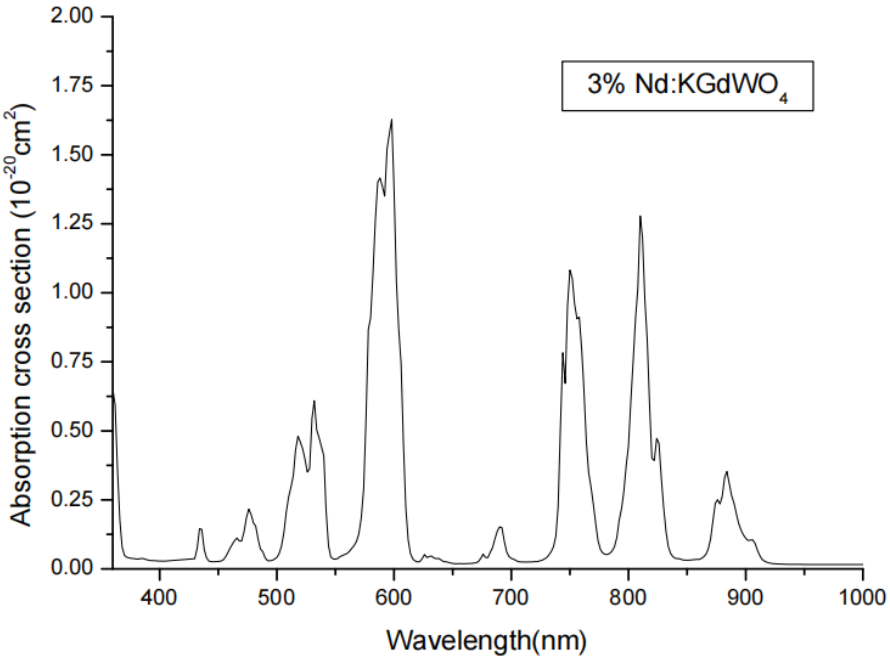

Figure 3. Absorption spectra of 3% Nd:KGW