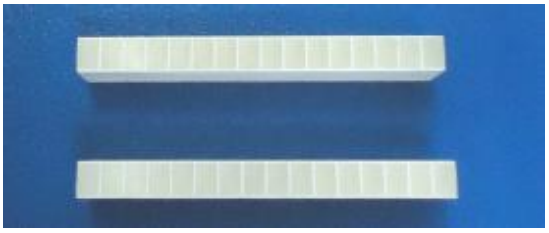
CWO - Cadmium Tungstate Scintillation Crystal ($CdWO_4$)

Introduction

Cadmium Tungstate ($CdWO_4$, CWO) single crystal is an important scintillation material applied in the radiation detection technology, especially for security checking, industrial CT and medical imaging. Large-size CWO single crystals with high quality are grown successfully by vertical Bridgman process in our company in recent years. CWO single crystal has a density as high as 7.9 g/cm^3 without any deliquescence. Under high-energy rays radiation such as X-rays or γ-rays, the crystal exhibits the luminescence output with a central wavelength of 470 nm. The crystal possesses a series of scintillation properties such as a relative light yield 2~3 times of BGO crystal, a low afterglow only 10^{-2} grade relative to CsI (Tl) crystal and a γ-ray radiation hardness of 107 rad. Our company provides the mass products of CWO wafers and array elements, which can meet the technical requirements for radiation detection devices.

CWO Crystal Boule



CWO Crystal Array Elements

Basic Properties of CWO Single Crystal

Crystal orientation	[100], [010]
Crystal structure	Monoclinic system, Space group p2/c
Crystal lattice	a = 5.029 Å, b = 5.859 Å, c = 5.074 Å; α = γ = 90 °, β = 91.47 °
Melting point	1276 ℃
Density	7.9 g/cm^3
Thermal expansion coefficient	6.39×10^{-6} /K ([100]), 1.09×10^{-5} /K ([010])
Refractive index	2.3
Hardness	4.5 Mohs
Colour	Nearly colorless to pale yellowish brown
Deliquescence	None
Central wavelength of luminescence	470 nm
Relative light yield index	20-30 (NaI (Tl) crystal with a light yield index 100 is used as reference)
Absolute light yield	2760 ± 50 p.e/MeV
Energy resolution	7.8-12%
Luminescence decay time	1.3 μs (36%, fast), 11.5 μs (64%, slow)
Afterglow	≦0.04% @3 ms
γ-ray radiation hardness	107 rad

Figures

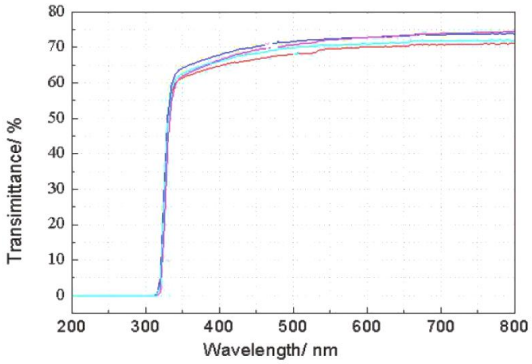


Fig.1 Ultraviolet-visible transmission spectra

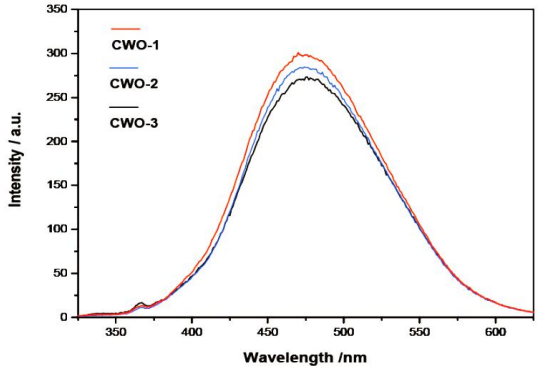


Fig.2 X-ray stimulated luminescence spectra

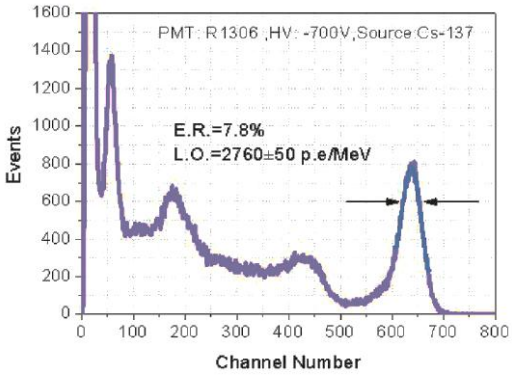


Fig.3 Energy spectrum and light yield of CWO wafer under γ-ray excitation

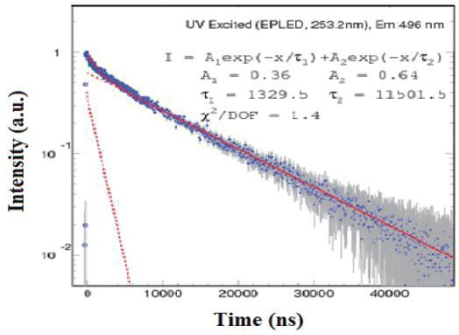


Fig.4 Luminescence decay time of CWO wafer under UV excitation

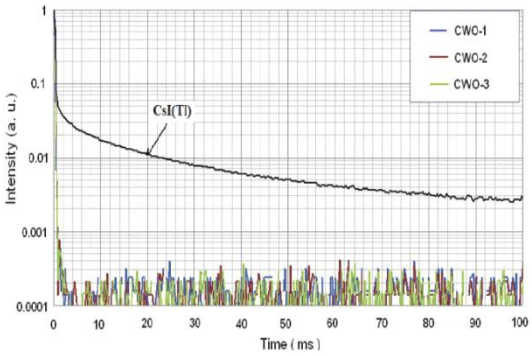


Fig.5 Afterglow of CWO crystal less than 0.04% @3 ms under γ-ray excitation which only 10^{-2} grade relative to CsI(Tl) crystal

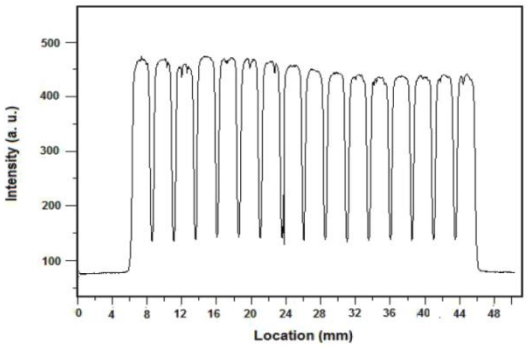


Fig.6 Relative light yield uniformity of crystal array elements