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Tl_2ZrCl_6 Crystal: Efficient Scintillator for X- and γ-ray Spectroscopies

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ABSTRACT

Crystal growth and luminescence properties of the intrinsic Tl_2ZrCl_6 scintillation crystal are presented. The proposed crystal is a promising candidate for γ-ray detection owing to its high light yield, good energy resolution, and high effective atomic number (Z = 69). It has a cubic structure, which is desirable for a large-size-crystal growth. In this study, the crystal is grown from its melt using the Bridgman technique. The emission peak under X-ray excitation is found at 460 nm, with a primary decay time of 2.7 μs. The light yield and energy resolution are estimated to be 47,000 photons/MeV and 4.3 % (full-width-at-half-maximum), respectively, obtained from the pulse-height spectra under a ^{137}Cs 662-keV γ-ray excitation.

Keywords: Scintillator, X-ray, Decay time, Light yield, Energy resolution

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1. Introduction

Scintillation materials are used in various applications, such as medical imaging, homeland security, high-energy physics, astrophysics, etc. Research is in progress to reveal novel scintillators with better performances. There are essential requirements for materials used in X- and γ-ray spectroscopies: high effective atomic number, high density, high energy resolution, small decay time, and good linearity [1, 2]. Materials with a high effective atomic number and high light output are promising, owing to their high detection efficiency, low Compton background, and capability to develop a compact detector for various applications.