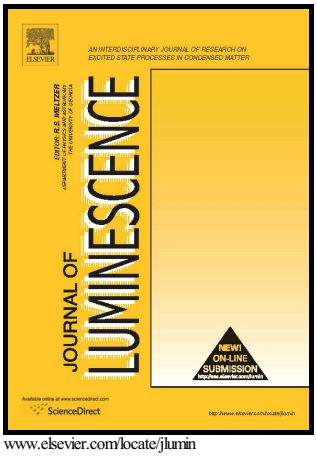

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M. Isik, N.M. Gasanly, L.G. Gasanova, A.Z. Mahammadov

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Thermoluminescence study in $Cu_3Ga_5S_9$ single crystals: Application of heating rate and $T_m - T_{stop}$ methods

M. Isik[a,*], N.M. Gasanly[b,c], L.G. Gasanova[d], A.Z. Mahammadov[d]

[a] Department of Electrical and Electronics Engineering, Atilim University, 06836 Ankara, Turkey

[b] Department of Physics, Middle East Technical University, 06800 Ankara, Turkey

[c] Virtual International Scientific Research Centre, Baku State University, 1148 Baku, Azerbaijan

[d] Department of Physics, Baku State University, 1148 Baku, Azerbaijan

[*] Corresponding author. Tel: +90 312 5868755; fax: +90 312 5868091. mehmet.isik@atilim.edu.tr

Abstract

$Cu_3Ga_5S_9$ semiconducting single crystals were investigated using thermoluminescence (TL) measurements in 10-300 K temperature region. In the TL glow curve, one peak starting to appear at the instant temperature is increased from 10 K and another peak, which is broader than a general individual TL peak, were observed. The broad peak around 66 K was investigated using T_m–T_{stop} experimental method to understand whether or not this peak is composed of more than one individual peaks or continuously distributed traps. Curve fitting, initial rise and peak shape methods were used for acceptable TL curves to be analyzed. TL curves in T_m–T_{stop} method indicated that observed peaks are due to the existence of quasi-continuous distribution of traps. Structural characterizations of $Cu_3Ga_5S_9$ single crystals were studied using x-ray diffraction and energy dispersive spectroscopy measurements. The crystal structure, lattice parameters and atomic composition of the elements were reported in the present paper.

Keywords: Thermoluminescence, Trap distribution, T_m–T_{stop} method

1. Introduction

$Cu_3B_5C_9$ ternary semiconductors, where B = Ga or In and C = S, Se or Te, have potentials as photo-absorbers in solar cells, optoelectronics devices, and photoelectrochemical cells [1–5]. They are visible-light-active crystals with high-absorption coefficients and suitable band gaps [6–8]. The production probability of $Cu_3B_5C_9$-type semiconductors has been established