

EPR of Mn²⁺ and Eu²⁺ in PbTe Thin Films Grown by Laser-assisted Deposition Technique

Plyatsko S.V.¹, Senior researcher; Gromovoj Yu.S.¹, Senior researcher;
Rashkovetskyi L.V.¹, Researcher; Kadyshch S.K.², Senior researcher

¹ Institute of Semiconductor Physics, 45, Nauki Pr., 03028 Kiev, Ukraine

² J. Balasagyn Kyrgyz National University named after J. Balasagyn,
547, Frunze Str., 720033 Bishkek, Kyrgyz Republic

Electron paramagnetic resonance (EPR) of Mn²⁺ and Eu²⁺ in thin films PbTe and also crystal structures of films grown by laser-assisted deposition technique (LAD) on different substrates at relatively low temperatures ($T = 293\text{-}573$ K) are analyzed. The investigations of EPR indicated to verify the crystalline quality of IV-VI layers. In the layers deposited from the Pb(Ge)Te : Mn and PbTe : Eu targets, measurements of the EPR spectra with the orientation of the magnetic field perpendicular to the layer surface exhibited satellite lines near each HFS line ($\Delta H \cong 4.5$ Oe), caused by superhyperfine interaction (SHFI) of Mn²⁺ 3d⁵ and Eu²⁺ 4f⁷ electrons with the nuclear moments of ¹²⁵Te and ¹⁵³Te in the first coordination shell. In this case the SH parameters are the next:

PbTe : Mn – $g = 1.9975 \pm 0.0005$, $A = (59.9 \pm 0.2) \cdot 10^{-4} \text{ cm}^{-1}$, and
 $a_{\text{Te}} = (15.8 \pm 0.2) \cdot 10^{-4} \text{ cm}^{-1}$, PbTe : Eu – $g = 1.997510 \pm 0.00055$,
 $b_4 = (40.1 \pm 0.45) \cdot 10^{-4} \text{ cm}^{-1}$, $b_6 = (-0.63 \pm 0.45) \cdot 10^{-4} \text{ cm}^{-1}$, $A =$
 $(27.0 \pm 0.45) \cdot 10^{-4} \text{ cm}^{-1}$, $a_{\text{Te}} = (11.8 \pm 0.45) \cdot 10^{-4} \text{ cm}^{-1}$ for the ¹⁵¹Eu isotope,
 $A = (11.9 \pm 0.45) \cdot 10^{-4} \text{ cm}^{-1}$ for the ¹⁵³Eu isotope.

where a_{Te} is SHFI constant.

Due to the heavy overlap of the EPR lines, the value of the SHFI constant for the ¹⁵³Eu isotope can't be determined. The ratio of the HFI constants, $A(^{151}\text{Eu})/A(^{153}\text{Eu})$ obtained from the experimental data is equal to the ratio of the nuclear magnetic moments for these isotopes.