

Unusual Magnetism of the Eu Based Compounds - $\text{EuB}_{6-x}\text{C}_x$, EuZn_2As_2 : the Low Temperature Electron Spin Resonance (ESR) Study

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EuCd_2Sb_2 and EuZn_2As_2 (sp.gr. $P\bar{3}m1$) are anti-ferromagnetic (AFM) with $\Theta_p \sim -6.5$ K and -16.5 K and their resistances are metal- and semiconductor-like, respectively. $\text{EuB}_{6-x}\text{C}_x$ (sp.gr. $Pm\bar{3}m$) is semi-metal, FM or AFM ($\Theta_p \sim \pm 18\text{K}$) depending on content x of carbon. The ESR measurements of Θ_p were performed on frequency 9.3 GHz in TE_{102} rectangular cavity in the temperature range from 4.2 to 300K. Well known, intensity $\chi_{ESR}(T)$ of ESR signal is proportional magnetic susceptibility. In general, the magnetic susceptibility is a tensor. Because the view of the Curie-Weiss's law can depend on directions. Surprising, but it is quite explainable that the paramagnetic temperatures Θ_p , obtained for EuCd_2Sb_2 and EuZn_2As_2 from the $1/\chi_{ESR}(T)$ dependence, have positive sign. For $\text{EuB}_{6-x}\text{C}_x$ Θ_p was $\sim +8$ K in case of a magnetic field along [111] axis, and $\Theta_p \sim -7$ K (!) for the field along [100] axis. Large deviation ($\Delta g \sim 0.03$) of the g-factor from $g=1.99$ free Eu^{2+} ion indicates on the strong hybridization of the f-states Eu^{2+} with the p- s- states of the band electrons and possible formation of Kondo-like bound states. The obtained data are interpreted in terms of indirect exchange interaction between localized magnetic moments of Eu^{2+} by the electrons of the valence band (Bloembergen-Rowland's modified RKKY interaction).