FERROMAGNETIC (Eu,Gd)Te SEMICONDUCTOR LAYERS

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In (Eu,Gd)Te magnetic semiconductor alloys the substitution of Gd^{3+} ions for Eu^{2+} ions creates a high concentration of quasi-free electrons and transforms EuTe (a well known antiferromagnetic compound) into a ferromagnetic (driven by RKKY interaction) n-type semiconductor alloy. This material is expected to have a very high degree of electron spin polarization and can serve as a spin injector in model semiconductor spintronic heterostructures. We studied the electron concentration induced magnetic transition in monocrystalline layers of (Eu,Gd)Te grown by MBE technique. By variation of Gd content and stoichiometry both n-type and insulating layers of (Eu,Gd)Te were obtained with ferromagnetic state found only in conducting layers. The ferromagnetic transition in (Eu,Gd)Te is also observed in electron transport as a peak of resistivity at the Curie temperature and a strong negative magnetoresistance. The magnetic properties of (Eu,Gd)Te layers will be discussed based on experimental studies of magnetization, ac magnetic susceptibility, and ferromagnetic resonance revealing the ferromagnetic transition temperature T_c=11-15 K as well as a dominant easy-plane type of magnetic (shape) anisotropy with negligible in-plane magnetocrystalline anisotropy.

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