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Amorphous Magnetic Ge(1-x)Mn(x) Thin Films Grown by MBE¹

WENJING YIN, COPELAND KELL, MELISSA DOLPH, JIWEI LU, JERROLD FLORO, STUART WOLF, University of Virginia — We explored the properties of Mn doped magnetic Group IV semiconductors with the ultimate goal of providing a new structure for logic switches that have extremely low bit switching energy. Precipitate-free amorphous Ge(1-x)Mn(x) thin films have been prepared by co-depositing Ge and Mn on SiO(2)/Si using a Molecular Beam Epitaxy (MBE) system. We varied the growth temperature and Mn doping concentration (2.8%, 10.9% and 21.3%) in order to achieve the optimal magnetic properties. The ferromagnetic saturation moments were found to increase with Mn concentration with a maximum of 0.7 Bohr magnetron per Mn in the as-grown samples. Similar to MBE-grown single crystalline and implanted amorphous GeMn, two magnetic transition temperatures around 15 K and 200 K were observed in these amorphous MBE-grown samples. The Anomalous Hall Effect (AHE) persisted up to 200 K and disappeared together with the magnetism, which confirmed the strong correlation between the magnetization and transport properties and indicated the presence of substitutional Mn ions dispersed in the Ge host. In addition, negative magnetoresistance (MR) was detected from 5K to room temperature.

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