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Magnetic Rare Earth (Gd) Doped Amorphous Carbon LI ZENG, Materials Science and Engineering Program, University of California, San Diego, ERIK HELGREN, FRANCES HELLMAN, Physics Department, University of California, Berkeley — Previous studies on rare earth (RE) doped amorphous silicon ($a-\mathrm{RE}_x\mathrm{Si}_{1-x}$, RE=Gd, Tb) have shown remarkable physics for compositions near the three-dimensional metal-insulator transition: many orders of magnitude negative magnetoresistance (MR) at low temperatures, and a high onset temperature (T*) where the effects of magnetic dopants "turns on." Both MR and T* are significantly reduced by substituting Ge for Si, an effect we suggest is due to the reduced band gap and consequently larger dielectric constant and larger electron screening of Ge. This suggestion is supported by a systematic decrease in T* and MR with increasing x and by data on ternary alloys (with non-magnetic Y additions). To test this theory, we have prepared samples of $a-\mathrm{RE}_x\mathrm{C}$. Amorphous C has the unique feature of a band gap which can be tuned by varying the $\mathrm{sp}^2/\mathrm{sp}^3$bonding ratio. As anticipated, $a-\mathrm{RE}_x\mathrm{C}_{1-x}$ shows even larger negative MR at low temperatures and higher characteristic temperature T*. Chemical and structural properties were studied by RBS, TEM, Raman spectroscopy. The temperature and magnetic field dependence of conductivity and magnetic properties and comparisons to previous work will be discussed. Thanks to the NSF for support.

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