Title

Different magnetic moment in Mn-doped amorphous group-IV semiconductors: A comparison study between Si and Ge matrices

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Publication Date

2008-02-20

Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Sorting Category: 02.8.1 (E)

Different magnetic moment in Mn-doped amorphous group-IV semiconductors: a comparison study between Si and Ge matrices.[1] LI ZENG, ERIK HELGREN, University of California, Berkeley, CINTHIA PIAMONTEZE, ELKE ARENHOLZ, ALS, Lawrence Berkeley Lab, Berkeley, CA, ADDISON HUEGEL, FRANCES HELLMAN, University of California, Berkeley — Mn-doped amorphous Si ($a-$Si) and Ge ($a-$Ge) are prepared by e-beam co-evaporation for a wide range of concentrations (0.5-18 at.%) to explore the Mn local moment in group-IV semiconductors. We find that Mn behaves quite differently in these two matrices: in a-Si, the Mn local moment is quenched, even for the lowest doping (0.5 at.%), while in $a-$Ge, a large Mn moment is observed, with a spin-glass ground state. X-ray absorption spectra (XAS) of $a-Mn_xSi_{1-x}$ have very broad L-edge absorption peaks which correlate with the quenched magnetic state. The quenched Mn moment in a-Si is unexpected and can be understood by the formation of Anderson-localized itinerant states even on the insulating side of the metal-insulator transition. By contrast, XAS of $a-Mn_xGe_{1-x}$ show atomic multiplets. a-Mn_xSi_{1-x} has positive magnetoresistance (MR) like typical non-magnetic disordered electronic systems, while $a-Mn_xGe_{1-x}$ has negative MR, consistent with magnetization data.

[1]This research was supported by NSF DMR-0505524.

[X] Prefer Oral Session
[ ] Prefer Poster Session

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Date submitted: 08 Jan 2008 Electronic form version 1.4