Abstract for an Invited Paper
for the MAR10 Meeting of
The American Physical Society

Induced ferromagnetic order in (Ga;Mn)As in epitaxial Fe/(GaMn)As heterostructures[1]

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One of the most interesting areas of spintronics research is the control of interface-induced phenomena in artificially grown systems, with capabilities that surpass the limitations of current technologies . In semiconductor spintronics, research on Diluted Magnetic Semiconductors (DMS) resulted in remarkable examples of the integration - in a single material - of the spin degree of freedom in a semiconducting environment. However, potential integration of DMS in applications rely on a firm understanding of the magnetic ordering mechanism as well as on the ability to induce ferromagnetism above room temperature. In the most frequently studied DMS material (Ga,Mn)As, the Curie temperature is today limited to about 200 K, while ferromagnetic behavior well beyond room temperature would be required in future spintronics devices. Here we demonstrate that the growth of Fe/(Ga,Mn)As heterointerfaces can be efficiently controlled by epitaxy, and that a robust ferromagnetism of the interfacial Mn atoms is induced by the proximity effect at room temperature. Chemically selective probes, supported by theoretical calculations, were used to monitor both the temperature and magnetic field dependence of the Mn magnetic moment in the semiconducting host. We identify distinct Mn populations, each of them with specific magnetic character. These results trace a possible path to interface-controlled ferromagnetism in DMS-based devices.

[1]Supported by the DFG via SFB 689 and by CNR-INFM.