Room temperature ferromagnetism in GaSb thin films doped with Mn

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The design and development of Hall Effect magnetic field sensors with III-V semiconductor materials and magnetic alloys (Mn) is a current topic - due to its applications in different branches of physics like spintronics. Semiconductor materials such as GaSb are important because of their applications in modern Nano-electronics, infrared emitting lasers with a 0.7 eV bandgap and especially in photovoltaic systems and their optical response to wavelengths longer than silicon-based solar cells [1][2]. When the Mn is introduced in the matrix of these semiconductors, we have new opportunities in the context of spintronics, owing that in the alloys the spatial distribution of electrons and holes can be controlled easily, resulting in the magnetic properties of these materials.

The structural, electrical and magnetic properties of GaSbMn thin films were studied. The samples were grown by Magnetron Sputtering on heated Si (111) substrates. In order to incorporate Mn in low concentrations in the GaSb matrix, the substrate temperatures were varied from 300°C to 400°C. X-ray diffraction patterns show that they have a polycrystalline structure. We find that at 300°C GaSbMn grows as a smooth, phase-pure film, whereas at higher temperatures (400°C) the films become increasingly rough, but more crystalline with segregated MnSb and Mn impurities, shown also by Scanning Electron Microscopy. High temperature SQUID magnetometry measures Curie temperatures of 350 K for the film grown at 300°C, and above 500K for 400°C. The GaSbMn exhibits a well-defined magnetic hysteresis loop above room temperature. These loops show that the superparamagnetic (or weak ferromagnetic) behavior of the GaSbMn layers depends on the Mn content. Magnetotransport measurements show well developed anomalous Hall effect (AHE) hysteresis loops that persist up to room temperature. This result shows that the magnetic properties are very sensitive to experimental parameters such as working pressure and growth temperature [3][4].

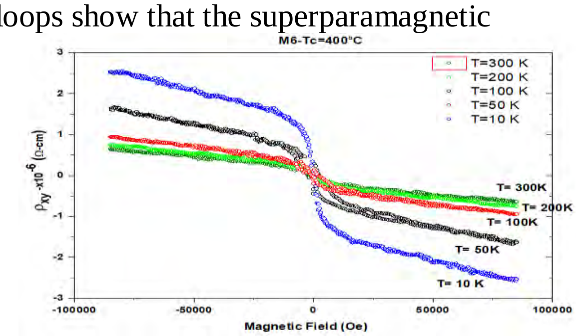

Figure 1**. Resistivity Vs Magnetic field**

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