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Magnetism and Mn Clustering in (In, Mn)Sb Magnetic Semiconductors.[1] BRUCE WESSELS, JINDONG LIU, MICAH HANSON, JOHN PETERS, Northwestern University — Magnetic semiconductors doped with transition metal elements such as (In,Mn)Sb and (Ga,Mn)Sb are considered ideal systems for spintronic devices such as magnetic junction transistors. The magnetic behavior of these semiconductors is largely influenced by magnetic atom distribution, electronic structure, and chemical state. The Mn distribution and phase composition in (In, Mn)Sb films grown by metal-organic vapor phase epitaxy (MOVPE) were determined using X-ray photoelectron spectroscopy (XPS). From XPS the spin-orbit splitting energy of the Mn 2p core-level was found to increase with increasing Mn concentration. The measured magnetic moment per Mn atom decreases with increasing Mn concentration, which is attributed to atomic-scale clusters that are ferromagnetic or ferrimagnetic. The magnetic properties in conjunction with XPS analysis indicate that atomic-scale Mn clusters could be responsible for the high-temperature magnetism of greater than 400 K in (In,Mn)Sb. These results demonstrate the potential of modifying the magnetic properties of (In,Mn)Sb films by controlling Mn concentration or phase composition.

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