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Epitaxial Growth and Properties of Fe and Co Co-doped Ge (100) Magnetic Semiconductor Films LIANG HE, BRIAN COLLINS, FRANK TSUI, University of North Carolina, YUNCHENG ZHONG, STEFAN VOGT, YONG CHU, Advanced Photon Source — Structural, magnetic and electronic properties of Fe and Co co-doped Ge (100) epitaxial films, grown by combinatorial molecular beam epitaxy techniques, have been studied systematically using diffraction, magnetometry, magnetotransport techniques. These experiments reveal that this epitaxial ternary system can be grown coherently on Ge (100) substrates for total doping concentrations of the transition metal dopants as high as 14 at. %, where high quality p-type magnetic semiconductor films have been synthesized with Curie temperature as high as 270 K. Above this concentration rough disordered growth occurs, which is characterized by a large number of stacking faults along the <111> directions; no phase separation has been detected for doping concentrations as high as 20 at. %. The observed magnetotransport properties exhibit large anomalous Hall coefficients and large magnetoresistance (MR) with MR ratios >100. They also indicate the presence of an acceptor level at ∼70 meV above the valence band with the resulting hole concentrations that can be controlled up to 10^{19} $cm^{-3}$by the doping concentrations. Ferromagnetic ordering, specifically the Curie temperature is shown to depend on the carrier concentration.

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