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Characterization of ferromagnetic τ -MnAl thin films grown by MBE[1] JAMES KALLY, DAVID RENCH, Pennsylvania State University, KUNHUA TU, Massachusetts Institute of Technology, DANIELLE REIFSNYDER HICKEY, JONG SEOK JEONG, RYAN WU, ANDRE MKHOYAN, University of Minnesota, CAROLINE ROSS, Massachusetts Institute of Technology, NITIN SAMARTH, Pennsylvania State University — The epitaxial stabilization of MnAl thin films in the τ-phase (tetragonal crystal structure) results in a metallic ferromagnet with a strong uniaxial out-of-plane magnetic anisotropy. The ensuing perpendicular magnetic anisotropy makes these films potentially attractive for energy efficient, high density magnetic memory applications. These thin films are also of contemporary interest for semiconductor spintronics since they can be integrated with III-V semiconductor devices. We describe the epitaxial growth of τ-MnAl films on GaAs (001), as well as the characterization of their structural, magnetic and transport properties. Thin films of τ-MnAl are prepared by molecular beam epitaxy at 250 ^{o}C. High-resolution transmission electron microscopy images show a well-ordered crystal while energy dispersive spectroscopy confirms stoichiometric control of the composition. Magnetometry measurements reveal a very high coercivity of 10 kOe, a saturation magnetization of 400 emu/cc and a uniaxial magnetic anisotropy constant K_{u} =10 Merg/cc. Further, we demonstrate a route for nanopatterning τ-MnAl films into pillars of sub-100 nm scale diameter.

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