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Embedded Ferromagnetic GdN Nano-Islands in GaN by Molecular Beam Epitaxy¹ T.F. KENT, J. YANG, L. YANG, M.J. MILLS, R.C. MYERS, Department of Materials Science and Engineering, The Ohio State University, Columbus, OH — Nano-islands of GdN are embedded into a GaN matrix by plasma-assisted molecular beam epitaxy. X-ray diffractometry shows that the cubic rocksalt islands are (111) oriented to the c-axis of the hexagonal wurtzite GaN matrix. Cross-sectional scanning transmission electron microscopy allows for the study of island formation, which occurs after 1.2 monolayers of GdN coverage, forming discrete particles, which the GaN matrix grows epitaxially around. Magnetometry reveals two ferromagnetic phases, one due to the GdN particles with Curie temperature of 70K and an anomalous phase with ferromagnetism persistent to room temperature. This room temperature ferromagnetic phase is strongly anisotropic, with out of plane magnetization nearly 300% larger than in-plane at fields less than 1T. Optical characterization reveals that GdN, when strained to GaN, is a semiconductor with direct and indirect bandgaps at 1.2eV and 0.75eV, respectively.

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