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Surface Electronic Structure of Gadolinium Nitride ZANE GERNHART, CHIN LI CHEUNG, Department of Chemistry, University of Nebraska-Lincoln, Lincoln NE 68588, JUAN COLÓN SANTANA, Department of Physics and Astronomy, University of Nebraska-Lincoln, Lincoln NE 68588, LU WANG, WAINING MEI, Department of Physics, University of Nebraska, Omaha, Omaha NE 68182 — In this work, we report our finding of the surface electronic structure of high-quality [100]-textured gadolinium nitride (GdN) thin films made by a chemical vapor deposition method. The demonstrated ability to synthesize high-quality thin films has allowed for a detailed inverse photoelectron spectroscopy (IPES) study to elucidate the surface band structure of GdN. The results of our study indicate that the band gap of the GdN surface is about a few milli-electron volts. These findings agree well with the predictions of a small density of states at the Fermi level and an overlap of bands at the gamma point from our density functional theory calculations for GdN slab models of eleven to twenty layers. Although it is accepted that GdN is ferromagnetic semiconductor, reports on the nature of the electronic structure of GdN have ranged from insulating to semi-metallic. We attribute this lack of agreement in the literature is likely due to a wide variation in the quality of the analyzed samples and the inability to consistently synthesize high-quality GdN films. Hence it is our belief that our in-depth study will provide insight to this promising ferromagnetic material with semiconducting behavior.

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