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Crystalline Quality and Surface Roughness Optimization of Hetero-Epitaxial Titanium Nitride on Sapphire. H. A. SMITH, SAID ELHAMRI, Department of Physics, University of Dayton, Dayton, OH 45469, B. M. HOWE, L. GRAZULIS, M. HILL, A. N. REED, Materials and Manufacturing Directorate, Air Force Research Laboratory, WPAFB, OH 45433 — In this project we optimized the growth of hetero-epitaxial titanium nitride (TiN) on sapphire using controllably unbalanced reactive magnetron sputtering. TiN is a mechanically-robust, high-temperature stable metallic material; these properties make TiN a material of interest for robust electrodes and resilient plasmonics. We adjusted deposition parameters such as external coil current, temperature, nitrogen/argon ratio, growth time and magnetron power to optimize the crystalline quality and surface morphology of TiN. Post-growth, we measured crystallinity using X-ray diffraction, and surface morphology using atomic force microscopy. X-ray diffraction showed a single TiN peak with pendellösung fringes; from these fringes we obtained a film thickness of ˜50 nm. Atomic force microscopy showed a surface roughness of ˜168 pm. Based on this characterization, we determined that the deposition parameters outlined in this presentation yielded (111)-oriented epitaxial TiN with minimal surface roughness. This optimization is a crucial first step in maximizing TiN's usefulness in the above mentioned applications.

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