

## Attachment 1 – DAGSI Research Topic Template

1. **Research Title:** Epitaxial Metal Nitrides for Electronic and Opto-Electronic Applications
2. **Individual Sponsor:**

Dr. Amber N. Reed, AFRL/RXAN  
AFRL/RXA Bldg652, Rm122  
2179 12th Street  
WPAFB, OH 45433-7333  
[Amber.Reed.5@us.af.mil](mailto:Amber.Reed.5@us.af.mil)
3. **Academic Area/Field and Education Level:** Electrical Engineering, Materials Science and Engineering, Physics, Electro-Optics (MS or PhD level)
4. **Objectives:** This work aims to develop epitaxial metal nitride films and heterostructures for electronic and opto-electronic applications using physical vapor deposition techniques. Additionally, material characterization will be used to determine the relationship between materials structure (i.e. crystallinity, surface morphology, defects and interface quality) and electrical and optical properties.
5. **Description:** From titanium nitride, a plasmonic material for resilient nonlinear optical systems, to aluminum nitride, a material of choice for optical waveguides, metal nitrides are a promising material system for a variety of electronic and opto-electronic applications due to a combination of robust physical properties (i.e. high temperature stability, chemical inertness and mechanical robustness) and tunable optical and electrical properties. For most applications, crystalline quality, which is partially determined by growth conditions, has a significant impact on material performance. This project will focus on the synthesis and characterization of epitaxial plasmonic nitrides (i.e. titanium nitride, zirconium nitride, and niobium nitride) and metal-dielectric heterostructures (e.g. TiN/GaN, TiN/AlN, etc. multilayers). Materials characterization of the nitrides will include electron microscopy, x-ray diffraction, atomic force microscopy, spectroscopic ellipsometry, other optical characterization and electrical characterization.
6. **Research Classification/Restrictions:** This research is unclassified and has no ITAR restrictions.
7. **Eligible Research Institutions:** DAGSI (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati)

**NOTE: Topics submitted to DAGSI must be approved for public release. Need PA Approval #**