

Ultra-wide bandgap (UWBG) materials for electronics and optoelectronics

1. **Research Title:** Ultra-wide bandgap (UWBG) materials for electronics and optoelectronics
2. **Individual Sponsor:**
Dr. Shin Mou, AFRL/RXAN
AFRL/RXA Bldg 651, Rm 229
3005 Hobson Way
WPAFB, OH 45433-7707
Shin.Mou.1@us.af.mil
3. **Academic Area/Field and Education Level:** Electrical Engineering, Materials Science and Engineering, Physics (BS/BA, MS or Ph.D. level)
4. **Objectives:** Study the fundamental properties of ultra-wide bandgap (UWBG) semiconductor materials (bandgap larger than 4 eV, e.g., AlN, Ga₂O₃, diamond, cubic boron nitride) including electronic transport measurement, defect information, photoluminescence, capacitance spectroscopy, etc. It will also involve the fabrication of the test structures for these measurements.
5. **Description:** UWBG semiconductors have the intrinsic advantages of large breakdown voltages for high power handling, emitting deep ultra-violet light, and providing stable single photon emission at room temperature due to their large bandgaps. Fundamental studies need to be pursued to understand the basic properties of these materials due to the early stage of research and development we are at. Therefore, in this topic, we look into various ways to characterize the UWBG materials to gain important knowledge on their bandstructures, electronic transport properties, defect information, interface properties, and optical emission. The characterization techniques include but are not limited to Hall-effect measurements, voltage-current measurements, capacitance spectroscopy, photoluminescence, and optical absorption. Sample preparation and test structure fabrication will also be involved to produce the test samples. The goal of this project is to generate critical and novel knowledge to evaluate UWBG materials for the interests of AF and DoD.
6. **Research Classification/Restrictions:** This research is unclassified and has no ITAR restrictions.
7. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided



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.