RX17-2

Flexible and Conformal RF Electronic Materials and Devices

1. **Research Title:** Flexible and Conformal RF Electronic Materials and Devices
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**
   Materials Engineering, Electrical Engineering, RF Electronics Engineering (MS, PhD)
4. **Objectives:** Develop materials and processing techniques for high frequency/high power electronics with consistent performance under static and dynamic mechanical loading for implementation into flexible and conformal systems.

5. **Description:** Active and passive radio frequency (RF) devices are essential for Electronic Warfare (EW) and Intelligence, Surveillance, and Reconnaissance (ISR) missions of the USAF, and are integrated into numerous platforms including passive RF sensors and radar systems. The planar and rigid nature of current RF materials and devices limit the implementation of these key war-fighter capabilities in emerging military applications including micro-UAVs and wearable electronics. In addition, the shock and vibration resilience needed for reliable use of the RF electronics in these applications is unexplored. The focus of this project is to develop new, mechanically robust RF materials and the necessary processing steps to fabricate and experimentally validate the material and device-level performance under mechanical loading. Areas of interest include the direct growth of high quality electronic materials onto low temperature substrates, processing schemes of enhancing crystallinity directly on polymer substrates by means of laser annealing, and exploring methods of removing films and devices to transfer onto flexible substrates. Semiconductor materials with high mobilities and cut-off frequencies to be considered include GaN, Ga_2O_3 (bulk and nanomembranes), InGaZnO, nanocrystalline ZnO, 2D materials, and other emerging materials within AFRL. Devices that will be constructed include both passive RF components such as antennas and traces, as well as active components including amplifiers, A/D converters, and others. RF performance of the devices including power densities and operational frequencies will be measured under both dynamic and static strain environments, and reliability characterization tools including IR imaging, Raman spectroscopy, and probe microscopy will be utilized to understand device operation. In the coming future, conformal and flexible RF electronics will become a necessary capability, as multifunctionality and savings in c-SWAP will enhance existing ISR and EW systems, as well as bring future capabilities to the warfighter.

6. **Research Classification/Restrictions:** Research will be non-classified and unrestricted.
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 #