

1. **Research Title:** Nanomaterials synthesis and processing for chemical sensing
2. **Individual Sponsor:**  
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3. **Academic Area/Field and Education Level:** Materials science and engineering, Chemical engineering, Chemistry, Physics (M.S. or Ph.D. level)
4. **Objectives:** To investigate nanomaterials for spectroscopy-based chemical sensing.
5. **Description:** Field detection of trace analytes faces challenges with reliability, cost-effectiveness, swiftness and portability. A number of portable spectroscopy-based techniques are emerging as solutions for this purpose. In particular, handheld Raman spectroscopy coupled with surface-enhanced Raman scattering (SERS) and surface-enhanced infrared absorption (SEIRA) substrates offer portability and reasonable acquisition times. In this topic, we wish to study and develop substrates based on plasmonic nanomaterials for SERS and SEIRA sensing of a variety of biomolecules and hazardous chemical analytes of interest to the DAF. The research project encompasses the study of multiplexing nanostructures to enable multi-excitation spectroscopy, exploring printing methods for the fabrication of low-cost, disposable SERS/SEIRA substrates, as well as machine learning (ML)-based classification for spectral deconvolution and classification.
6. **Research Classification/Restrictions:** This research has no ITAR restrictions
7. **Eligible Research Institutions:** Universities, AFIT, USAFA
8. **PA Approved – AFRL-2024-3669**