

1. **Research Title:** Synthesis and Surface Characterization of $\text{Si}_{1-x-y}\text{Ge}_x\text{Sn}_y$ Alloys
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Physics, Materials Science/Engineering (MS or Ph.D. level)
4. **Objectives:** The goal of this research project is to develop $\text{Si}_{1-x-y}\text{Ge}_x\text{Sn}_y$ for sensor applications: 1) remote sensing applications such as IR countermeasures, remote hyperspectral imaging, and high sensitivity chemical/biological weapons detection; 2) as a potential broad NIR, MWIR, and LWIR detector material for use in laser RADAR; 3) as a CMOS-compatible material for development of electro-optic integrated circuits (EOIC) including smart pixels for advanced focal plane arrays (FPAs); and 4) for free-space optical communication. The large size difference of these group IV elements presents unique challenges which require the development of a new approach to allow synthesis over a broad range of composition. Achieving this goal will require substantial effort in process development. Investigation of the gas phase chemistry and associated growth kinetics will provide a fundamental understanding of the surface physics and reaction chemistry involved in this process. Synthesis will be closely coupled with characterization of the basic structural, surface, electrical and optical properties of the resulting films to inform the growth optimization process.
5. **Description:** The initial phase of this project will focus on the design and assembly of an advanced chemical vapor deposition apparatus. Design of experiment (DOE) will then be used to evaluate different reaction precursors and process conditions to optimize film growth. Film composition and bonding chemistry will be determined by X-ray photoelectron spectroscopy (XPS) analysis.
6. **Research Classification/Restrictions:** unclassified
7. **Eligible Research Institutions:**
 - DAGSI (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati)
PA Approval #: Topics submitted to DAGSI must be approved for public release.
 - AFIT (only)
 - USAFA (only)
 If you are submitting a topic for the USAFA, please indicate if you are also interested in sponsoring a USAF Cadet in summer of 2013 (**Avg Cost for USAF Cadet for 33 days was \$5000**)
 Yes

Include the appropriate Distribution Statement. All topics must have an approved distribution statement.