Opportunity Title: Detection of Low Volatile Materials Fellowship
Opportunity Reference Code: ICPD-2024-43

Organization Office of the Director of National Intelligence (ODNI)

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How to Apply

Create and release your Profile on Zintellect – Postdoctoral applicants must create an account and complete a profile in the on-line application system. **Please note: your resume/CV may not exceed 3 pages.**

Complete your application – Enter the rest of the information required for the IC Postdoc Program Research Opportunity. The application itself contains detailed instructions for each one of these components: availability, citizenship, transcripts, dissertation abstract, publication and presentation plan, and information about your Research Advisor co-applicant.

Additional information about the IC Postdoctoral Research Fellowship Program is available on the program website located at: https://orise.orau.gov/icpostdoc/index.html.

If you have questions, send an email to ICPostdoc@orau.org. Please include the reference code for this opportunity in your email.

Application Deadline 2/28/2024 6:00:00 PM Eastern Time Zone

Description

Research Topic Description, including Problem Statement:

The solutions implemented for bulk and trace detection of explosives and other related materials have matured to a sufficient point that they are now widely accepted as the gold standard within the field, being capable of high levels of sensitivity. A useful augmentation to the arsenal of detection solutions would be a portable vapor detection system with optimized selectivity and sensitivity required to work outside of a laboratory environment. Current gas sampling and analysis techniques – such as gas chromatography, mass spectrometry and ion mobility spectroscopy – when used in the vicinity of particular materials allow for detection at a satisfactory concentration level. Whilst sufficient, many of the techniques used could benefit from reduced operational costs, easier sample preparation, simplified useability, and reduced need for re-calibration.

Many threat materials either have low volatility or are concealed in such a way that the amount of vapor available to detect is minimal. As well as the challenges imposed by commercial and military grade explosives, the diverse chemistries of homemade explosives (HMEs) pose an additional challenge. The complex vapor signatures of HMEs are not only highly variable, but their compositions vary with time and environmental conditions which requires additional consideration. The techniques for explosives detection should be noninvasive and based on direct detection at the source.

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The successful development of a portable system with high selectivity and the sensitivity needed would potentially find application in finding the location of an odor source, to not only classify the material of interest, but also search for the threat.

Example Approaches:

The utility of a sensor is dependent on many parameters, the most important of which is sensitivity and selectivity, which have been the focus of much research to date. Currently available commercial sensors do not demonstrate the level of selectivity required but many novel sensors have the potential to improve performance. Functionalization of receptor materials has demonstrated improvement in selectivity demonstrating the capability to characterize materials of similar chemical groups, but performance improvements in the presence of many interferents and continuous change in background (e.g., temperature and humidity) would be beneficial.

The focus of this project is to leverage emerging technology in novel sensing such as quantum sensing, polymers or nanomaterials which have the potential to enable sensors to reliably detect and identify tiny amounts of chemical vapors. The realization of accurate sensing devices would have potential applicability in the early detection and identification of airborne threats.

Approaches should include experimental methods and, where possible, comparison to existing solutions.

Key Words: detection; explosives; quantum; nanomaterials; sensing

Qualifications

Postdoc Eligibility

- U.S. citizens only
- Ph.D. in a relevant field must be completed before beginning the appointment and within five years of the appointment start date
- Proposal must be associated with an accredited U.S. university, college, or U.S. government laboratory
- Eligible candidates may only receive one award from the IC Postdoctoral Research Fellowship Program

Research Advisor Eligibility

- Must be an employee of an accredited U.S. university, college or U.S. government laboratory
- Are not required to be U.S. citizens

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.

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- **Discipline(s):**
  - **Chemistry and Materials Sciences** (12 👁)
  - **Communications and Graphics Design** (3 👁)
  - **Computer, Information, and Data Sciences** (17 👁)
  - **Earth and Geosciences** (21 👁)
  - **Engineering** (27 👁)
  - **Environmental and Marine Sciences** (14 👁)
  - **Life Health and Medical Sciences** (45 👁)
  - **Mathematics and Statistics** (11 👁)
  - **Other Non-Science & Engineering** (2 👁)
  - **Physics** (16 👁)
  - **Science & Engineering-related** (1 👁)
  - **Social and Behavioral Sciences** (30 👁)