

**Opportunity Title:** Quantum cascade laser Mid-IR spectroscopy for real time online monitoring of kinetics

**Opportunity Reference Code:** ORNL-HBCU-MEI-2017-0015



**Organization** Oak Ridge National Laboratory (ORNL)

**Reference Code** ORNL-HBCU-MEI-2017-0015

**Application Deadline** 2/18/2017 12:00:00 AM Eastern Time Zone

**Description** We are developing a new approach for high sensitivity and real-time online measurements to monitor the kinetics in the processing of nuclear materials, specifically applied to nitrate/nitrite analysis related to the separation of Np and Pu for Pu-238 production. For the proof of principle, we plan to demonstrate rapid and continuous detection and identification of chemical species in aqueous and organic reactive systems using mid infrared (Mid-IR) quantum cascade laser (QCL) high-resolution spectroscopy. The QCL-IR method has been demonstrated by ORNL as a standoff technique with the capability for trace chemical detection and identification of surface residues and environmental gases with high sensitivity and selectivity. The innovation comes from demonstration of the capability of the Mid-IR QCL spectroscopy for the first time in the detection and identification of chemical processes in aqueous and organic solution. In this standoff or off-set method, the collection of a sample for analysis is not required. A flow cell is used for in situ sampling of a liquid slipstream. A deployable prototype has been designed based on attenuated total reflection (ATR) coupled with the QCL beam for hostile environments, radiological or chemical.

**Qualifications** Faculty with experience in IR spectroscopy, FTIR, Raman, lasers, specifically quantum cascade lasers, and chemical kinetics could be very helpful to this project.

- Eligibility Requirements**
- **Degree:** Any degree .
  - **Discipline(s):**
    - **Business** (11)
    - **Chemistry and Materials Sciences** (12)
    - **Communications and Graphics Design** (6)
    - **Computer, Information, and Data Sciences** (16)
    - **Earth and Geosciences** (21)
    - **Engineering** (27)
    - **Environmental and Marine Sciences** (14)
    - **Life Health and Medical Sciences** (45)
    - **Mathematics and Statistics** (10)
    - **Other Non-Science & Engineering** (13)
    - **Physics** (16)
    - **Science & Engineering-related** (1)
    - **Social and Behavioral Sciences** (28)

**Affirmation** I certify that I am a full- time member of the teaching faculty at a

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