Opportunity Title: New Class of (Semi)Fluorinated Proton-Conducting Polymers with Superior Properties for PEM Fuel Cell
Opportunity Reference Code: ORNL-HBCU-MEI-2020-0006

Organization Oak Ridge National Laboratory (ORNL)

Reference Code ORNL-HBCU-MEI-2020-0006

How to Apply All documents must be submitted via Zintellect. All application components **must** be completed and received in the system in order to be considered.

Application deadline January 10, 2020 at 11:59 pm EST.

For questions, please contact HBCUMEI@orau.org.

Application Deadline 1/10/2020 11:59:00 PM Eastern Time Zone

Description ORNL is the largest science and energy laboratory in the Department of Energy system. Areas of research include materials, neutron sciences, energy, high-performance computing, systems biology and national security. Visit http://www.youtube.com/watch?v=NSCdUJ8cavw to discover some exciting reasons why ORNL offers a great internship experience!

Benefits:

- Selected faculty spend 10 weeks (Summer Term) at Oak Ridge National Laboratory (ORNL) engaged in a research project under the guidance of a laboratory scientist.
- Faculty members build collaborative relationships with ORNL research scientists, become familiar with ORNL sponsored research programs, scientific user facilities, and potential funding opportunities.
- ORNL may provide laboratory tours, scientific lectures and seminars, workshops on accessing ORNL scientific user facilities.
- Host laboratories provide all required site specific training.

Project:

Proton exchange membranes (PEM), also known as polymer electrolyte membranes, are a cornerstone of the technology that facilitates direct conversion of chemical fuels, such as hydrogen, into electric energy via electrochemical processes. Finding new materials that possess improved proton conductivity, in combination with the ability to operate under extreme conditions (i.e., low humidity and high temperatures), will significantly expand applicability of PEM fuel cells in transportation and other areas. The overarching goal of this proposal is to overcome current PEM limitations and develop efficient synthesis of materials with superior proton-conducting and mechanical properties, at high temperature and low humidity. To address this goal, we will focus on semifluorinated polymers which have the potential to have the desired properties with the key challenges that need to be overcome by answering the following questions: How does the molecular structure of fluorinated sulfonimide monomers impact regiochemistry of the reaction with nucleophiles and the structure of the resulting polymers? How is the regiochemistry of nucleophilic reactions affected by the molecular structure of the fluorinated sulfonimide? We will take advantage of one of a kind fluorine chemistry expertise available in the Chemical Sciences Division to support advances in synthesis science and ORNL's unique solid-state fluorine nuclear magnetic resonance

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spectroscopy and neutron diffraction capabilities to probe physico-chemical properties of fluoroarylsulfonimide monomers and polymers.

ORNL Mentor/Point of Contact (email address): Ilja Popovs (popovsi@ornl.gov)

Qualifications

Applicant must be a faculty member at a HBCU/MEI at the time of application.

Faculty Qualifications/Skills Desired: Faculty member with expertise in synthetic organic chemistry, physical organic chemistry, polymer chemistry, materials science or related field. Specifically, synthesis and characterization of small organic molecule compounds and/or polymer electrolyte membranes would be helpful. Familiarity with spectroscopic techniques such as proton and fluorine NMR, IR spectroscopy., as well as gravimetric characterization i.e. TGA would be helpful too.

Eligibility Requirements

- **Citizenship:** LPR or U.S. Citizen
- **Degree:** Any degree .
- **Discipline(s):**
  - **Chemistry and Materials Sciences** (12)
  - **Communications and Graphics Design** (2)
  - **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** (2)
  - **Physics** (16)
  - **Science & Engineering-related** (1)
  - **Social and Behavioral Sciences** (27)

Affirmation I am a faculty member at one of the nationally recognized HBCU or MEI institutions. I can provide certification of my faculty position, if requested.