

## **Application of Microfluidic Electrochemistry to Understand Crud Formation and Materials Degradation in Nuclear Energy Applications**

### **Executive Summary:**

The CUNY Energy Institute's focus is on the research and development of advanced energy technologies that reduce oil imports: electricity generation and storage, as well as thermal hydraulics and thermal storage for nuclear applications. Our expertise in electrochemistry and materials science can be used to answer important questions in the nuclear field, such as the impact of aging on existing nuclear reactors, ways to safely extend the lifetime of the current fleet, and the study of advanced nuclear reactors that will be constructed in the US over the next twenty to thirty years. The program will support a post-doctoral researcher and three students. This team will conduct *in situ* studies of the development of crud and the failure of nickel alloys and steels using silicon nitride based microfluidics. The team will also use multiphysics packages to integrate the findings of other CUNY EI researchers with the electrochemical data. Extending the Nuclear Thermal-Hydraulics and Safety Research Laboratory, the proposal focuses on a program to examine materials degradation phenomena at the City College of New York (CCNY). Since CCNY is a minority and a Hispanic Serving Institution, the proposed materials research program will provide minority students with the knowledge, experience, and skills needed to understand the structural needs of current and next generation reactors. The Faculty Development Grant will be used by Dr. Daniel Steingart, a tenure-track Assistant Professor in the Department of Chemical Engineering at CCNY to develop a research program on the study of the failure mechanisms of reactor materials. Professor Steingart has experience in electrochemical modeling and experiments, having spent extensive time and effort producing next generation batteries as well as implementing metal electrowinning plants with *in situ* observation devices.

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