Nuclear Fuels and Materials Characterization Enhancement at Idaho National Laboratory

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ABSTRACT:

The objective of this effort is to enhance nuclear fuels and materials transmission electron microscopy (TEM) characterization throughput and data quality at the Center for Advanced Energy Studies and INL and make these capabilities available to the broader nuclear fuels and materials research community. The first objective to obtaining this goal is achieving a higher standard in preparation of nuclear fuels and materials for transmission electron microscopy through integrating existing conventional sample preparation and focused ion beam-based (FIB) lift-out techniques with concentrated, ultra-low energy argon (Ar) ion beam processing available through the requested Fischione 1040 NanoMill. A firm understanding of radiation effects in reactor materials is imperative to understanding and mitigating deleterious radiation-induced changes in reactor materials and nuclear fuels. The project will impact a broad range of nuclear fuels and materials by substantially improving quality of the existing sample preparation procedures, increasing productivity, establishing new procedures for working with irradiated materials and setting higher data standards.

The second objective of this request is to obtain a Topspin ASTAR™ system to greatly expand existing TEM capabilities at CAES. The system provides automated crystallographic indexing and orientation/phase mapping of samples in the TEM. It presents a significant technological advancement to the characterization capabilities of the TEM that will result in a dramatically improved performance to cost ratio. The system will increase the speed at which data is generated and will significantly reduce analysis time. This will result in increased research output and will increase researcher's efficiency and quality of results.

Installed at CAES these systems will be made available for use on radioactive materials. The systems will be made available through the ATR NSUF and be used as an educational training tool for nuclear scientist, engineers, students at any level of education as well as other researchers involved in nuclear fuels and reactor materials research.