New Diffraction Contrast Tomography Capability For Application and Technique Development in Nuclear Fuels and Materials Research

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ABSTRACT:

The requested instrumentation described here will provide new diffraction-contrast x-ray tomography (DCT) equipment for the characterization of metallic and ceramic nuclear fuels. The goal of this project is to apply DCT to support educational efforts and to provide a new capability to support DOE Nuclear Energy sustainability and R&D efforts. DCT provides non-destructive microstructural information in the form of three dimensional crystallographic/diffraction and grain orientation information from heterogenous polycrystalline samples. DCT coupled with traditional absorption computed tomography and phase contrast tomography modalities (on the same instrument) will be particularly advantageous to characterize microstructure across multiple-length scales. Such a capability could prove to be revolutionary in uncovering the origins of degradation in nuclear structural materials including structural materials.

The proposed equipment represents a unique capability and will leverage significant existing equipment and expertise at the host institution and represents a new addition to the NSUF suite of characterization tools. The DCT technique will also provide greater access to tomographic imaging coupled with crystallographic and structural information to the entire nuclear community. Moreover, this request represents a set of equipment that will be excellent teaching instruments with which simple, small-group laboratory sessions can be organized around.