



Multipurpose High-Resolution X-Ray Diffractometer for Nuclear Energy Research and Education

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ABSTRACT:

We plan to procure an advanced multipurpose X-ray diffraction (XRD) system for the benefit of nuclear materials research and education at The University of Tennessee. The special features of this XRD system include: (1) high resolution, high intensity, advanced X-ray beam optics; (2) a centric Eulerian cradle on a 2-axis goniometer; and (3) three types of detectors (NaI- Scintillation (0D), Lynx-Eye XE (linear 0D and 1D) and the Vantec-500 (2D) detector). This system will be capable of performing quantitative and qualitative phase analysis, high resolution XRD, X-ray Reflectometry, reciprocal space mapping, grazing incidence in-plane and out of plane diffraction, conventional and grazing incidence small angle X-ray scattering, texture, residual stress measurements and Laue measurements. The system will be configured and procured from Bruker and installed at the UT Science Engineering and Research Facility. It will be finally moved to the new center of excellence, Joint Institute of Advanced Materials, where it will be operated and maintained as a recharge facility. This system will allow UT materials researchers to examine and quantify materials behavior upon exposure to extreme conditions such as radiation, corrosion and mechanical stress. This new XRD capability will serve to enhance research and education in nuclear science and engineering at UT. In addition, several other academic departments at UT will also use this new XRD system to perform interdisciplinary research. Ten organizations at UT have signed up to contribute towards the cost-sharing portion of this Nuclear Energy University Programs (NEUP) infrastructure proposal. This proposed advanced XRD system will be a major improvement to UT's university infrastructure and its basic research and development capabilities. It will allow us to perform first-rate research on several existing NE projects (7 NEUP) at UT, as well as to provide our graduate and undergraduate students with the opportunity to use state-of-the-art experimental instrumentation, thus allowing them to participate in outstanding, cutting-edge, and innovative research.