

# **RESIDUAL STRESSES IN ALUMINUM CLAD URANIUM-10WT%MOLYBDENUM FUEL PLATES**

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The mission of the Global Threat Reduction Initiative (GTRI) of the National Nuclear Security Administration (NNSA) in the U.S. Department of Energy is to reduce and protect vulnerable nuclear and radiological material located at civilian sites worldwide by providing support for countries' own national programs. The GTRI Reactor Convert program converts research reactors from the use of highly enriched uranium (HEU) to low enriched uranium (LEU). The baseline fuel for conversion of high performance research reactors is aluminum clad monolithic uranium-10wt.% molybdenum (U10Mo). One bonding technique for the fuel to the cladding is hot isostatic pressing. The thermal expansion of U10Mo is roughly half that of aluminum, so a significant residual stress is expected following cooling from the pressing temperature. Finite element analysis (FEA) has been completed to calculate the residual stress and other properties under varying processing specifics, but model validation is necessary. The residual stress field was measured with 0.1mm resolution on mini fuel plates (0.25 mm thick U10Mo, 1mm thick Al-clad) in transmission with high-energy x-ray diffraction at beamline 1ID-C at the Advanced Photon Source. The entire Debye rings of five U10Mo (bcc) peaks were collected using an area detector and "caked" into 24 diffraction patterns. This was repeated with the sample normal to the beam and rotated 45° and 60° about a vertical axis to allow the full strain, and subsequently the stress tensor to be determined. In-plane compressive stresses of greater than 150MPa were observed in the U10Mo. The diffraction results will be compared to the model and the importance of the measurements at three sample orientations discussed.