

## **AUTHORS**

Richard S. Triplett

Donald J. Weidner

Matthew L. Whitaker

Haiyan Chen

## **TITLE**

Anvil Development for the DT25 Press and Mineral Physics Applications

## **ABSTRACT**

The maximum pressure for experiments utilizing multi-anvil apparatus is limited primarily by the properties of available ultra-hard (UH) materials. Investigation of the properties of lower mantle minerals requires pressures in excess of 30 GPa at relevant high temperatures, which has not been reasonably reachable for large-volume experiments. Factors involved include the interaction of steel 1st-stage anvils with UH 2nd-stage anvils, the difference in compressibility of cemented carbide versus x-ray transparent UH materials (e.g. polycrystalline diamond and cubic boron nitride), and the consideration of material strength vs. plasticity and toughness on the capability and the reusability of anvils. The DT25 press is a Kawaii-style large-volume multi-anvil apparatus which accepts 25 mm 2nd-stage anvils, to be the primary device at the new NSLS-II beamline 28ID2-D (XPD-D). Utilizing the large anvil size and advances in UH materials we develop techniques to do new experiments at lower mantle conditions. Our goal is to routinely reach pressures over 30 GPa and temperatures over 1800 K with large volume samples (3 mm anvil corner truncation), while retaining the ability to gather x-ray diffraction data along a majority of the circumference of the Debye-Scherrer rings. These capabilities will enable entirely new types of studies on the elasticity and the rheology of lower mantle minerals.