High Temperature X-ray Diffraction (HT-XRD) Analysis of Simulated Defense Waste Process Facility (DWPF) Glasses

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The processing of nuclear materials at the Savannah River Site has generated approximately 34 million gallons of high level radioactive waste. The Defense Waste Processing Facility (DWPF) converts this liquid waste into glass, which is suitable for long term storage in a geologic repository.

Simulated DWPF glasses are subjected to a heat treatment using the DWPF canister centerline cooling schedule to determine potential crystalline phases that form upon slow cooling. This schedule replicates the same conditions found in the glass at the center of the DWPF canister. The process starts at 1150 °C, which is the melting temperature of the glass, and cools the glass to 400 °C over a programmed cooling rate. Characterization of the slow cooled glass is preformed to assess the crystalline phases to determine the impact of the crystalline phases on the glass durability or repository performance.

The focus of this study was to use high temperature x-ray diffraction to determine the metastable and stable crystalline phases as a function of cooling temperature. An Anton Paar HTK 1200 camera was used and programmed with the centerlined cooling schedule. The results of this research will be presented.