

IN-SITU PHASE DIAGRAM DETERMINATION OF THE $\text{HfO}_2\text{-Ta}_2\text{O}_5$ BINARY UP TO 3000°C

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Ceramic equilibrium phase diagrams have proven to be difficult to produce for materials above 1500 °C. We demonstrate that in-situ X-ray diffraction on laser heated levitated samples can be used to elucidate phase fields. In these experiments, solid spherical samples are suspended and rotated by a gas stream through a conical nozzle levitator, heated by a 400 W CO_2 laser at Argonne National Labs beamline 6-ID-D. X-ray diffraction patterns suitable for Rietveld refinement were collected at 100°C temperature intervals and were used to determine the phase fraction of phases present. The temperature of each phase was determined based on thermal expansion data collected by using powder diffraction in conjunction with the Quadrupole Lamp Furnace (QLF) at beamline 33-BM-C. $\text{HfO}_2\text{-Ta}_2\text{O}_5$ was used as an example system.

The phase equilibria of the $\text{HfO}_2\text{-Ta}_2\text{O}_5$ oxide system are important when studying high temperature Hf-Ta alloys and high temperature HfC-TaC composites. The $\text{HfO}_2\text{-Ta}_2\text{O}_5$ phase diagram will be able to provide great insight into degradation and corrosion of Hf-Ta and HfC-TaC during application.