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IN SITU STUDY OF PHASE TRANSFORMATIONS AND PHASE EQUILIBRIA IN THE TANTALA AND HAFNIA BINARY SYSTEM

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Abstract

Tantala (Ta₂O₅) has useful dielectric, optical, catalytic and chemical properties while hafnia (HfO₂) has found applications as a high temperature structural ceramic. Tantala and hafnia ceramics have yet to be studied in detailed. During this study, the Ta₂O₅-HfO₂ binary system was investigated using high temperature x-ray diffraction from room temperature to 1650°C in air using synchrotron radiation. The crystal structures of Ta₂O₅, HfO₂ and Hf₆Ta₂O₁₇ were examined with their corresponding phase transformations and 3-D thermal expansions.

In situ synchrotron study of the monoclinic to tetragonal transformation on heating in hafnia (HfO₂) showing a volume decrease on heating (red) as well as a volume increase and hysteresis on cooling (bleu).

\[ \frac{\Delta V}{V₀} = -2.73 \pm 0.04\% \]  \[ \frac{\Delta V}{V₀} = 2.99 \pm 0.06\% \]