

MECHANICAL AND THERMAL PROPERTIES OF ZETA PHASE TANTALUM CARBIDE AT ELEVATED TEMPERATURES

Evan Schwind, Missouri University of Science and Technology, USA
ecsg3f@umsystem.edu

Greg E. Hilmas, Missouri University of Science and Technology, USA
William G. Fahrenholtz, Missouri University of Science and Technology, USA

Zeta phase tantalum carbide (ζ -Ta₄C_{3-x}) is an ultrahigh temperature ceramic of interest to the ceramic engineering community due to its potential to provide high fracture toughness. High phase purity zeta phase tantalum carbide was synthesized and densified using reaction hot pressing of tantalum hydride powder and carbon black powders. X-ray diffraction and Rietveld refinement were used to ensure high phase purity. The microstructure of the synthesized ζ -Ta₄C_{3-x} was imaged using scanning electron microscopy. Fracture toughness and flexure strength were measured at elevated temperatures up to 2000°C. Thermal diffusivity and heat capacity were measured at room and elevated temperatures and the thermal conductivity was calculated. Electrical resistivity was also measured at room and elevated temperatures.

This study is the first time that the mechanical and thermal properties of ζ -Ta₄C_{3-x} have been investigated at elevated temperature.