OXIDATION RESISTANCE OF MULTI-COMPONENT CARBIDE AND BORIDE UHTCS

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Bulk samples of high entropy ultra-high temperature ceramics (UHTCs) of the composition (HfNbTaTiZr)C and (HfNbTaTiZr)B_2 were fabricated via high energy ball milling and spark plasma sintering. Oxidation behavior of this new class of UHTCs was tested at 1500ºC and 1700ºC using a resistive heating apparatus in 1 atmosphere reduced PO_2 oxygen/argon gas mixtures for times between 5 minutes and 1 hour. Oxidation kinetics were determined from the variation of oxide thickness vs. time. Oxide composition and morphology were characterized using XRD, SEM, and EDS. A nearly continuous layer of complex oxides was observed on the surface, and a subsurface layer showed evidence of selective grain boundary oxidation. Rapid oxidation rates were observed for both carbide and boride at 1500ºC, even in 1% O_2/balance Ar. This work serves to further elucidate the oxidation behavior of a new class of ceramics that are proposed for ultra-high temperature applications where oxidation properties are of key importance.