Reactions and Microstructures of Materials in the Hf-N-B Ternary System

Eric J. Wuchina and Mark M. Opeka
Naval Surface Warfare Center
Bethesda, MD

Single- and multi-phase Hf-N-B materials were produced by solid-state reaction using combinations of Hf, HfN, B, BN, and HfB_2 starting materials. Hot pressing conditions and reactant concentrations were varied to produce ceramics with differing proportions of HfB_2, HfN, and α-Hf. X-ray diffractometry was used to analyze phase composition, while scanning electron microscopy was employed to identify microstructure and phase morphology in polished cross sections and fracture surfaces. Figure 1 is a backscattered electron image of a polished cross section that shows needle-like HfB_2 grains in a matrix of HfN and αHf. It has been found that the HfB_2 morphology is dependent on the composition of matrix phase. Oxidation testing was conducted to identify the effects of B/N ratio and microstructure on oxidation rates and oxide scale morphology for selected compositions.

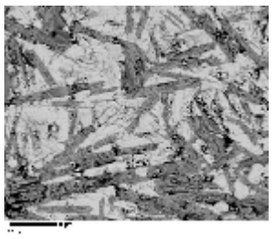

Figure 1. BSE of αHf/HfN/HfB_2 Material