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HIGH TEMPERATURE OXIDATION BEHAVIORS OF ZrB2-SiC COMPOSITES

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Summary: The oxidation behavior of zirconium boride composites with various SiC contents (0-40 vol%) at 1500 °C in air (pO2= 10^4 Pa) and under low pO2 (10^-8 Pa) was investigated. Due to different oxidation kinetics calculated from the oxidation depths, the oxidized composites exhibited different layered structures. In addition, the composites of ZrB2-30 vol% SiC (one of the typical compositions) oxidized at 1500 °C for 10 h in air and under low pO2 conditions were analyzed using TEM (transmission electron microscope). Due to kinetic difference of oxidation behavior, the three layers (surface silica-rich layer, oxide layer, and unreacted layer) were observed over a wide area of specimen in air, while the two layers (oxide layer, and unreacted layer) were observed over a narrow area in specimen under reducing condition. Based on TEM analysis of ZrB2-SiC composites tested under air and low oxygen partial pressure, the ZrB2 begin to oxidized preferentially and the SiC was remained without any changes at the interface between oxidized layer and unreacted layer. The high temperature oxidation kinetics of composites also evaluated. In air, the oxidation depth as a function of time indicated a parabolic kinetic behavior, and the ZrB2-40 vol% SiC composite exhibited the lowest parabolic rate constant (kP) of 232 um^2/h. Under low pO2, the oxidation depth as a function of time indicated a parabolic to linear transition kinetic behavior, except for monolithic ZrB2. The monolithic ZrB2 exhibited the lowest parabolic rate constant (kP) of 811 um^2/h.