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Properties of ZrB_2 Thin Films Grown by E-Beam Evaporation[1]
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Zirconium diboride (ZrB_2) is a candidate material for many high temperature applications because it has a high melting point, high hardness, thermal shock resistance, and metallic conductivity. However, very little work has been reported concerning growth of ZrB_2 thin films and high temperature oxidation behavior. In this study, ZrB_2 films with nominal thickness of 200 nm have been deposited using electron-beam evaporation of either ZrB_2 pellets or elemental B and Zr sources. The ZrB_2 source yields a film that has a 1:1 Zr:B average composition as measured by X-ray photoelectron spectroscopy, consisting of ZrB_2 precipitates within an amorphous Zr matrix as determined by X-ray diffraction. Use of elemental B and Zr sources allows precise control of film growth over a range of stoichiometries and yields ZrB_2 films with much lower oxygen contamination. After annealing ZrB_2 films to 1200°C in air, oxidation leads to a loss of B and formation of a textured monoclinic ZrO_2 phase. Several strategies, including deposition of a thin Al_2O_3 capping layer over the ZrB_2 film are being pursued in an attempt to stabilize the electrically conductive ZrB_2 phase at high temperature, where it can be used for high temperature electronic devices in harsh environments.

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