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Oxidation resistance of Ta doped WB2-z coatings

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Future tasks in many different fields of academia and industry are directed towards environmental sustainability, asking also for new advances in the field of protective coating materials. Especially, transition metal diboride based thin films exhibit a great potential to be applied in various applications, due to their extreme refractory character as well as interesting electrical properties. Latest studies on various diborides emphasized their strong and weak points being on the one hand high hardness and phase stability in a wide range but on the other, the limited oxidation resistance. Alloying concepts involving transition metals (TM) such as W, Ta, or Zr forming ternary diborides ($TMI_{1-x}TMII_xB_{2-z}$) suggest to be a proper solution to overcome these restrictions.
Hence, the oxidation behaviour of $WTaB_2$ thin films was experimentally investigated up to 700 °C and annealing times from 1 to 1000 minutes. Decreasing oxide scales and a change from linear to paralinear or parabolic oxide growth mode have been attested for coatings with increasing amount of Ta. Thus, adding Ta to α-structured WB_{2-z} does positively influence the oxidation resistance. Due to resolution limits regarding boron detection with EDS technology, we additionally conducted TOF-ERDA. Especially, tungsten rich coatings revealed nearly boron free oxide scales, indicating a clearly volatile character of boron containing oxides during heat treatment. Moreover, a distinct increase in oxide scale density with increasing Ta content could be detected, also underlined by detailed TEM investigations.

Keywords
Ternary Borides
Protective Coatings
Oxidation Resistance
Scale Formation