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Presented at the 2nd International Congress on Ceramics (ICC2), Verona, 29 giugno- 4 luglio 2008
Promoted by the European ceramic Society and the Italian Ceramic Society

Microstrure Characterization of Boride-based Ultra-High Temperature Ceramics

Laura Silvestroni,[1,2] Diletta Sciti,[1] Alida Bellosi[1]

Stefan Lauterbach,[2] Hans-Joachim Kleebe[2]

[1]*CNR-ISTEC, Institute of Science and Technology for Ceramics, Via Granarolo 64, I-48018 Faenza, Italy*

[2]*Institute of Applied Geosciences, Technische Universität Darmstadt, Schnittspahnstraße 9, D-64287 Darmstadt, Germany*

THEME 3 – Poster presentation

Abstract

Hafnium and zirconium borides are leading candidate materials for use in ultra-high-temperature applications thanks to their excellent combination of physical, mechanical and oxidation resistance properties. It has been shown that the addition of $MoSi_2$ allows the densification without the application of pressure, improves the oxidation resistance and the mechanical properties at high temperatures.
Despite the use of this sintering additive for several ultra high temperature ceramics, the densification mechanisms are still unclear and matter of debate.

Transmission electron microscopy (TEM) is a powerful tool to explore microstructure at small length scale. A careful literature analysis reveals that neither detailed TEM work nor ~~any~~ reports on densification mechanism are available for this class of materials.

In the present work, the microstructure of HfB_2-$MoSi_2$ and ZrB_2-$MoSi_2$ composites was analyzed in detail in order to gain an insight into the densification mechanism during pressureless sintering.
The formation of solid solutions was observed in ZrB_2-$MoSi_2$ system, whilst the solubility of Mo into HfB_2 lattice seems to be more limited. For both composites the presence of $(TM,Mo)_5SiB_2$, where TM=Hf or Zr, was detected. The formation of secondary phases is analysed and discussed in accordance with thermodynamical calculations and the phase diagrams.