Dr. William G. Fahrenholtz

University of Missouri – Rolla, Ceramic Engineering Department

"Processing and Characterization of ZrB2-Based Ultra-High Temperature Monolithic and Fibrous Monolithic Ceramics"

University of Missouri-Rolla Ceramic Engineering Seminar Series Speaker
Thursday January 29, 2004

McNutt Hall, Room 204
3:30pm

Biography:

Dr. Fahrenholtz earned a BS in Ceramic Engineering from the University of Illinois at Urbana-Champaign (U of I) in 1987 and a MS in Ceramic Engineering also from U of I in 1989 under Dr. David A. Payne. He earned his PhD from the University of New Mexico in 1992 under Dr. Douglas M. Smith. Dr. Fahrenholtz worked as an Assistant Professor of the Department of Chemical and Nuclear Engineering at the University of New Mexico from 1993 to 1999. Dr. Fahrenholtz joined the Ceramic Engineering Department of the University of Missouri – Rolla in 1999 where he currently serves as an Assistant Professor.

Abstract:

Zirconium diboride (ZrB_2) based ultra-high temperature ceramics either unmodified or with SiC particulate additions of 10, 20, or 30 volume percent were prepared by conventional hot pressing. The ZrB_2-SiC compositions had improved four-point bend strength compared to the ZrB_2 prepared in our laboratory as well as other reported ZrB_2 or ZrB_2-SiC materials. Strength and toughness increased as the amount of SiC increased. Measured strengths ranged from ~550 MPa for ZrB_2 to over 1000 MPa for ZrB_2-30% SiC. Likewise, toughness increased from 3.5 MPa•$m^{1/2}$ to more than 5 MPa•$m^{1/2}$ over the same composition range. The addition of SiC also improved oxidation resistance compared to pure ZrB_2.

Co-extrusion processing was used to produce ZrB_2-based ultra-high temperature ceramics with a fibrous monolithic structure. Samples had dense ZrB_2-30 vol.% SiC cells approximately 100 µm in diameter surrounded by porous ZrB_2 cell boundaries approximately 20 µm thick. ZrB_2-based fibrous monoliths had four point bend strength of ~450 MPa, about half of a conventional ZrB_2-SiC ceramic with the cell composition. Preliminary analysis of fracture behavior found that ZrB_2-based fibrous monoliths did not exhibit graceful failure because the difference in strength between the cell and cell boundary of the current materials was not sufficient.

A meeting of the UMR Chapter of the American Ceramic Society and the Missouri Chapter of Keramos will follow the Seminar in McNutt 211.

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