

MSE SEMINAR

March 30, 2018

113 McBryde Hall

3:30 – 4:30 PM

Refreshments at 3:00 PM

David Cyprian Hicks

Graduate Student

Materials Science and Engineering, Virginia Tech

“Aligned Continuous Cylindrical Pores Derived from Electrospun Polymer Fibers in Titanium Diboride”

ABSTRACT

The use of electrospun polystyrene to create long range, continuous, ordered multi-scale porous structures in Titanium Diboride (TiB_2) has been explored. The introduction of electrospun polystyrene fibers as a sacrificial filler into a colloidal suspension of TiB_2 allows for easy control of pore size, volume percent porosity, and long range ordered pore structures within the sintered ceramic. Green bodies were formed by vacuum infiltrating an electrospun-fiber-filled mold with the colloidal TiB_2 suspension. The size, volume, uniform distribution, and dispersion of the pores was optimized by carefully selecting the fibers material, its diameter, the solvent type and the solid content of TiB_2 . Samples were partially sintered at 2000°C in argon to form a multiscale pore structure. Continuous aligned cylindrical pores from the fibers (5–10 μm) and random porosity between the ceramic particles from partial sintering (300–900 nm) were revealed under the SEM. TiB_2 near-net-shaped parts with this multi-scale porosity and porosities from 50% to 70% were successfully cast and sintered. This low cost processing technique facilitates the production of thermally and mechanically anisotropic structures into near-net shape parts, for extreme environment applications, such as ultra high temperature insulation.

BIOSKETCH

David Cyprian Hicks is a Master's student in Dr. Tallon's Group. He graduated from Virginia Tech with a bachelor of engineering in Materials Science and Engineering in 2017 and started his M.S. as part of the MSE Accelerator Program. His expected completion date is July 2018. In the Tallon Research Group, his research focuses on new processing methods, and high temperature characterization for functional multi-scale porous materials for applications in hypersonic flight. His research won the Paul E. Torgersen Excellence in Graduate Research Award Spring 2017. He is also one of the recipients of the Dr. Gary S. Clevinger, Sr. Memorial Endowed Scholarship for 2018. In 2008 while in 8th grade he won his High School conference art competition, with a torn paper collage of a sunflower. He also is a member of the VT APEX High Altitude Balloon Team and a Merck Scholar. The work of this presentation has been done in collaboration with Dr. Liu and Dr. Zhou, in the Chemistry Department at VT.