

April 16th, 2021**Optimization of the Dip Coating Process with Zirconium Diboride****Allison Slominski and Carolina Tallon***Department of Materials Science and Engineering,
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With hypersonic vehicles, or vehicles that travel at Mach 5 or above, there has been a need for effective thermal protection systems due to the extreme environment they operate in. A class of advanced ceramic materials called ultra-high temperature ceramics (UHTCs) have been identified as a suitable option as part of these thermal protection systems and other related applications. UHTCs are characterized by their high melting points (above 3000°C) and high thermal conductivities. This project focuses on using colloidal processing routes with UHTC powders to create uniform, stable coatings using slurry-based dip coating. Dip coating is a physical deposition method where the withdrawal stage of the substrate from the slurry is the biggest determinant of the thickness and quality of the coating. To accomplish this process, a dip coating rig was constructed using a stepper motor to control the withdrawal speed and dwell time. Zirconium diboride (ZrB_2), a UHTC material, was used as both the coating and substrate material (with dense and porous microstructures), as to concentrate on the optimization of the coating process. Analysis focused on assessing the quality and adhesion of the coatings produced, observing the coating-substrate interface, and evaluating trends observed due to the adjustment of different parameters in the coating process. The work on this project is being used as a proof-of-concept for a study into new hybrid-slurry coating methods using colloidal processing for high entropy rare earth oxides in turbine engines operating at high temperatures.

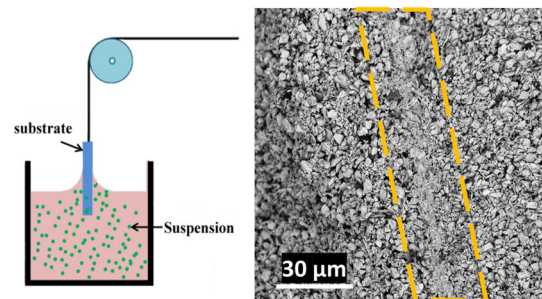


Fig 1. (Left) Schematic of the Dip Coating Process used and (Right) Magnified image of Coating-Substrate Interface, pictured in the highlighted area

Biography

Allison Slominski is a 1st-year Masters of Engineering student in Dr. Tallon's group, in the Department of Materials Science and Engineering at Virginia Tech. She is expecting to graduate in Summer 2021. She completed her B.S. in Materials Science and Engineering also at Virginia Tech in Spring 2020. Allison's focus is on ceramic processing and advanced manufacturing techniques for aerospace applications.

