

ULTRA-HIGH TEMPERATURE CERAMIC COATINGS AND STRUCTURES FORMED BY VACUUM PLASMA SPRAY

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Group IVB and VB transition metal carbides, nitrides, borides and oxides are attractive for extreme environment applications. While stoichiometric phases tend to exhibit the highest temperature capability, highest hardness and superior chemical inertness, mixtures of binary stoichiometric phases and non-stoichiometric phases have demonstrated tailorable mechanical properties. Ternary systems have also exhibited unique mechanical properties in addition to superior oxidation behavior. Efforts at Plasma Processes, using vacuum plasma spray (VPS) fabrication, have focused on advancing the technology readiness level (TRL) and manufacturing readiness level (MRL) of various ultra-high temperature ceramics in the form of coatings and structural components. Studies have included fabrication and characterization of VPS deposits comprised of the following chemistries: Ta-C, Ta-Hf-C, Hf-N, Hf-Ta-N, Zr-C, Zr-O, Zr-C-Hf-O. This presentation will provide an overview of select chemistries and discuss the following:

- Temperature-dependent physical and mechanical properties
- Processing-microstructure-property relationship
- Progression from coupon to sub-scale to full-scale fabrication

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