Contribution ID: **42** Type: **2. Invited speaker (by invitation only)**

Elemental grain boundary segregation and geometry during spark plasma sintering of multi-component carbides

Monday, 31 August 2026 16:01 (30 minutes)

Multi-component carbides are promising materials for ultra-high temperature applications, offering greater tunability of properties and design flexibility. However, they still suffer from processing challenges that must be addressed before full advantage can be taken during use in advanced technologies. In this study, we describe the spark plasma sintering and grain boundary characterization of (Mo-Nb-Ta-V-W)C (MNTVW-C) multi-component carbides. Specifically, we describe variations in grain boundary chemistry in MNTVW-C, sintered from either the single-phase rock-salt carbide powder, or from powders that include the rock-salt carbide phase, Mo2C and W2C. Grain boundaries in the sintered ceramic fabricated from the pure carbide powder possess greater levels of tungsten segregation. Additionally, the grain boundary geometry varies significantly between samples. The concentration (measured in percent length) of lower energy special grain boundaries is increased measurably in the ceramic prepared from multi-phase powder. These microstructural variations may have consequences in the bulk MNTVW-C behavior connected to fracture strength, creep resistance, oxidation behavior, and thermal or electrical transport. Grain boundaries can act as fast diffusion pathways and preferred sites for chemical reactions, making their local composition especially influential in high-temperature and extreme environments. These effects will be considered in detail during this talk.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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Session Classification: Field assisted sintering technology/Spark Plasma Sintering FAST/SPS

Track Classification: Group 3: Field assisted sintering technology/Spark Plasma Sintering FAST/SPS