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Preparation of (VNbTaMoW)C High Entropy Carbide from a High Entropy Alloy Using Different Sintering Techniques

High entropy carbides (HEC) represent a promising class within the emerging field of high entropy ceramics. HEC are attractive due to their high hardness and excellent wear and oxidation resistance. However, achieving high densification while maintaining a homogeneous microstructure remains a significant processing challenge.
This study investigates the preparation of a HEC with (VNbTaMoW)C composition using three sintering approaches: spark plasma sintering (SPS), conventional pressureless sintering, and ultra-fast high-temperature (UHS) sintering. The carbide was synthesised from a high entropy alloy precursor combined with graphite, offering an alternative processing route for HEC fabrication compared to the commonly used mechanical alloying approach.

Sintering temperatures were set above 1800 ℃ for SPS, 2050 ℃ for conventional pressureless sintering, and over 3000 ℃ for UHS. The effect of UHS processing conditions on densification was also investigated. The prepared samples were characterised in terms of phase composition and microstructure by using SEM/EDX and XRD. Hardness was evaluated using Vickers indentation.

The influence of the sintering method on densification behaviour, hardness, and microstructural development was evaluated. The results provide insight into suitable sintering routes for processing HEC derived from alloy–carbon precursor systems and reveal significant differences in densification behaviour among the sintering methods.

Professional Status of the Speaker

Doctoral or Master Student

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No

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