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Microstructure Evolution in Spark Plasma Sintered Hafnium-Tantalum Carbides

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Hafnium carbide and Tantalum carbide are ultrahigh temperature ceramics and possess superior oxidation resistance in oxygen rich and oxygen deficient environments respectively. This study focuses on synthesizing fully dense ceramic composites with 5 different compositions (Pure HfC, HfC-20 vol.% TaC, HfC- 50 vol.% TaC, TaC-20 vol.% HfC, and pure TaC) by spark plasma sintering without any sintering aids. A detailed analysis of the microstructural evolution with varying compositions is performed. *In situ* indentation at high load is carried out inside a SEM chamber to understand the deformation and cracking propagation mechanism in spark plasma sintered microstructure as a function of varying compositions. Preliminary findings of oxidation behavior of SPSed HfC-TaC compositions by exposing them to a high velocity plasma jet at temperature exceeding 2200^{o}C are also reported.