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Synthesis and properties of $(\text{Hf}_{1-x}\text{Ta}_x)\text{C}$ solid solution carbides

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ABSTRACT

Thermodynamically stable $(\text{Hf}_{1-x}\text{Ta}_x)\text{C}$ ($x = 0.1-0.3$) compositions were selected by First Principle Calculation and synthesized in nanopowders via high-energy ball milling and carbothermal reduction of commercial oxides at 1450 °C. The formation of a solid solution during powder synthesis was investigated. The solid solution carbide powders were sintered at 1900 °C by spark plasma sintering without a sintering aid. As a result, the $(\text{Hf}_{1-x}\text{Ta}_x)\text{C}$ solid solution carbides exhibited high densities, excellent hardness and fracture toughness (ρ : 98.7-100.0 %, HVN: 19.69– 19.98 GPa, K_{IC} : 5.09-5.15 MPa m^{1/2}) compared with previously reported HfC and HfC–TaC solid solution carbides.

Keywords

A. Powders; solid state reaction; A. Sintering; D. Carbides; Solid solution

1. INTRODUCTION

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