

Fabrication of diamond/SiC composites using HIP from the mixtures of diamond and Si powders

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Fabrication of diamond/SiC=75/25~50/50vol% composites have been tried using hot isostatic pressing at 1450°C under 196 MPa for 2 h from the mixtures of diamond and Si powders. The former consisted of bimodal particle sizes P_s of 69 and 9.2 μm , and the latter average P_s of 0.60 μm . They were mixed using an alumina mortar and pestle for 30 min in ethanol thoroughly. After drying, a small amount of binder was added to the mixed powders and compacted uniaxially and isostatically (245 MPa). They were pre-heated at 950°C for 2 h in a vacuum to be densified for easy handling. Calcined mixed powder compacts wrapped with BN powder were sealed into Pyrex glass petri dish in a vacuum. They were heated with heating rate of 300°C/h, between room temperature and around 820°C in Ar gas atmosphere of 0.3-0.4 MPa, and from 820° to 1450°C with increasing pressure to 196 MPa. Archimedes method to determine the bulk densities revealed that the highest density of 96.7% has been achieved at the composition of diamond/SiC =55/45vol%, in which composition the diamond content is higher than that (45 vol%) of previous works. SEM observation on the microstructure of composites showed a little amount of cleavages at grain boundaries between diamond and SiC, which might be originated from the volume reduction around 19.3% in the formation of SiC from C + Si during HIPing. However, with decreasing the content of diamond the cleavages disappeared due to the rearrangement of diamond particles less than 35vol%.

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Materials

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