Vapor Phase Growth of β-Sialon Whisker by Nitridation of the System SiO_2-C-Na_3AlF_6

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The vapor phase growth of β-sialon whisker was investigated by nitridation of the system SiO_2-C-Na_3AlF_6 in a flow of N_2 gas at 1350° and 1400°C. Whiskers were grown both inside and outside graphite sample cylinder with caps. In the former, α-Si_3N_4 whisker grew mainly, while in the latter, β-sialon ($Si_{6-z}Al_zO_zN_{8-z}$) whisker grew along with a small amount of α-Si_3N_4 whisker. Although the amount of the whiskers formed at the outside increased with an increase in molar ratio Na_3AlF_6/SiO_2, the fraction of β-sialon whisker decreased and that of α-Si_3N_4 whisker increased. The β-sialon/α-Si_3N_4 ratio in the whiskers formed at outside depended also on the reaction temperature and N_2 gas flow rate. Under optimum condition, the whiskers containing about 85% β-sialon, up to 10 mm long and 1.0～10 μm thick, were obtained in about 20% yield. It was considered that β-sialon whiskers with droplets at the tips grew by the VLS growth mechanism by the precipitation from the supersaturated solution of SiO, CO, AlF_3 and N_2 gas in the droplets. The composition of β-sialon whiskers was estimated to be $z \fallingdotseq 1.8$-2.0 on the basis of XRD data. [Received August 8, 1985]

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Pressureless Sintering of Ultrafine SiC Powder Produced by Gas Evaporation Method

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Pressureless sintering of ultrafine powders of β-SiC prepared by a gas evaporation method was carried out in the atmosphere of Ar. When the raw material was sintered without sintering aids, only the grain growth occurred without significant densification. It was proved that the simultaneous addition of boron and carbon is effective for the densification of present ultrafine powder produced by gas evaporation method also. The addition of carbon as a sintering aid is not always necessary, because the raw materials contain a few percent of free carbon. The highest density, 97% theoretical, was obtained with the aids of 1.0 wt% boron and 4.3 wt% free carbon at 2200°C. In the following two cases, plate-like crystals (6H-type SiC) larger than 50 μm grew and the densification was significantly prevented : (1) The raw material including a considerable amount of free silicon was sintered with the aids of boron 1.0 wt% above 1900°C. (2) The raw material containing free carbon less than 3.0 wt% was sintered with the excess aids of boron more than 1.0 wt% above 2100°C. [Received July 15, 1985]

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