

Spark-Plasma-Sintering (SPS) of Nanostructured Tungsten Carbide Powders

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ABSTRACT

The preparation of ultrafine tungsten carbide bulk solids is of a more general interest in respect of the increased mechanical properties of such materials. Nanostructured tungsten carbide powders have been synthesized by ultra-rapid condensation from a high-frequency plasma. Commercial powder samples with a grain size (0.7 micrometer grain size) as used in the cermet production were taken as a reference material. The samples were compacted by means of the Spark-Plasma-Sintering (SPS) method at temperatures between 1200°C and 1800°C (sintering time 1 min). A pulsed electric current is applied directly in the graphite die during this procedure. The mechanical device can be roughly compared with conventional hot press. The results were compared with data obtained by various conventional sintering techniques. The compacted samples were investigated by X-ray diffraction (XRD) to study the phase composition and the crystallite size. The materials were also further characterised by electron microscopy methods (SEM and TEM). The topic of this study was to investigate the sintering behaviour of the material, the grain-growth development, and the phase development in the WC-W₂C system due to its technological importance.

Keywords: Spark-plasma-sintering, tungsten carbide, nanopowder and grain-size