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Contents

Nanostructured materials compacted via hot pressing method by direct current transmission

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Nanostructured ceramics have unique properties and performance characteristics due to the formation of a fundamentally different structure compared to their large-crystal counterparts. The most important stage in the technology of nanoceramics production is the formation of quality pressings (compacts) of a given shape made of ceramic nanopowders. NPs of ceramic compositions (often very complex) have a metastable structural-phase state, a developed specific surface and as a consequence, high surface activity and tendency to agglomerate. Pre-prepared tungsten carbide tablets were hot-pressed in a vacuum of 10-2 mmHg. Maximum pressure for graphite PG-7 is about 50 MPa at a temperature higher than 1200□C, so the maximum force for the given mould with a punch d=20 mm is 45 MPa. Temperature of termination of shrinkage has made 1700□C. The density of pressings after grinding was determined by hydrostatic weighing. Rockwell HRA hardness was determined by indenting a diamond pyramid on the TM-12. During high-temperature sintering under load the WC grain size increased insignificantly, remaining mostly less than 1 μm. At the same time there is practically no porosity in the materials. That is why high values of σvizr = 720 MPa were obtained. In our case, a high value of fracture toughness K1c, which is important for cutting tool ceramics, can also be expected with a high value of HRA. The increase of fracture toughness of such material can be explained on the basis of the known model of increase of K1c in polycrystalline materials, namely by the joint action of two factors: highly dispersed grains and low strength boundaries both between grains below 1 μm and between coarser ones. To conclude, the method of hot pressing under direct current flow makes it possible to obtain high-density nanoporous tungsten carbide products with high physical and mechanical properties.

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