Nanocomposites and nanomaterials

Spark Plasma Sintering: energy efficient technology for consolidation of novel ceramics

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Spark Plasma Sintering (SPS) is a special very fast hot pressing method with a direct heating of the die or the powder compact by a pulsed direct current. One of the SPS features is a reduction of sintering duration and process temperatures facilitating preservation of ceramic grains in nanoscale region [1 - 4].

In the present work we consider the influence of consolidation method on the formation of structure and properties for nanocrystalline materials. Focus of our study applied to investigation of structural peculiarities for nanoceramics based on high melting point composites consolidated by SPS and explores relationship structure-properties. Grain boundaries in the bulk nanoceramics under different consolidation conditions could forms through different mechanism like local welding, fusing (SPS) compared to conventional diffusion-controlled conditions and, therefore it would be important to experimentally determine this feature and its effect on properties of nanocomposites. The conditions of nanocomposites enhancement by elongated structures (nanowires) have been estimated. Relationships between structures of nanocomposites based on high melting point compounds and mechanical (tribological) properties were studied. Energy efficiency of Spark Plasma Sintering technology and economical effect from implementation of nanocomposites based on high melting point compounds as wear resistant and technical ceramics were estimated.

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