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To the Special Scientific Council Д 26.207.03
in IPMS NAS of Ukraine

Review Letter

Concerns support the nomination of the habilitation thesis for Doctor of Science Degree "Features of consolidation, formation of the structure and properties of ceramic materials in the processes of spark-plasma sintering" by Hanna Borodianska in Specialty 05.02.01, 'Materials Science' on the Special Scientific Council Д 26.207.03 in IPMS, NAS of Ukraine.

Habilitation thesis of Dr. Borodianska focuses on solving the significant scientific & technological problems related to the preparation of dense bulk nanostructured ceramics with different types of conductivity and nature of the chemical bonding. Dr. Borodianska combined the features of electric field assisted sintering techniques (EFAST/SPS) and the ceramic powder processing strategies to produce nanostructured ceramics with predetermined characteristics. The precise control of processing parameters leads to consolidation of high quality ceramics. Grains and grain boundary control made it possible to establish complex correlations between raw materials, processing and bulks with promising functional properties. This is essential to guarantee the reproduction of results in practice.

Ceramic composites of $Ti_{1-x}Al_xN$ are known to have excellent durability, resistance to oxidation, high strength, conductivity, and resistance to thermal shock. Dr. Borodianska produced the bulk nanocomposites of $Ti_{1-x}Al_xN$–AlN, which composed of the cubic $Ti_{0.82}Al_{0.18}N$ matrix oreinforced with hexagonal AlN nanograins with indentation hardness exceeding 25 GPa.

The chapters 6 to 8 of her habilitation thesis is devoted to boron carbide based composites. The technique of reactive SPS of $B_{13}C_2$–(B_xO_y/BN) composite with a nano-lamellar B_xO_y/BN grain boundary framework is developed. Lamelar grain boundary framework B_xO_y/BN is the result of reactions of nitrogenwith the initial B_4C powder. The possibility of modification of boron to carbon ratio to produce harder $B_{13}C_2$ phase and nanocomposites had been tested in this Doctor Science work. The best nanocomposites $B_{13}C_2$–(B_xO_y/BN) exhibit the elevated temperature flexural strength of up to 800 MPa which was the best result for massive boron carbide. In addition, the complex relation between spark plasma sintering conditions, grain and G.B. structure modification, static and dynamic mechanical properties of consolidated bulks has been througthly analyzed.

I'd like to emphasize that the work consolidated by Dr. Hanna Borodianska to habilitation thesis for Doctor of Science Degree been accepted and published by top interntaional peer-reviewed ICI journals like the Journal of the American Ceramic Society, Journal of the European Ceram. Soc., Journal the Ceram. Soc. of Japan, Scripta Materialia, Ceramics International and many others, attesting to the quality and impact of her work.

In conclusion I would like to emphasize that the habilitation thesis "Features of consolidation, formation of the structure and properties of ceramic materials in the processes of spark-plasma sintering" of Dr. Hanna Borodianska is deffinitely deserving of the degree of Doctor of Science in Specialty 05.02.01, 'Materials Science'.

Yours sincerely,
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