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Development of SiC based nanocomposites with enhanced electrical conductivity

Three principal types of materials were developed and investigated: SiC-TiNbC, SiC-CNT a SiC-graphene. They were compacted using standard hot pressing (HP), spark plasma sintering (SPS), and rapid hot pressing (RHP). Their microstructure, chemical and phase composition were studied in detail, the results showed successful microstructure design and confirmed desired composition. In all cases a reference material, a single phase SiC, prepared by the same ways, was used for comparison. As the base, series of three optimized SiC-TiNbC (with 30, 40 and 50 wt.% of TiNbC) composites were developed. Increase in electrical conductivity by four orders was achieved without compromising the mechanical and tribological properties. Technological tests showed possibilities to machine these materials by electric discharge technique as well as other non-conventional methods. The materials with carbon based nano-fillers included SiC-graphene and SiC-CNT (carbon nanotubes). Methods of their preparation were optimized, mainly to achieve a good distribution of the carbon nano-phases. In SiC-graphene (graphene nano-platelets and reduced graphene oxide up to 5 wt.%) the rapid hot press (RHP) technique was successfully developed and tested and materials with graphene nano-platelets and reduced graphene oxide were produced. Both types reached satisfactory parameters with respect to their microstructure and basic mechanical properties. Their electrical conductivity increased by four orders which clearly shows their potential. In SiC-CNT (with up to 10 wt.% CNT) a new technique of *in situ* CNT preparation by CCVD was developed. This enabled to solve the problem with distributing of CNTs and in this way to increase the electrical conductivity by about three orders of magnitude.

Biography

Pavol Hvizdos has been working in the Structural Ceramics Department of IMR SAS, Kosice, Slovakia, since 1988. In 1996 he has received his PhD degree in Material Sciences from Technical University, Kosice, Slovakia. From 2000 to 2008 he has worked as a Marie Curie Fellow in Queen Mary University of London, UK and as a Ramon y Cajal Fellow at Polytechnic University of Catalonia, Barcelona, Spain. Currently he is a Senior Scientist in IMR SAS Kosice. His scientific expertise includes microstructure and fracture properties of composite structural ceramics, recently his interests have been focused on nano-indentation and tribology of composite materials and cermets.

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