



CONFERENCE ON FAST/SPS

From Research to Industry

BOOK OF ABSTRACTS

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Multiscale Investigation of Nickel – Silicon Carbide Composites Sintered by SPS Method

Abstract

Silicon carbide (SiC) is characterised by good thermal and electrical conductivity, and high hardness and mechanical strength. Due to its unique properties SiC is applied as the reinforcement in metal matrix composites to improve their thermal, mechanical and wear properties. Ni-SiC composites are widely used in the automotive industry (pistons, brake discs), aviation and aerospace industries (engine components), as structural materials for the molten salt reactors, as well as in electronics (as the layered materials).

Comprehensive investigation of the influence of the main process parameters of spark plasma sintering on the mechanical and microstructural properties of nickel-silicon carbide composites at various scales. Microstructure analysis performed by scanning and transmission electron microscopy revealed a significant interfacial reaction between nickel and silicon carbide due to the decomposition of silicon carbide. The chemical interaction of the matrix and reinforcement results in the formation of a multicomponent interphase zone formed by silicides ($\text{Ni}_{31}\text{Si}_{12}$ or/and Ni_3Si) and graphite precipitates [1]. The influence of SPS on Ni-SiC composites was revealed by implementing a multiscale experimental tests at three different scales (macroscopic, microscopic, and nanoscale) [2]. The nanomechanical properties of composite components: metal matrix, ceramic reinforcement, and the interface have been evaluated by nanoindentation testing. Next, the deformation, strength, and fracture behaviour of the bonding zone of composite components was determined by a microcantilever bending test on the microscale. Finally, a uniaxial tensile test has been carried out to designate the effective mechanical performance of nickel-silicon carbide composites at a macroscopic level.

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