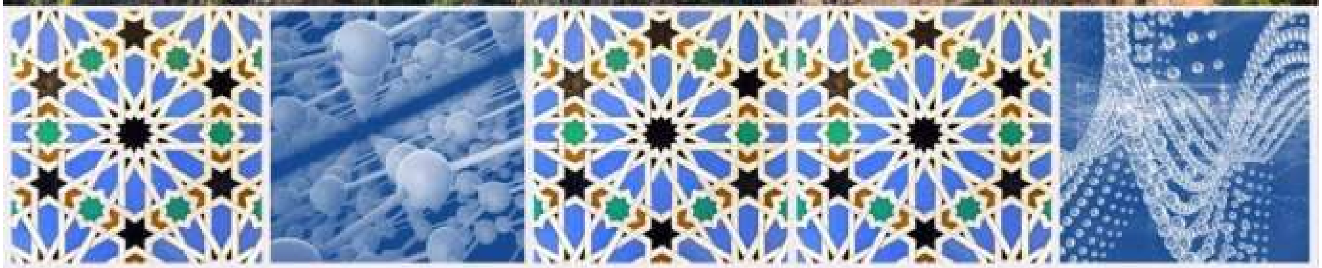
FEMS 2025 EUROMAT

18th European Congress and Exhibition on Advanced Materials and Processes

Granada, Spain,
14 – 18 September

# FEMS EUROMAT 2025
# Book of abstracts



Palacio de Congresos de Granada, Granada (Spain)

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# The influence of spark plasma sintering parameters on the structure and properties of NiAl based materials

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Sintering is a thermally activated process that depends on many technological factors, such as temperature, time, external pressure, atmosphere, etc. [1]. The progress of sintering, measured by an increase in the cross-sectional area of the intergrain neck and a decrease in the distance between the centres of two adjacent grains, leads to an increase in the density of the material. A great increase in interest in field assisted sintering techniques has been evident in recent years. The main advantage of the Spark Plasma Sintering technique is the direct resistive heating of graphite elements and electrically conductive powders [2]. Due to the high heating rates (up to 1000°C/min) and short dwelling time at the sintering temperature, the limitation of undesirable material reactions and structural transformations can be obtained.
The goal of the presented work was to investigate the changes in the microscopic and macroscopic parameters related to the microstructure of the NiAl and NiAl-Al2O3 composites and its dependence on the sintering parameters (temperature and pressure). The materials were densified using Spark Plasma Sintering method. The applying of diversified sintering parameters allowed to obtain a materials with different relative density (from 70.0 to 97.5%). The analyses included SEM investigations by electron backscatter diffraction to evaluate the crystallographic orientation of NiAl grains and microcomputed tomography to visualize the grain evolution at different stages of sintering, especially the grain size, shape and boundary contact features. The application of the electric current resulting in high temperature and the additional external loading leads to the significant changes in the structure of sintered materials, such as the occurrence of lattice reorientation resulting in grain growth, increase in the grain neighbors, or the evolution of grain ellipticity, circularity, grain boundary length, and fraction.

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[2] Trapp, J., Kieback, B. (2019) Fundamental principles of spark plasma sintering of metals: part I – Joule heating controlled by the evolution of powder resistivity and local current densities. Powder Metallurgy, 62(5), 297–306.