

Winter 3-11-2016

Spark plasma sintering: From the thermal gradient to advanced ceramic composites

Dmytro Demirskyi

Nanyang Technological University, dmytro.demirskyi@ntu.edu.sg

Follow this and additional works at: http://dc.engconfintl.org/efa_sintering



Part of the [Engineering Commons](#)

Recommended Citation

Dmytro Demirskyi, "Spark plasma sintering: From the thermal gradient to advanced ceramic composites" in "Electric Field Assisted Sintering and Related Phenomena Far From Equilibrium", Rishi Raj (University of Colorado at Boulder, USA) Thomas Tsakalakos (Rutgers University, USA) Eds, ECI Symposium Series, (2016). http://dc.engconfintl.org/efa_sintering/55

This Abstract is brought to you for free and open access by the Proceedings at ECI Digital Archives. It has been accepted for inclusion in Electric Field Assisted Sintering and Related Phenomena Far From Equilibrium by an authorized administrator of ECI Digital Archives. For more information, please contact franco@bepress.com.

SPARK PLASMA SINTERING: FROM THE THERMAL GRADIENT TO ADVANCED CERAMIC COMPOSITES

Dmytro Demirskyi, Temasek Laboratories, Nanyang Technological University, 50 Nanyang Avenue, 639798
Singapore, dmytro.demirskyi@ntu.edu.sg

Key Words: Spark plasma sintering, ceramics, driving forces, boron carbide.

It is well recognized that spark plasma sintering (SPS) is one of the most popular consolidation methods used to produce metal, ceramics and their composites. The better properties of the materials consolidated using SPS is usually attributed to: (i) shorter processing cycle and (ii) lower processing temperature. Hence, it is sometimes debated that there is a specific role of pulsed electric current or local thermal gradient which affect the consolidation process during SPS by changing mass-transport mechanism or local phase composition.

This work summarizes some model experiments on the initial and final stages of SPS consolidation process to verify possible effects of *additional driving forces* behind 'enhanced' mass-transfer during SPS. The effects of heating rate, pressure, particle size and electric field strength are also evaluated.

Furthermore, it was shown how these *additional driving forces* may be used to fabrication of advanced ceramic composites. Namely, ceramic composites with unique eutectic structure were prepared by in situ synthesis/consolidation of B₄C with transition metal diborides of IV or V groups. This work summarizes recent activity on processing of lightweight ceramics composites based on boron carbide in the respect to mechanical properties: such as hardness, fracture toughness and flexural strength.