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

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

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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 $B_4C$ 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.