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NEW EMERGING SINTERING TECHNIQUES ASSISTED BY CURRENT: SPARK PLASMA SINTERING AND FLASH SINTERING

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RESUMEN

Sintering behavior of ceramic materials is enhanced when an external electric field/current is applied during the sintering process, tailoring the final microstructure of the sintered compounds. Use of electric field/current leads to high heating rates (> 200 °C/min) and short sintering times (minutes), which limit the grain growth and promote the densification process.

These effects are determinant in advanced ceramics with poor sinterability that cannot be fully densified by conventional sintering. Among all the techniques assisted by electric field/current, two are the most interesting: Spark Plasma Sintering (SPS) and flash sintering.

SPS is the most used and studied technique, while flash sintering has strongly arisen in the last years due to the promising results. However, the involved mechanisms are not yet fully understood and the response of the materials strongly depends on the electrical properties.

In this work, sintering behavior, microstructure and final properties of different ceramic materials sintered by SPS and flash sintering are analyzed. Diverse configurations of the convectional graphite system used in SPS are presented, leading to enhance the densification process and designing novel microstructures in Si_3N_4, ZnO and ZrB_2. Regarding the flash sintering, effect of the strength of the applied electric field/current is investigated on solid state sintering (ZnO) and liquid phase sintering (Al_2O_3 containing different amounts of glass).

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