Abstracts

FDTD Simulation of Microwave Sintering of Ceramics in Multimode Cavities

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Microwave sintering of ceramics in multimode cavities, particularly the use of picket-fence arrangements, has recently received considerable attention. Various types of ceramics have been successfully sintered and, in some cases, a desirable and unique "microwave effect" has been observed. At present, various aspects of the sintering process such as preparation of sample sizes and shapes, types of insulations, and the desirability of including a process stimulus such as SiC rods are considered forms of art and highly dependent on human expertise. The simulation of realistic sintering experiments in a multimode cavity may provide an improved understanding of critical parameters involved and allow for the development of guidelines towards the optimization of the sintering process. In this paper, we utilize the FDTD technique to model various geometrical arrangements and material compatibility aspects in multimode microwave cavities and to simulate realistic sintering experiments. The FDTD procedure starts with the simulation of a field distribution in multimode microwave cavities that resembles a set of measured data using liquid crystal sheets. Also included in the simulation is the waveguide feed as well as a ceramic loading plate placed at the base of the cavity. The FDTD simulation thus provides realistic representation of a typical sintering experiment. Aspects that have been successfully simulated include the effects of various types of insulation, the role of SiC rods on the uniformity of the resulting microwave fields, and the possible shielding effects that may result from excessive use of SiC. These results as well as others showing the electromagnetic fields and power-deposition patterns in multiple ceramic samples are presented.

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