Simulation of Microwave Sintering of Ceramic Bodies with Complex Geometry *

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Microwave sintering is an emerging technology in which the energy is directly applied to the material, enabling fast sintering with a potential for synthesis of advanced ceramic materials with superior properties. A dynamic balance between the rate of electromagnetic energy absorbed within the bulk of the sample and the rate of energy loss from its surface generally give rise to temperature gradients. These temperature gradients may be especially important during microwave sintering of bodies having a complex geometry since both the diffusion distance and the electromagnetic penetration depth do not scale with sample dimensions. The gradients generated in a zinc-oxide green body of a complex geometry were studied theoretically using various microwave sintering approaches. It was found that: (a) dual frequency (2.45 GHz and 30 GHz) microwave processing leads to reduction in the duration of the temperature gradients, and (b) an increase in the heating rate from 5 ^{0}C/min to 1400 ^{0}C/min at 2.45 GHz reduces the total required microwave energy by a factor of 55 (see figure below), while at the same time the internal temperature gradients are maintained over a substantially shorter time.

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