ELSEVIER

Materials Science and Engineering A266 (1999) 211–220

MATERIALS SCIENCE & ENGINEERING A

Use of partially oxidized SiC particle bed for microwave sintering of low loss ceramics

Peelamedu D. Ramesh [a,*,1], David Brandon [a], Levi Schächter [b]

[a] *Department of Materials Engineering, Technion-Israel Institute of Technology, Haifa 32000, Israel*
[b] *Department of Electrical Engineering, Technion-Israel Institute of Technology, Haifa 32000, Israel*

Received 17 March 1998; received in revised form 17 November 1998

Abstract

A 1 kW hybrid microwave system was fabricated using a partially oxidized SiC powder bed and used to sinter small components of low-loss insulating ceramics. Samples of 3% yttria stabilized zirconia/20% alumina (3YZA) and 99% alumina were sintered to final densities of 99%(3YZA) and 95%(99% alumina). Partially oxidized silicon carbide (β-SiC) powder was used as susceptor (preheater). By comparison, unoxidised β-SiC powder, which couples well with microwaves at room temperature, exhibited thermal runaway above 400°C. It could be possible that at high oxidation levels the connectivity between SiC particles in β-SiC powder bed might become depercolated, and a model similar to one proposed for silicon nitridation under microwaves could be appropriate in understanding the microwave absorption phenomenon. Stable temperature measurements at various positions in the system confirmed that the maximum temperature was at the center of the 3YZA sample. The plot of the relative temperature difference between the sample and its surroundings as a function of sample temperature resulted in a bell-shaped curve with a clear maximum at around 800°C, associated with the rapid increase in radiation heat transfer above this temperature. Experiments also confirmed that sintering occurred at lower temperatures in a microwave field when compared to conventional sintering.

Keywords: Hybrid microwave heating; Oxidized silicon carbide; Depercolation; Sintering