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Title:Rapid sintering of silica xerogel ceramic derived from sago waste ash using sub-millimeter wave heating with a 300 GHz CW gyrotron
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Abstract:In this paper, we present and discuss experimental results from a microwave sintering of a silica-glass ceramic, produced from a silica xerogel extracted from a sago waste ash. As a radiation source for the microwave heating a sub-millimeter wave gyrotron (Gyrotron FU CW I) with an output frequency of 300 GHz has been used. The powders of silica xerogel have been dry pressed and then sintered at temperatures ranging from 300°C to 1500°C. The influence of the sintering temperature on the technological properties such as porosity and bulk density was studied in detail. Furthermore, X-ray diffraction (XRD) and Fourier Transform Infrared (FTIR) spectroscopy have been used in order to study the structure of the produced silica glass-ceramics. It has been found that the silica xerogel crystallizes at a temperature of 800°C, which is about 200°C lower than the one observed in the conventional process. The silica xerogel samples sintered by their irradiation with a sub-millimeter wave at 900°C for 18 minutes are fully crystallized into a silica glass-ceramic with a density of about 2.2 g/cm³ and cristobalite as a major crystalline phase. The results obtained in this study allow one to conclude that the microwave sintering with sub-millimeter waves is an appropriate technological process for production of silica glass-ceramics from a silica xerogel and is characterized with such advantages as shorter times of the thermal cycle, lower sintering temperatures and higher quality of the final product. © 2011 Springer Science+Business Media, LLC.