STUDY OF THE MICROWAVE SINTERING OF PORCELAIN BODIES

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ABSTRACT

There is growing evidence to support the use of microwave energy in various industrial processes. In contrast to conventional furnaces, the material to be processed in a microwave furnace (oven) interacts with the microwaves instead of radiant heat. Because the material itself generates the heat, heating is more volumetric and can be very rapid and selective. These features, when properly controlled, can result significant reduction in manufacturing costs due to energy savings and shorter processing times. Microwave sintering of ceramics have been basically studied on advanced ceramics, such as Al_2O_3, ZrO_2, Si_3N_4, and so on. These studies have been mainly reported with respect to the solid state sintering, while the liquid phase sintering have been only reported in just a few cases. The porcelain bodies are composed of many compounds, and produce a large amount of liquid during sintering. The studies about the microwave sintering of traditional ceramics are very lower than that of advanced ceramics [1-5], which make more difficult the application of microwave energy in the industrial production of these kinds of ceramic bodies. This work had as aim study the microwave hybrid heating of porcelain bodies of the clay-quartz-feldspar system . The starting powders used in this study are commercially raw materials used by the Brazilian traditional ceramic plants. The powders were mixed in an aqueous median by ball milling for 4 h and afterwards dried by spray-dry. Samples of 4,5 mm x 5 mm x 5 mm were uniaxially pressed and sintered in a conventional furnace and in a 2,45 GHz microwave oven. The heating rate of conventional firing was 10^oC/mim and the soaking times were 30 and 60 mim. The microwave-sintered samples were fired in a heating cycle of 25 mim using silicon carbide as the susceptor agent. The cooling cycle was not controlled. The relative density was determined by the Archimedes method. X-ray diffraction was used to identify the phases in the sintered bodies. SEM was uses in the microstructure analysis. According to the results, can be observed that, although the time of the microwave sintering are approximately 10-15% of the time of the conventional sintering the densities and microstructures of the conventional and microwave sintered bodies are similar. With the microwave hybrid sintering the heating hate can be very fast and the microstructure was uniform in all he body, which is an indication of the uniform temperature distribution in the body without special blanket arrangements.

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