INFLUENCE OF THE CONFORMATION METHOD ON FLASH SINTERING OF ZNO CERAMICS

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Flash Sintering has been shown to be a promising alternative in obtaining high-density ceramics with grain growth control. However, some conditions are still under development. Regarding the dimension of the ceramic, there is a limitation related to obtaining a homogeneous material in large specimens, in order to avoid the formation of preferential current flow paths. Depending on the temperature required for the flash event to occur, some electrode materials have a high cost, or controlled atmosphere operations are required. Typically, the electrodes used in flash sintering consist of platinum, however, in some cases, other materials may be a cheaper suitable alternative, such as stainless steel[1] or nickel-chromium alloys. Also, the use of different compositions in the electrode influences the conductivity of the material, which affects the onset of thermal runaway[2]. In this regard, different conformation techniques were studied in order to improve the homogeneity of the sintered ZnO ceramic body. Additionally, the feasibility of the use of Inconel (nickel-chromium) electrodes in the replacement of platinum electrodes was evaluated. Then, ZnO specimens were conformed (cylindrical shape - 6 mm diameter and 5 mm thickness) by uniaxial pressing under 140MPa and 300 MPa, isostatic pressing under 200 MPa, and slip casting. All experiments were conducted isothermally at 800 °C in an adapted tube furnace[3], with an applied field of 60 V/cm and 200mA/mm^2 as maximum current density, using either platinum or Inconel electrode. Figure 1 shows the variating in time incubation with respect to the conformation method used. The distinct incubation times are justified by the difference in the pore distribution, which affects the electrical resistivity of the samples. Also, according to Figure 1, it can be seen that in addition to presenting a higher electrical resistivity, which increased the incubation time, the samples conformed by slip casting are also characterized by the high formation of hotspots, which can be observed by the appearance of several spikes during the occurrence of the flash event. Figure 2 shows, for the samples conformed by uniaxial pressing (140 MPa), the difference between incubation times in relation to the material used for the electrode. It can be seen that, in this case, the use of Inconel increased the incubation time. Microstructural and further analyzes are being conducted.

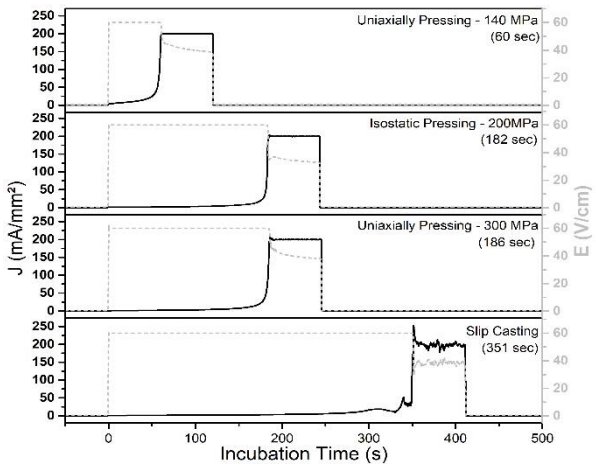

Figure 1 - Variation in incubation time (s) according to the conformation method used, for Pt electrodes.

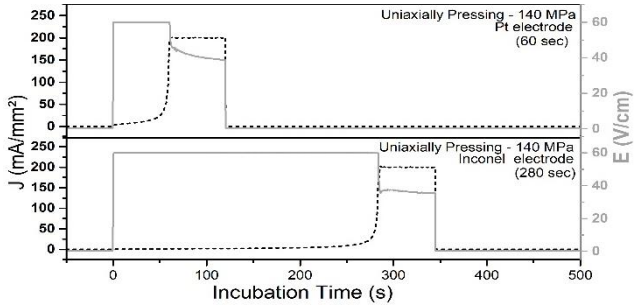

Figure 2 - Variation in incubation time (s) for Pt and Inconel electrode, using 140 MPa uniaxial

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