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AC ELECTRIC FIELD-ASSISTED SINTERING OF STABILIZED ZIRCONIAS

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Green pellets of ZrO2:3 mol% Y2O3 and ZrO2: 10 mol% Sc2O3:1 mol% CeO2 were sintered by applying AC (500 Hz – 1.1 kHz) electric fields (typically 100 V.cm-1) during the first stage sintering stage (T < 1200oC). The experiments were carried out positioning the specimens inside a vertical dilatometer with platinum disks acting as electrodes in a capacitor-like setup. The shrinkage level was controlled by monitoring the dilatometer gauge. Under the same conditions of temperature and magnitude of the applied AC voltage, the results show that the higher is the frequency of the electric field, the higher are the attained shrinkage and apparent density. Microstructural analyses of surfaces of the flash sintered specimens show that the average grain size also depends on the frequency of the electric field for the same sintering temperature, sintering time, applied electric field and electric current limit. We propose that increasing the frequency of the electric current pulse (resulting from the applied electric field) leads to an increase of charge carriers collisions, therefore increasing the amount of Joule heating delivered to the specimen, which is the primary phenomenon responsible for the densification of the specimens.