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Analysis of the luminescent emission during the sharp shrinkage of ceramic compacts in electric-field-assisted sintering

Muccillo, R.(1); Muccillo, E.N.S.(1); Albornoz Diaz, J.C.(1);
(1) IPEN;

Light-emission data were collected with an optical spectrometer before, during, and after the occurrence of the sudden shrinkage (flash sintering event) upon electric field-assisted sintering zirconia:8 mol% yttria (8YSZ) and ceria:20 mol% samaria (20SDC) ceramic green pellets. The shrinkage was monitored in uniaxial and isostatic pressed ceramic compacts, positioned in the sample holder of a vertical dilatometer, under an electric field of 100 V.cm?1 at 800oC. Luminescence data were obtained in the 200–1200 nm (ultraviolet–visible–near infrared) range. The deconvolution of the luminescence spectra during the flash event showed emission bands in the visible range due exclusively to the samples, with wavelength maxima in 8YSZ different from those in 20SDC. A physical mechanism is proposed, based on interaction of the intergranular electric current, due to the application of the electric field, with depleted species located at the space-charge region at the grain boundaries of these ceramics. Joule heating at the grain boundaries, promoted by the electric current, is proposed as responsible for the increase of the bulk ionic conductivity and the fast densification with inhibition of grain growth in electroceramics.