ELECTRICAL FIELD ASSISTED SINTERING OF YTTRIUM DOPED CERIA INVESTIGATED BY SINTER-FORGING

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The production of traditional and advanced ceramics is an energy-intensive activity, which requires high sintering temperatures and long holding times to activate diffusional processes necessary for densification. Electric field assisted processing has the potential to significantly reduce the sintering time and temperature which are not obtainable by other methods. The role of electric fields in the densification and coarsening of oxide ceramics is still under debate. By using a sinter-forging device equipped with a versatile power source and high-resolution laser scanners, it is possible to investigate in detail field assisted sintering process by quantifying uniaxial viscosity, viscous Poisson's ratio and sintering stress of oxide ceramics. The macroscopic Joule heating effect was eliminated by using Finite-Element Simulations calibrated experimentally and by lowering the furnace temperature accordingly. In other words, the sample temperature was kept constant under the different testing conditions, enabling a correct estimation of a thermal electric field effects. The sintering parameters of the ceramic pellets were measured without / with alternating electrical field well below flash sintering conditions. Clear effect of the electrical field on both uniaxial viscosity and sintering stress were observed. Microstructures of the specimens were investigated by SEM and TEM, and correlated to the electrical properties of the samples measured by Electrochemical Impedance Spectroscopy in order to understand the interplay between grain boundaries and electric field.