Novel sintering approaches for densifying ceramic oxides with improved properties

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Ion conducting, semiconducting and superconducting oxides have been sintered to designed density and controlled grain size distribution by applying AC electric fields at temperatures lower than those used in conventional sintering. Temperature, electric field strength and frequency, electric current density threshold, number of electric current pulses, constant or pulsed delivered electric power, average particle size, particle size distribution, and green density are key factors to be considered for a successful fabrication of ceramic pieces with desired properties. Experiments have been carried out in fully and partially oxide ion conducting zirconia solid electrolytes, doped barium cerate and barium zirconate proton conductors, pure and doped semiconducting tin dioxide, in high-T_C bismuth-based superconducting oxides, and in planar solid oxide fuel cells. Near to full density ceramic pellets have been produced with enhanced properties. Noteworthy is the possibility of densifying ceramic bodies to full density with controlled grain growth at considerably lower temperatures and in short times than in conventional sintering.