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THE INFLUENCE OF DOPING ON FLASH SINTERING CONDITION IN $\text{SrTi}_{1-x}\text{Fe}_x\text{O}_{3-\delta}$

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The innovative flash sintering process raised a great interest in the past few years due to its applicability in various engineering fields and the interesting scientific questions it evokes. This technique could be beneficial in many applications since it reduces the time and cost of the sintering process. Joule heating can explain the sudden temperature rise of the sample, which enhances the rate of grain boundary diffusion. However, for a given material the temperature of the sample remains lower than the temperature at conventional sintering. Although Joule heating is a significant phenomenon, it is proposed that lattice defects and their transport properties are also influenced by the applied field and can play an important role in the flash sintering process. In this work, iron doped SrTiO_3 , was chosen as a model material to examine the influence of dopants on the threshold conditions of flash sintering (i.e., temperature and applied electric field). SrTiO_3 has been flash-sintered before at different furnace temperatures and electric fields. [1,2] Additionally, it is a simple cubic perovskite and its defect chemistry is well defined in the dilute dopant case. The threshold conditions of five different $\text{SrTi}_{1-x}\text{Fe}_x\text{O}_{3-\delta}$ samples ($x=0, 0.1, 0.5, 1, 3$) indicate that the furnace temperature decreases when doping is increased. This result can be explained both by the increase of the electric conductivity that affects directly the Joule heating; and by the existence of added ionic defects in the lattice. In a doped semiconductor, extrinsic defects can be compensated electronically and by self-compensation (native ionic defects). The analysis of point defect concentration was done using the doping factor concept. The doping factor, f , is defined by the ratio between the electron concentration after introducing a dopant and the electron concentration at a reference state. Substituting the new electron concentration in the mass action relations of all the defects yields new values for their concentrations in the doped material, expressed by the same factor f . [3] The flash sintering setup is assembled in a dilatometer, utilizing its ability to measure shrinkage in-situ. [4] AC measurements are performed before applying the field and after the sintering has been terminated. DC Electrical field is applied to the electrodes at both edges of the sample via source meters to achieve maximum voltage of 600 V with limited current of 100 mA.

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