

Characterization and investigation of Fe:STO thin films prepared by pulsed laser deposition

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The perovskite-type oxide SrTiO_3 is one of the best investigated materials in solid state ionics and commonly used as a model material for many studies. The defect model of bulk SrTiO_3 is well understood and the conductivity of bulk samples can be tailored by acceptor or donor doping, e.g. with Fe^{3+} or Nb^{5+} on the Ti^{4+} site. However, other aspects of SrTiO_3 have not been understood so far, for example the electrochemical properties of SrTiO_3 thin films [1, 2].

Slightly Fe-doped SrTiO_3 thin films were prepared by pulsed laser deposition (PLD). The electrical conductivity was measured using Electrochemical Impedance Spectroscopy (EIS) and was found to be near the intrinsic point, independent of the Fe^{3+} dopant concentration. When investigating the reasons for this ultra-low conductivity, special attention was put on the relation between exact stoichiometry and electrical conductivity. The cation stoichiometry was varied by modifying the target composition, but also by using different PLD parameters. X-ray diffraction (XRD) and inductively coupled plasma optical emission spectroscopy (ICP-OES) measurements were carried out on the obtained thin films to investigate their structure and stoichiometry, respectively. A model linking the low conductivity to the stoichiometry of the thin films is presented, highlighting the possible impact of cation vacancies and antisite defects on the electrical conductivity of Fe: SrTiO_3 . In

a second part of the study, the behavior of Fe:STO thin films under UV light irradiation was investigated for different oxygen partial pressures and bias voltages.

1. Kubicek, M., et al., *Resistive states in strontium titanate thin films: Bias effects and mechanisms at high and low temperature*. Journal of Electroceramics, 2017: p. 1-13.
2. Taibl, S., G. Fafilek, and J. Fleig, *Impedance spectra of Fe-doped SrTiO₃ thin films upon bias voltage: Inductive loops as a trace of ion motion*. Nanoscale, 2016. **8**(29): p. 13954-13966.