IMPACT OF AN EXTERNAL ELECTRIC FIELD ON GRAIN GROWTH IN OXIDES: COMPARISON OF FLASH SINTERED SAMPLES TO FIELD ASSISTED GRAIN GROWTH

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In the last years ample effort was done to investigate the effect of electric fields on matter. We investigated the effect of an external electric field on the oxide ceramic model system strontium titanate. More precisely, we observed that a non-contacting external electric field has an impact on the defect distribution and the grain growth. Oxygen vacancies are migrating towards the negative electrode yielding a higher oxygen vacancy concentration compared to the positive electrode. As a result, faster grain growth was observed on the negative electrode. Recent thermodynamic defect calculations revealed the mechanism for this relationship [1]: A high oxygen vacancy concentration results in less space charge and, as such, in less segregation of cationic defects. As less segregation requires less diffusion for grain boundary migration, faster grain growth occurs.

We extended these findings to flash sintering of doped strontium titanate. TEM imaging and EDS analysis were used to investigate the microstructure and to map the dopant segregation at the grain boundaries. Observing different dopant species (acceptors and donors) gives insight on flash sintering for different defect concentration and types with different segregation properties. In addition, field assisted microstructure evolution experiments with titania (no current, insulating electrodes) allow to apply the gained knowledge to different material systems with different defect chemistry.

[1] Work of Jana P Parras and Roger A. de Souza