

Visualization of ion motion in Fe-SrTiO₃ thin films by means of impedance spectroscopy under bias

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SrTiO₃ is among the most investigated perovskite-type oxides and therefore serves as model material for other -more complex- perovskites e.g. BaTiO₃ or Pb(Zr,Ti)O₃. The scientific interest in SrTiO₃ not only refers to polycrystalline as well as single- crystalline bulk material ^[1], SrTiO₃ recently came into the focus of research since it is a promising candidate in the field of resistive switching. Local conductivity changes after applying a high electrical field to single- and polycrystalline SrTiO₃ bulk samples were already measured and simulated ^[2,3]. Accordingly, in current literature the observed resistive switching behavior of SrTiO₃ thin films is also discussed in terms of field driven ion motion ^[4].

In this contribution we combine two methods to obtain more information on the mass and charge transport properties in slightly Fe-doped SrTiO₃ thin films. Electrical impedance spectroscopy (EIS) performed in a temperature range between 700°C and 300°C revealed an additional low frequency feature under anodic (inductive loop) as well as under cathodic bias (second semicircle or inductive loop). DC measurements with different cycling rates made it possible to probe the samples in two different states, providing information on samples with continuously changing stoichiometry as well as information on samples in a fixed polarization condition. By correlating the results obtained from current-voltage measurements with the impedance data we were able to quantify ion motion in these thin films even though the ionic conductivity is much lower than the electronic one.

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[3] R. Waser, *Journal of the American Ceramic Society*, 1991, 74, 1934-1940.

[4] R. Waser, R. Dittmann, C. Staikov and K. Szot, *Advanced Materials*, 2009, 21, 2632-2663.