REMANENT RESISTANCE CHANGES AT PCMO-METAL INTERFACES: ELECTRICAL INDUCED POLARON ORDERING

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Non-volatile electric pulse induced resistance changes (EPIR) seem to be a rather common feature in several oxides in contact with metallic electrodes. These EPIR-effects are of interest for RRAM-technologies, since short voltage pulses of a few 100 ns are suitable for persistent resistance changes. Despite of the high interest, the possible mechanisms, e.g. charge accumulation or oxygen vacancy diffusion, are controversially discussed.

In our previous in-situ TEM studies [1] we showed a reversible electrically induced phase transition in Pr0.7Ca0.3MnO3 (PCMO) in the vicinity of a metal interface, which is accompanied by polaron ordering and disordering processes and residual resistance changes. These results imply a strong correlation between the EPIR in this material and the well known low-temperature effects in manganites, i.e. electronic phase separation and charge ordering.

We fabricated several metal-PCMO heterostructures by ion beam sputtering. The samples are realized with different electrode materials (e.g. Ag, Au, Al, Pt), interface sizes (lithography, shadow masks, focussed ion beam) and geometries (sandwich and lateral film) and characterised them by REM, XRD and TEM.

Time-depended transport measurements with variable pulse lengths are performed to study properties of the resistance states like stability and relaxation. If the differences in the work functions of PCMO and the metallic electrodes are taken into account, the results may be discussed in a model of modified band bending due to polaronic correlation effects [2].

References

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