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Tuning the physical properties of La0.7Sr0.3MnO(3-δ) via oxygen off-stoichiometry using assisted thermal vacuum annealing

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The physical properties of complex oxides can be tuned via controlling oxygen vacancies thus enabling potential applications. In La0.7Sr0.3MnO(3-δ) (LSMO), the topotactic phase transition from the Perovskite (PV, ABO3) phase to the layered oxygen-vacancy-ordered Brownmillerite (BM, ABO2.5) phase can be triggered by deoxygenation. Here, we employed polished Aluminum foils as oxygen getter during the thermal vacuum annealing and realized the PV-to-BM phase transition in both a strained LSMO thin film system and bulk-like unstrained LSMO powder system. For LSMO thin films, the structural changes were monitored using X-ray Diffraction. A metal-to-insulator and simultaneously a ferromagnetic-to-antiferromagnetic transition is found. The variation of the manganese oxidation state is characterized using X-ray Absorption Spectroscopy. Rutherford Backscattering Spectroscopy implies a manganese-deficient BM phase after annealing. This BM phase shows in the magnetization vs. temperature curves a peculiar peak above room temperature which cannot be explained within the usual AF ordering at low temperatures. For LSMO powder, the evolution of the crystal structure and spin structure at different oxygen-deficient states from PV to BM is investigated using neutron diffraction. The neutron diffraction study hints at a process including multiple transitions of the crystal structure and spin structure.

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Sitzung Einordnung: Session 2: Condensed Matter (Chairs: Werner Paulus, Holger Kohlmann & Simon Steinberg)

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