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Morphology and crystallinity of $Sr_xCo_yO_z$ films at different growth conditions and stoichiometry

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Because of its multivalent Co states and high oxygen mobility, $SrCoO_{3-\delta}$ is a promising material for energy and information applications. $SrCoO_3$ is a ferromagnetic metal with a Curie temperature of 305K, which becomes an antiferromagnetic insulator with a Néel temperature of 570K, when the oxygen content is decreased to $SrCoO_{2.5}$. Along with this magnetic transition, the structure changes from perovskite to brownmillerite, and the missing oxygen atoms form vacancy channels.
We aim to grow thin films of $SrCoO_{3-\delta}$ by molecular beam epitaxy and to fill the oxygen vacancies by annealing in a tube furnace under constant oxygen flow. These films are investigated by in-situ electron diffraction, ex-situ X-ray reflectometry and diffraction as well as atomic force microscopy. The stoichiometry is determined by Rutherford backscattering spectrometry. To investigate the intercalation of oxygen into the film in depth dependence, neutron reflectometry is performed to determine the change of the magnetic structure.
We present the effect of growth conditions on the stoichiometry, crystallinity and morphology of $Sr_xCo_yO_z$ films on $SrTiO_3$ and requirements for $Sr_1Co_1O_{2.5}$ films. Results of decreased oxygen vacancies by annealing in a furnace under oxygen flow and corresponding changes in the structure and magnetic properties are shown, as well as neutron reflectometry measurements to determine the depth dependent magnetic profile.

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