MS18-P02 | Tailored exsolution of metal nanoparticles: Structural and chemical characterisation of doped Perovskites by XPS and XRD

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Perovskite-type oxides are a large class of materials with many interesting properties, including piezo- and pyro electricity, mixed ionic-electronic conductivity and high catalytic activity. There is a wide range of applications, e.g. the use as sensors or electrode materials in solid oxide fuel cells. Their chemical formula is ABO_3, with two different cations A (bigger) and B (smaller). The ideal structure is cubic, but it is often distorted as can be seen for $NdFeO_3$. The high versatility is due to the possibility of adjusting the properties by choosing different elements for the cations. Doping of the cation sites opens up an even larger matrix for materials design.

Different perovskite-type oxides will be synthesised and characterised. These perovskites are promising catalyst materials for several energy related reactions, such as the water gas shift reaction, water splitting or the CO oxidation. Another recently shown outstanding property is the exsolution of metal nanoparticles from perovskites under reducing conditions. This surface modification can change the catalytic activity and selectivity of the perovskite surface completely.

Starting with $La_xCa_{1-x}FeO_3$, perovskites with different cation species and dopant amounts will be investigated, choosing the most promising. X-ray diffraction (XRD) allows structural determination, while X-ray photoelectron spectroscopy (XPS) gives chemical information of the surface. A focus will be on the stability and reducibility of the synthesized perovskites, as this is crucial for nanoparticle exsolution. Only in an ideal metastable window, controlled formation of metal nanoparticles can be achieved.