Compounds with perovskite or Ruddlesden-Popper type structure are known for their structural and compositional flexibility of the anion sublattice. Due to this, such materials can be modified via topochemical reactions at low temperature (ranging from fluorination, via oxidation/reduction to hydration). After topochemical modification, material properties (e.g., conductivity characteristics and magnetic behavior) are often found to change drastically.

Due to a high capacity for interstitial fluoride ions, we have recently shown that compounds of the Ruddlesden-Popper structure family can serve as cathode materials for solid state fluoride ion batteries, with improved charging kinetics and cycling stability. To understand structural changes on charging/discharging, we complement electrochemical investigations by chemical routes for the topochemical defluorination.

Apart from batteries, our group focuses on the understanding of water uptake in anion deficient perovskites, aiming to develop proton and electron conducting materials as catalysts for protonic ceramic fuel cells (PCFCs). Examples will be given on structural changes induced on water uptake. It will be shown that epitaxially grown films can serve as model systems to study the grain conductivity of protons, when sintered ceramics or single crystals cannot be obtained.

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