Design strategies towards perovskite nanostructures for environmental catalysis

Jun.-Prof. Dr Simone Mascotto

Institute of Inorganic and Applied Chemistry, University of Hamburg, 20146 Hamburg

The development of cost-effective, efficient of pollution abatement technologies covers a key role in nowadays society. An optimal catalyst for these applications should be highly active, stable and comprised of earth-abundant materials. In these regards, perovskite oxide family with general formula ABO_3 is a favorable class of materials, thanks to their structural flexibility and ease in accommodating non-stoichiometry.

In this talk, the development of synthesis strategies that encompass variation of chemical composition, material morphology and defect structure of perovskite oxide catalysts is presented.

Chemically complex mesoporous perovskite oxides were prepared by La- and Fe- co-substitution in the $SrTiO_3$ lattice to form $La_{0.3}Sr_{0.7}Ti_{1-x}Fe_xO_{3\pm\delta}$ solid solutions with a composition variation between $0 \leq x \leq 0.5$. The choice of cationic substituents was based on the compromise between stability and catalytic performance. Porosity and nanostructure tuning of $SrTiO_3$-based systems were realized through a straightforward inorganic endotemplating route integrated into a polymer complex synthesis. Finally, the consolidation of $SrTiO_3$-based nanoparticles by electric field-assisted treatments determined significant modification of the point defect structure of the materials along with their conductivity mechanism, thus resulting in high surface reactivity and improve catalytic performance.

This multistep material development perspective aims to present the preparation of oxide architecture with tunable functional properties as a forward-looking strategy towards catalysts with higher performance.