Exploration of the Potential of Perovskites in Oxidation Catalysis

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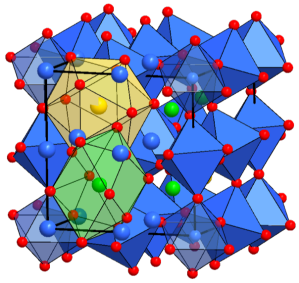
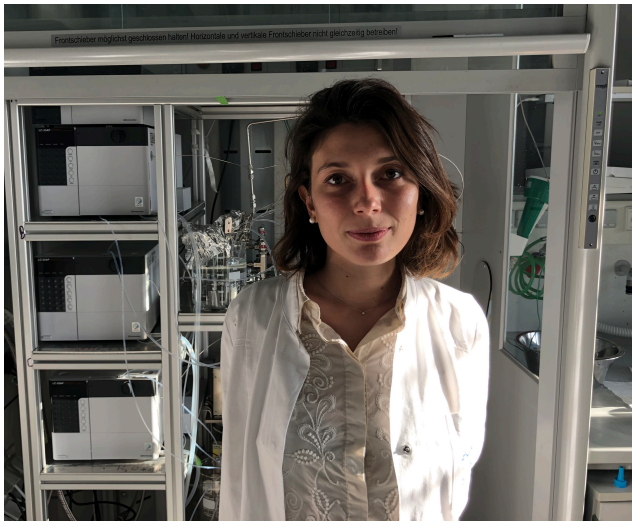


Perovskite-like structures containing V, Cu and Mn as B-site cation and Sr, Ba, La, Pr, Nd, and Sm as A-site cation will be explored in their potential in oxidation catalysis, mainly in the oxidation of propane and in CO oxidation. Vanadium has been chosen because it is claimed to be a key element in oxidation catalysts, Cu is reported to be a promoter, and Mn oxides are known to be very active in oxidation catalysis.

The materials are prepared by combustion synthesis and hydrothermal techniques. Hydrothermal synthesis in the present project will be also carried out in continuous operation. Supercritical synthesis routes have already been employed to synthesize nano-structured perovskites and the temperature and pressure range reported in the literature is between 400-500°C and between 30-35 MPa, respectively, in aqueous medium. The continuous hydrothermal synthesis is currently under construction.



The Pechini route was applied to synthesize double B-site perovskites

$AB_{(1-x)}B'_xO_3$ (A = La, Pr; (B, B') = (Mn, Cu), x=0.1-0.5).

As evidenced by XRD and electron microscopy, all materials were phase-pure oxides presenting a porous structure defined by a coral-like morphology and specific surface areas that vary between 1.8 and 29 $m^2 \cdot g^{-1}$. The catalysts were tested in the oxidation of CO and propane. The function of various oxygen species present on the surface under operation conditions is analyzed by operando XPS and NEXAFS. Increase in propene selectivity was observed when Mn was partially substituted by Cu in the double B site-based catalysts, underlying how the synergistic effect of two elements in the B-site exerts a beneficial influence under oxidative catalytic conditions.