

X-ray absorption spectroscopy.

X-ray absorption spectroscopy provides element specific information on the electronic structure (including the oxidation state) and the local geometric structure (identity and number of neighboring atoms, bond distances up to $\sim 6\text{\AA}$) of solid materials (both ordered and amorphous) but also of solution and gas species (see figure). Thanks to the penetration depth of hard X-rays ($> 4.5\text{ keV}$) this information can be obtained of functional materials while they operate, for example of an electrocatalyst during electrochemical water splitting or a heterogeneous catalyst during a catalytic reaction.

In this experiment you will determine the oxidation state and local structure of a Ni-perovskite during the different environments an automotive three way catalysts, used for the reduction of nitrous oxides and oxidation of carbon monoxides and unburnt fuel, is exposed to. This Ni-perovskite is a promising three way catalyst to reach the stringent emission limits set on modern diesel fueled cars.

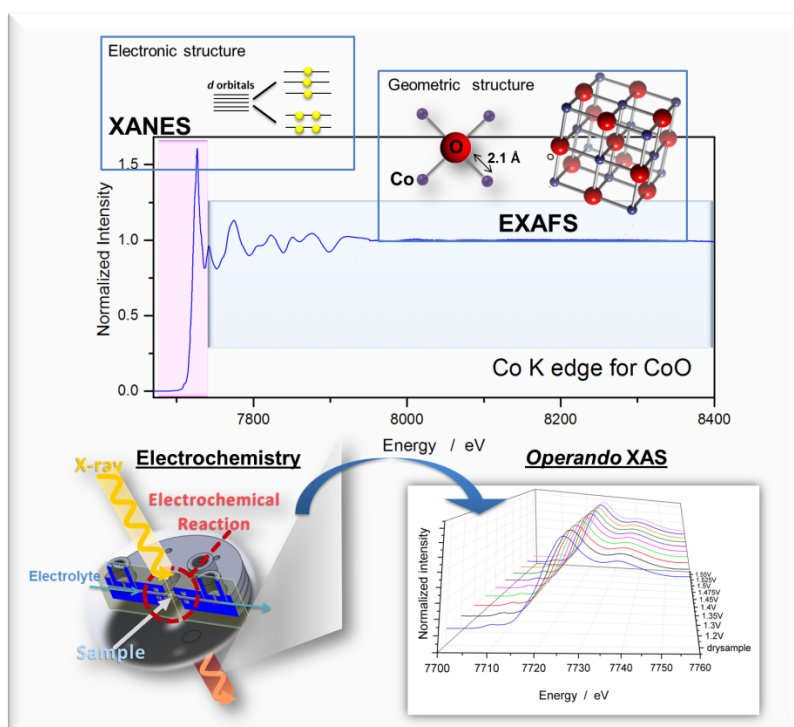


Figure 1: On top, Co-K.edge XAS spectrum of CoO. On the bottom, a sketch of a three electrode flow-cell for electrochemical characterization using X-ray based techniques and an example of operando XAS spectra recorded at different operative potential.