Electrode interface engineering and analysis using in-situ ALD and SR based spectroscopies

We analyze electrochemical systems by SR based techniques such as XPS, XAS, and resPES. Two examples will be addressed here. The first concerns the Co-PI catalysts. Here we determine the spin state, chemical state and electrochemical potential $s$ depending on the thickness of as prepared catalysts. We attribute a charge-transfer state forming a Co 3$d^7$ L ($s=1/2$) low-spin state to be the most active catalytic site for water oxidation reaction.

The second example deals with Ti-oxide ALD films deposited in-situ on p-Si samples. The modification with TiO$_2$ leads to a significant improvement of the onset potential in comparison to the bare p-Si. In a model we explain these properties by localized in-gap states formed within the Ti-oxide film.