

Influence of nitrogen oxides and UV-radiation on metal oxide surfaces: XPS investigation

M. LAMPIMÄKI¹, S. SCHREIBER¹, V. ZELENAY¹, A. KŘEPELOVÁ¹, M. BIRRER¹, S. AXNANDA², B. MAO², R. CHANG², H. BLUHM², Z. LIU² AND M. AMMANN¹

¹*Laboratory of Radio- and Environmental Chemistry, Paul Scherrer Institute, Villigen, Switzerland*

markus.lampimaeki@psi.ch

²*Lawrence Berkeley National Laboratory, Berkeley, USA*

Catalytic and photocatalytic processes of atmospheric trace gases on the surface of Fe- and Ti-oxide containing mineral dusts may play an important role in atmospheric chemistry. On TiO₂, UV-radiation induced electron/hole pairs can directly or indirectly via photogenerated reactive oxygen species affect environmental processes through the redox chemistry of atmospheric gases, volatile organic compounds, H₂O and O₂ [1,2,3]. Photoelectron spectroscopy provides a valuable tool to study adsorption of nitrogen oxide species and the effect of UV-radiation on metal oxide surfaces [4,5]. Here, we have employed near-ambient-pressure x-ray photoelectron spectroscopy for measurements of nitrogen oxide chemistry on well defined Fe- and Ti-oxide surfaces.

The photoelectron spectroscopy measurements were performed at the beamline 9.3.2 at the Advanced Light Source. Core-level metal cation, O and N XPS-transitions, as well as valence band regions were measured at elevated pressures of NO_x, O₂, O₃ and H₂O. Phases of surface nitrite and nitrate formation were observed after exposure to NO and O₃. Furthermore, photochemical experiments were conducted on TiO₂ surfaces in situ by using a UV diode laser.

References

- [1] A. Linsebigler et al., Chem. Rev. **95** 735 (1995)
- [2] H. Chen et al., Chem. Rev. **112** 5919 (2012)
- [3] M. Shiraiwa et al., Nat. Chem. **3** 291 (2011)
- [4] J. Haubrich et al., Langmuir, **26** 2445 (2010)
- [5] O. Rosseler et al., J. Phys. Chem. Lett. **4** 536 (2013)