

Electron spectroscopic studies on metal oxide surfaces: Effect of ozone, nitrogen oxides and UV-light

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Metal oxides, as a part of atmospheric mineral dust, have an important role in the heterogeneous reactions of ozone and nitrogen oxides in the atmosphere [1,2]. However, the mechanism behind these processes is yet not well understood. For instance, the effect of surface hydroxylation or water adsorption in the catalytic decomposition of ozone is still not clear. In the present study we have investigated Fe₃O₄(100) and TiO₂(110) single crystal surfaces during exposure to O₂, O₃, NO and humidity. Ozone concentration was monitored by gas phase measurements and O, Fe, Ti and N core-level XPS-transitions as well as valence band regions were measured in situ at elevated pressures. Additionally, the surface chemical composition was monitored by Near edge X-ray absorption fine structure (NEXAFS) spectroscopy. Preliminary results for ozone decomposition indicate no significant pressure dependency or inhibition due to water adsorption.

The formation of surface nitrogen oxide species after exposure to NO₂ have been previously investigated on TiO₂ and MgO surfaces by ambient pressure XPS [3,4]. In this study we have used O₃ and NO to observe different phases of surface nitrite and nitrate formation during a sequence of gas exposures. The latest results from the experiments, where the sample surfaces are measured during in situ exposure to nitrogen oxides, water vapor and UV-light, will be discussed.

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