2.173 Heterogeneous photochemical reactions on TiO2 in the presence of UV irradiation.

Presenting Author:
Qingxin Ma, Research center for eco-environmental sciences, CAS, qxma@rcees.ac.cn

Co-Authors:
Hong He, Research center for eco-environmental sciences, CAS

Abstract:

TiO2 is an important component of mineral dust due to its efficient photochemical reactivity. Recent researches found the heterogeneous reactions on TiO2 has a significant impact on the formation of secondary pollutions like HONO and sulfate. In this study, we used wall coated flow tube and in situ DRIFTS to study the heterogeneous reactions of SO2 and NH3 on TiO2 at 298 K with or without irradiation. Both the reaction of SO2 and NH3 on TiO2 under dark condition were very weak. The presence of UV irradiation was found to promote the adsorption of sulfur species and the formation of sulfate through the photo oxidation of sulfite/bisulfite species. However, UV irradiation exhibits slight effect on the initial uptake coefficient (γ_{BET}). Increase in relative humidity (RH in the range of 0-75%) led to the decrease in the γ_{BET} and uptake capacity of SO_2 both in the dark and the light reaction due to the competition effect. Adsorbed water can promote the formation of sulfate in dark reaction but decrease the conversion of sulfite to sulfate upon irradiation. It was found that NH3 could be converted to NOx in the presence of UV irradiation, while the presence of SO2 inhibited the reaction of NH3. In the presence of NH3, formation of (NH4)2SO4 species was observed during the heterogeneous reaction of SO2 on TiO2 under UV irradiation. These results suggest that under atmospherically relevant conditions the heterogeneous chemistry of TiO_2 can represent a potential source of sulfate and ammonium in the dust.