



Heterogeneous SO₂ oxidation in sulfate formation by photolysis of particulate nitrate

Chak K. Chan (1), Masao Gen (1), Ruifeng Zhang (1), Dandan Huang (2), and Yongjie Li (3)

(1) City University of Hong Kong, School of Energy and Environment, Hong Kong, Hong Kong (chak.k.chan@cityu.edu.hk),
(2) Shanghai Academy of Environmental Sciences, Shanghai, China, (3) University of Macau, Faculty of Science and
Technology, Department of Civil and Environmental Engineering, Macau, China

Heterogeneous oxidation of sulfur dioxide (SO₂) is suggested to be one of the most important pathways for sulfate formation during extreme haze events in China. Yet, the exact mechanism remains highly uncertain. We propose a much less explored pathway for aqueous-phase SO₂ oxidation to form particulate sulfate by NO₂ and OH radicals produced from photolysis of particulate nitrate. Reactive uptake experiments of SO₂ by ammonium nitrate particles under UV irradiation show the measured SO₂ uptake coefficients of ~10⁻⁵. Model calculations of sulfate production rates, comparing known oxidation mechanisms by O₃, NO₂, H₂O₂, and transition metal ions, and the nitrate photolysis mechanism suggest that the nitrate photolysis pathway could contribute significantly to the overall sulfate production at pH = 4 to 6. The present study provides a new insight into the current debate on sulfate production pathways under typical haze conditions in China.