

# Competitive reaction of CH<sub>2</sub>OO with SO<sub>2</sub> and water vapour and the thermal lifetime of CH<sub>2</sub>OO at 293 K

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H<sub>2</sub>SO<sub>4</sub> represents a key substance in the process of atmospheric nucleation. The importance of gas-phase products from olefin ozonolysis other than OH radicals, most likely stabilized Criegee Intermediates (sCIs), for the process of atmospheric SO<sub>2</sub> oxidation to H<sub>2</sub>SO<sub>4</sub> has recently been discovered.

Subject of this work are investigations on H<sub>2</sub>SO<sub>4</sub> formation from CH<sub>2</sub>OO + SO<sub>2</sub> as a function of the water vapour content and the measurement of the CH<sub>2</sub>OO steady state concentration starting from the ozonolysis of ethylene used for formaldehyde oxide generation. Measurements have been conducted in an atmospheric pressure flow tube at 293 K using NO<sub>3</sub><sup>-</sup>-CI-APi-TOF mass spectrometry for H<sub>2</sub>SO<sub>4</sub> detection.

The experiments show a square-dependence in H<sub>2</sub>O for the kinetics of the reaction CH<sub>2</sub>OO + H<sub>2</sub>O indicating that likely the water dimer (H<sub>2</sub>O)<sub>2</sub> governs the reaction with CH<sub>2</sub>OO rather than the water monomer. This finding is in line with results from quantum chemistry. Furthermore, a sCI yield (CH<sub>2</sub>OO) of 0.40 ± 0.18 can be deduced from the H<sub>2</sub>SO<sub>4</sub> measurements in accordance with results from other experimental techniques. A CH<sub>2</sub>OO thermal lifetime > 1s was found as a result of CH<sub>2</sub>OO steady state measurements for different reactant concentrations at 293 K.

The importance of H<sub>2</sub>SO<sub>4</sub> formation from CH<sub>2</sub>OO + SO<sub>2</sub> for atmospheric conditions is discussed based on kinetic parameters obtained in this study.