RAMAN SPECTROSCOPIC INVESTIGATION OF THE ISOMERIZATION OF HSO_3^- IN MICROPARTICLES. H. Moritz, P. Heinrich, R. Vehring and G. Schweiger, Ruhr-Universität Bochum, Maschinenbau, Laseranwendungstechnik, D-44780 Bochum, Germany

Raman Spectroscopy on a chain of microdroplets is used to investigate heterogeneous reactions in aqueous aerosols. The potential of the method is demonstrated with a time-resolved measurement of the absorption, dissociation and isomerization in the H_2O-SO_2 system.

A chain of micro droplets from a vibrating orifice generator was injected into a sulphur dioxide atmosphere with a velocity of 20 m/s. Water droplets were produced in the size range from 20 to 45 µm. Immediately after the exit from the generator orifice absorption of SO_2 from the gas phase started. The following reaction products subsequently formed in the liquid phase :

$$SO_{2(g)} + H_2O \Leftrightarrow SO_{2(aq)} + H_2O$$

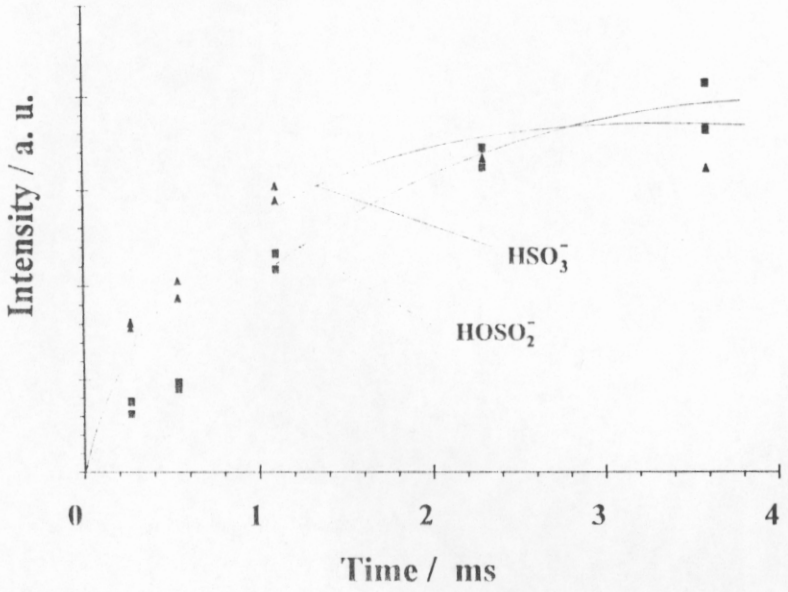
$$SO_{2(aq)} + H_2O \Leftrightarrow HSO_3^- + H^+$$

$$HOSO_2^- \Leftrightarrow SHO_3^-$$

Dissolved sulphur dioxide forms sulphurous acid which dissociates into hydrogen sulphite ions. Recently Littejohn, Walton and Chang (1992) identified the Raman lines of two coexisting hydrogen sulphite isomers.
Linear Raman spectra from the micro particles and the surrounding gas phase were taken at different distances from the generator. A cw argon ion laser was used for excitation. 90° scattering was detected by a liquid nitrogen cooled CCD-camera which was mounted on the exit plane of a double monochromator.
Using the technique of droplet chain measurements, time dependent processes can be transformed into space dependent processes, Vehring and Schweiger (1991). Depending on the spatial resolution of the experimental set-up, processes can be analysed with a time resolution in the µs time range. In the present case time resolution was better than 100 µs.
Droplet temperatures were derived from a contour analysis of the OH-stretching band of water as described by Vehring and Schweiger.

The Raman signals from all chemical components in the gas phase and in the liquid phase were detected and could be discriminated from each other. Con-

centrations of the substances in the liquid could be quantitatively measured down to a detection limit of approximately 1 mmol/l. The kinetics of the formation of dissolved sulphur dioxide and of the hydrogen sulphite isomers could be monitored. Fig. 1 shows results of a measurement of concentrations of the hydrogen sulphite isomers as a function of time.



The results obtained were compared with a simplified numerical model of the process.

Littlejohn, D., Walton, S.A., and Chang, S.-G. (1992) Appl.Spec. 46: 848-851.
Vehring, R. and Schweiger, G. (1991) J.Aerosol Sci. 22: S399-S402.
Vehring, R. and Schweiger, G. (1992). Appl.Spec. 46: 25-27.

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ABSTRACTS

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