

PARALLEL RAMAN SPECTROSCOPY AS A TOOL FOR THE INVESTIGATION OF FAST HETEROGENEOUS REACTIONS ON MICROPARTICLES. R. Vehring and G. Schweiger, Fakultät für Maschinenbau, Lehrstuhl für Laseranwendungstechnik, Ruhr-Universität Bochum, W-4630 Bochum, Germany

An experimental technique is described which facilitates a time-resolved investigation of fast heterogeneous reactions on liquid microdroplets. The feasibility of the method is demonstrated with a measurement of the desorption of carbon dioxide from oversaturated water droplets.

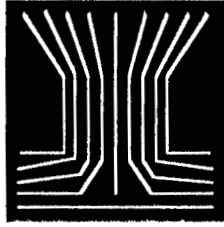
A chain of microdroplets from a vibrating orifice generator was injected into a nitrogen atmosphere with a velocity of 25 m/s. The droplets were in the size range of $\sim 20 \mu\text{m}$ and consisted of water in which large amounts of CO_2 had been dissolved. Immediately after the exit from the generator orifice vigorous desorption from the microdroplets started. Linear Raman spectra were taken at different distances from the generator. An cw argon ion laser was used as excitation source. 90° scattering was collected from a scattering volume which was 2 mm wide. A liquid nitrogen cooled CCD-camera which was fitted with a two-dimensional CCD-chip was mounted on the exit plane of a double monochromator. One axis of the CCD-chip which was oriented parallel to the dispersion of the monochromator was used to simultaneously record a spectral window with a width of $1/\text{cm}$. The other axis of the CCD-chip was parallel to the entrance slit and therewith perpendicular to the direction of propagation of the droplet chain. Therefore, from the intensity distribution along this axis gas phase concentrations could be derived as a function of distance from the microdroplets. It is shown that a space resolution of $5 \mu\text{m}$ can be achieved.

Due to the high velocity of the droplet chain the process could be monitored with a time resolution of $50 \mu\text{s}$.

Raman signals from all chemical components in both the liquid and the gas phase (i.e. liquid water, water vapor, dissolved CO_2 , free CO_2 and nitrogen) were detected and could be discriminated from each other. Absolute molar concentrations could be derived. Gas phase temperatures were determined from the rotational N_2 spectrum. Droplet temperatures were derived from a contour analysis of the OH-stretching band of water¹. The results obtained were compared with a simple numerical model of the desorption process.

With this experimental method a detailed investigation of fast processes on multicomponent microparticles can be performed. Heat and mass transport in the immediate vicinity of the droplets can be observed.

¹ Vehring R., Schweiger G.: Optical Determination of the Temperature of Transparent Microdroplets, *App. Spec.* 46, 25 (1992)



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ABSTRACTS

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