Recent applications of the WALS-technique

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Nanoparticles produced in combustion processes often exhibit complex fractal structures. While laser-induced incandescence (LII) is a proven technique for the determination of primary particle size no information about aggregate sizes can be obtained. To gather information about aggregate size and fractal dimension elastic light scattering (ELS) [1] is an often used *in situ* method.

The wide-angle light scattering (WALS) approach [2] extends classical ELS-concepts by using a combination of an ellipsoidal mirror and an intensified CCD-camera. The ellipsoidal mirror redirects the light scattered within a plane onto the CCD-chip (cf. Fig. 1), which makes it possible to almost instantaneously record a complete scattering diagram over an angular range of approx. 10° to 170° with an angular resolution $\Delta\theta$ of typically 0.6°.

The basic performance of the approach was demonstrated previously by measurements on soot particles in laminar premixed flames [2]. This contribution highlights various recent developments and applications of the technique. These include measurements in a turbulent diffusion flame [3], employing a pulsed laser and underlining the favourable applicability to unsteady processes. Also measurements with a particular high resolution of $\Delta\theta = 0.3°$ were performed which allow for a detailed investigation of selected angular regions. To simultaneously measure the vv- and hh-scattering components polarization foils were mounted in front of the ellipsoidal mirror. Radii of gyration obtained for soot particles in a premixed ethene flame show good agreement with former results. Furthermore investigations on silica particles produced in a diffusion flame were carried through (cf. Fig. 2) for various relative velocities between the precursor flow (nitrogen flow saturated with hexamethydisiloxane) and the methane/oxygen flow of the supporting flame. Recorded scattering diagrams indicate a change in the structure of the silica particles for the different velocities.

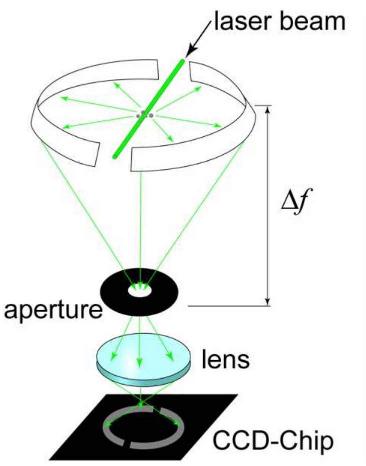

Fig. 1: *Experimental setup*

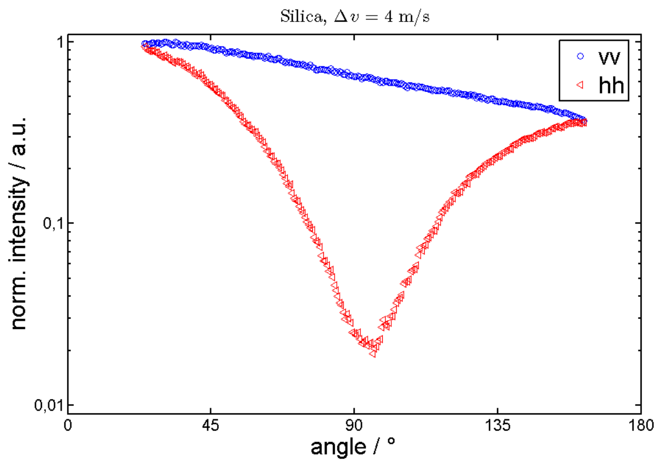

Fig. 2: *Measurement on silica particles in a diffusion flame*

[1] C. M. Sorensen, Aerosol Sci. Technol. 35, 648-687 (2001)
[2] H. Oltmann, J. Reimann, S. Will, Combust. Flame 157, 516-522 (2010)
[3] H. Oltmann, J. Reimann, S. Will, Appl. Phys. B 106, 171-183 (2012)