Single Particle Scattering Sensor System: Sizing and counting of particles from nano- to microscale.

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Methods for characterizing physical properties of nano- and microparticles are of increasing importance for research, industry and health care. Particle size, size distribution and particle count are considered as major characteristics. On the other hand, contamination analysis and classification of nanomaterials according 2011/696/EU also demand precise data of size distribution and particle concentration.

In this paper an optical scattering measuring technique is described which delivers both high-resolution particle size distribution over a very wide size range from 50 nm to 10 micrometres and, at the same time, the particle count of size classes. The measuring system consists of a measuring quartz cell enabling hydrodynamic focussing, a laser light source (405 nm) with non-spherical beam cross-section, two identical PMT-sensors and two two-stage amplifiers with a dynamic range of more than 120 dB. The fluidic system separates particles before they entering/passing the laser focus. The scatter intensity in two directions (90° and 180°) of each single particle is detected simultaneously by the PMTs, amplified, digitized and electronically saved. Internal sampling rate amounts of 2.5 x 10^6 and resolution 22 bits, respectively. Data are presented for the lower size range of forward (around 150 nm) and sideward (50 nm gold) scatter. The upper detection range is currently at about 10 µm. The new sensor system is able to discriminate between very narrow monomodal particle fractions (peak resolution better than 15 nm). It allows for a fast analysis (10.000 particles per second) and sample concentration as high as 10^7 particles per µL. Results presented demonstrate the advantages and the potential of the new developed measurement technique (Single Particle Light Scattering – SPLS) determining the number-based concentration and size distribution of micro- and nanoparticles.

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