# Direct Transfer of Aerosol Particles into Liquid Suspensions

C. Anderlohr[1], K. Schaber[1]

[1]Institute for Technical Thermodynamics and Refrigeration, Karlsruhe Institute of Technology, Karlsruhe, 76131, Germany
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Presenting author email: christopher.anderlohr@kit.edu

Nanoparticles produced by gas phase processes are usually precipitated in (baghouse-) filters forming a more or less agglomerated powder.

However, in many cases the final application of these particles is not as a powder but as a liquid suspension, i.e. printable electronics, heterogeneous catalysis, paints etc. This necessitates the dispersion of the particles into a liquid before use.

In this work the direct transfer of $SiO_2$ nanoparticles generated by a lab scale flame reactor into aqueous suspensions by means of a wet electrostatic precipitator (WESP) and particle stabilization in the liquid are studied.

Wet electrostatic precipitation is an energy efficient possibility for gas cleaning with high removal efficiencies. WESPs are employed in numerous industrial applications, i.e. the control of acid mist, the precipitation of sticky or high resistivity aerosol particles, or when fire hazard is an issue. Recently, there have also been approaches of using WESPs for emission control of diesel particulate matter from stationary diesel generators (Saiyasitpanich, 2007).

Different from dry type electrostatic precipitators, particles collected on the precipitation electrode are not removed by intermittent rapping, but are washed off by a liquid flushing the electrode. In the common processes the precipitated particles are usually removed from the flushing liquid before it is redistributed onto the collection electrodes (Parker, 1997). The aim of this study, rather than extracting the particles from the liquid, is to produce a stable suspension of product particles, which can be used directly for its later application.

The aerosol particles produced in the gas phase in our setup exhibit little to no agglomeration. Thus, if the single particles can be precipitated directly into the liquid, no additional energy for dispersion and deagglomeration is necessary in order to create a stable suspension. Thus the particle size distribution (PSD) should be preserved during the transfer.

During the experiments the PSDs in the liquid suspension are measured by Photon Correlation Spectroscopy (PCS) as well as with the novel Liquid Nanoparticle Sizer (LNS) technique by TSI. These data are compared to the SMPS-measurements of the aerosol size distributions. It is shown that direct particle transfer into suspensions with merely minor changes to the PSD is possible (Fig. 1). These suspensions can be stable for several weeks before exhibiting any signs of degradation.

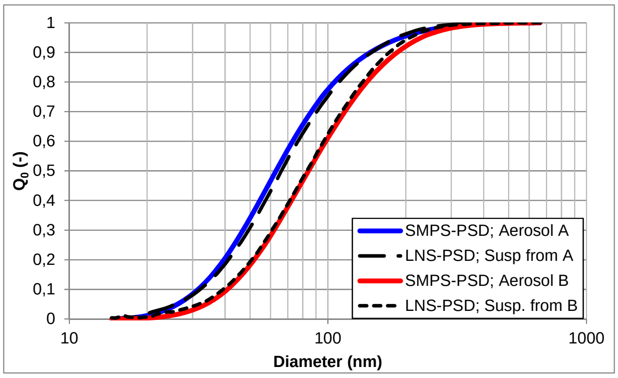


Figure 1: LNS-PSDs of $SiO_2$ nanoparticles in liquid suspension with the SMPS-PSDs of the corresponding aerosols before precipitation.

For possible industrial application it is desirable to produce suspensions with a high solid content. In order to achieve high particle concentrations, the suspension is recirculated in the WESP. The influences of residence time and concentration are studied (Fig. 2).

Furthermore, the effects of pH-value, salt concentration and stabilizing agents in the circulated liquid on stabilization are investigated.

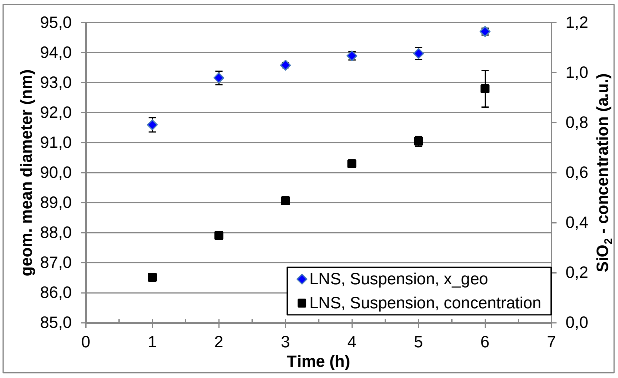


Figure 2: Progression of geom. mean diameter and particle concentration over time, during precipitation in the WESP.

Parker, K. (1997) *Applied Electrostatic Precipitation*, Blackie Academic & Professional, Great Britain.

Saiyasitpanich, P. (2007) *Journal of Electrostatics.* **65**, 618-624.