Measurement and 3D Simulation of NaCl aerosol deposition on electrically charged microfibers

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An important effect influencing the deposition of aerosols especially on electret microfibers is electrostatic. E.g., electret fibres are used in particle filters for respiratory protection or inside air cabin filters. Measurement and simulation techniques for electrostatic forces respectively charges still need to be investigated. Charge quantity and distribution inside microporous media are usually unknown and can additionally change the charge continuously.

At the modelling of particle deposition based on a single fiber approach, the electrical field is taken into account only in a basic way to such a degree that the interaction of the electrical field induced by several adjacent charged fibers is neglected.

Measurements and 3D simulations of particle deposition on electret microfibres have been carried out. The filtration efficiency for submicron particles can be measured by Scanning Mobility Particle Sizer (SMPS).

The measurement and evaluation of the filtration efficiency for submicron particles is technically extensive, time-consuming and the influence of electrostatic is hard to estimate. Therefore, direct numerical simulation is applied to get deeper insight into the occurring effects. For a 3D model of the distribution of charged fibres e.g. spotted or bipolar the airflow and the electric field are computed directly at high resolution as shown in figure 1 and 2. The trajectory of each single particle driven by flow, electric field and diffusion is computed, as well as the deposition of the particle at the fibre surface.

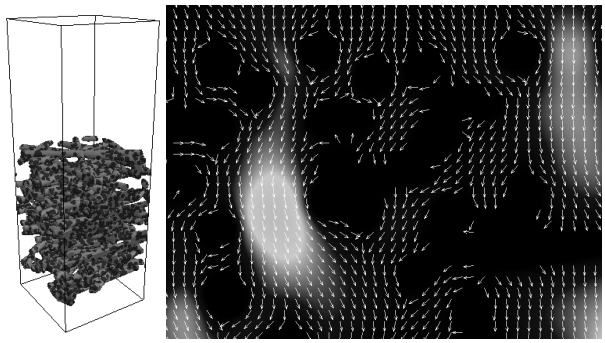

Figure 1 3D model (DNSlab) for direct numerical simulation (left) and a 2D slice of a computed flow field around defines fibre area.

In this contribution the results of measurements and 3D simulations for the aerosol fraction deposition rates at a collection of electrically charged and discharged microfibers will be presented and compared.

Figure 2 Example of a generated spotted charged fibre media.

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