Abstract Book

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6.5. Development of an effective system to test the de-agglomeration process of airborne nanoparticles

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The stability of nanomaterial agglomerates is an important material parameter for estimating the particle size when nanomaterials are accidentally released into the environment and for toxicological assessment. The aim of this study is to develop a system that creates an aerosol with stable concentration and that allows testing at which energy the agglomerates break apart into smaller pieces.

The aerosol generation is achieved by mean of fluidic agitation. Air flow agitates nanopowders inside a generator and bring the aerosol to a sedimentation chamber which eliminates micro-sized particles. Humid air can be introduced from here to alter the humidity of aerosol. Afterwards the sample enters a deagglomeration orifice. In the final phase, the aerosol is introduced into a measurement chamber where it is stabilized and measured by scanning mobility particle sizer (SMPS).

The defragmentation orifice is still under development, but the generator and the measurement chamber have been already successfully tested with hydrophobic silica nanopowder. Flow rates of 0.3 l/min to 1 l/min were used to agitate the powder. Particle concentration in the measurement chamber reach stable values after certain period of time. The one-box well mixed model was used to estimate the time needed to obtain steady state and the experimental results correspond well to the modeling, but this has to be verified with additional tests and other powders. Particle size distribution remains stable throughout a single test while number concentration increases until steady state is reached. The flow rate needs to be fixed in this study owing to the "flow-dependant" nature of the size using this system. Initial experiments with an orifice suggest that we will be able to apply high shear forces to the agglomerates that pass through the orifice. Whether these changes in pressure lead to relevant variations in aerosol size needs to be studied next.