7PC1

DIFFUSION CHARGER-BASED AEROSOL SURFACE AREA MONITOR RESPONSE TO SILVER AGGLOMERATES WITH 2-D FRACTAL DIMENSIONS RANGING FROM 1.58 TO 1.94.

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The effect of particle morphology on a diffusion charger-based aerosol surface area monitor has been comprehensively investigated using the LQ1-DC diffusion charger (Matter Engineering, Switzerland). Silver particles sintered at various temperatures ranging from 20 oC (no sintering) to 700 oC were used to provide different particle shapes. With the exception of the 20 nm particles measured with the diffusion charger, the data response is fitted well with a power model of the form y=axb (where x is mobility diameter, y is normalized surface area and x is in the range from 20 to 100 nm), giving power b equal to almost 2. The deviation at 20 nm may be partly accounted for by the detection limit of the diffusion charger.
For the diffusion charger response vs. particle sizes extended up to 200 nm, the power b decreases to 1.62 when instrument response to particles larger than 100 nm is included. The change in response appears to start at mobility diameter 80~90 nm. Fitting data above and below 80 nm indicates two distinct response regions, with data above 80 nm being described by a power law with an exponent of 1.5. Diffusion charger response to the agglomerates at temperatures not larger than 300 oC (complex shape) is slightly higher than those at temperatures above 500 oC (spherical), indicating that the attachment rate of charged ions in the diffusion charger to particles appears to depend slightly on particle morphology. It is hypothesized that complex shaped agglomerates entering the diffusion charger will have a lower charge-to-surface ratio than equivalent spherical particles, thus leading to a greater probability of multiple charging.

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7PC2

CHARACTERIZATION OF AEROSOL PARTICLES RELEASED DURING AGITATION OF UNPROCESSED SINGLE WALLED CARBON NANOTUBES, USING AEROSOL PARTICLE MASS ANALYSIS AND TRANSMISSION ELECTRON MICROSCOPY.

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As the commercial production of engineered nanomaterials continues to increase, the health and environmental impact of material exposures and releases needs to be quantified and controlled. Single Walled Carbon Nanotubes (SWCNT) represent a unique nanomaterial that is close to production on a commercially viable scale. The size, shape and chemistry of SWCNTs have raised concerns over their harmfulness if inhaled. Recent studies have indicated that unprocessed SWCNT material formed in the gas phase does not readily aerosolize, although when sufficient mechanical energy is imparted to the material, a bimodal aerosol with modes below 50 nm, and between 100 nm and 1 µm is generated (Maynard et al. 2004). However, the unprocessed material is a complex matrix consisting of nanotubes, amorphous carbon and transition metal particles, and the relative balance of each within generated particles may profoundly affect aerosol toxicity. Mobility-based size analysis alone is insufficient to determine the structural nature of particles within specific size ranges. To further characterize particles released following agitation of unprocessed SWCNT produced in the HiPCO (High Pressure Carbon Monoxide) process (Bronikowski et al. 2001), Transmission Electron Microscopy (TEM) and Aerosol Particle Mass analysis (APM) (McMurry et al. 2002) have been used to study individual particle morphology and mass. The APM measures the mass of mobility-classified particles. Together, the two techniques allow an assessment of particle effective density, and enable the APM data to be interpreted in terms of individual particle components. Particles in the mobility diameter ranges of 20 nm – 30 nm, and 100 nm – 150 nm have been studied. Preliminary results indicate that the aerosol primarily consists of compact carbonaceous particles, and not nanotube-rich material.

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