from Feb 2005 AAAR Specialty Conference
8C-2

A FAST-RESPONSE, NANOPARTICLE WATER-BASED CONDENSATION COUNTER. SUSANNE V. HERING and Mark R. Stolzenburg, Aerosol Dynamics Inc.; Frederick R. Quant, Patricia B. Keady and Derek Oberreit, Quant Technologies, LLC.

A thermally diffusive, laminar-flow, water-based condensation particle counter (WCPC) has been developed to measure number concentrations for nanometer and ultrafine particles. Particles are enlarged by water condensation in a laminar flow using a "growth tube" technology that explicitly takes into account the high diffusivity of water vapor. The supersaturation necessary for particle activation and growth is produced in a warm wet-walled condenser. Because the mass diffusivity of water vapor exceeds the thermal diffusivity of air, the flux of water vapor to the centerline is faster than the heat flux from the walls. The first version of this instrument has an unsheathed sample flow of 1 L/min and saturator and condenser temperatures of 20C and 60C respectively. Its lower cutpoint, defined as the particle size detected with an efficiency of 50% is 4.5 nm for non-hydrophobic aerosols, including salts, organic acids and ambient aerosols. Reported here is a second, nanoparticle version of the instrument. The nano-WCPC utilizes a 50% sheath flow with an aerosol flow of 0.3 L/min, and saturator and condenser temperatures of 10C and 70C respectively. Tests with ambient, tunnel and laboratory generated aerosols show that the effective cutpoint is approximately 2.7 nm. The time response is approximately 300 ms, excluding the flow-enduced lag. The relatively high aerosol sampling rate yields significantly better counting statistics, allowing much faster size distribution scans that previously possible.