

*from 2004 Annual AAAR Conference*

**1B1**

**A LAMINAR-FLOW, WATER-BASED CONDENSATION PARTICLE COUNTER**

SUSANNE V. HERING and Mark R. Stolzenburg, Aerosol Dynamics Inc., Frederick R.

Quant and Derek Oberreit, Quant Technologies, LLC

A thermally diffusive, water-based condensation particle counter (WCPC) has been developed to measure airborne particle number concentrations in the size range above approximately 6 nm. 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. Traditional laminar-flow condensation particle counters do not work well with water because water vapor diffuses too rapidly and does not reach the necessary supersaturation within the cold-wall condenser region. In contrast, the WCPC employs 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. This difference produces a maximum in the water vapor supersaturation along the centerline of the flow. Theoretical modeling indicates that cutpoints as small as 2 nm could be achieved with this approach. A commercial prototype, utilizing an unsheathed sample flow of 1 L/min, was tested with laboratory-generated sodium chloride, ammonium nitrate, oleic acid and dioctyl sebacate aerosols. Particles were generated by atomization, neutralized using a Po-210 source, classified with a nano-DMA, and detected with a TSI 3025 ultrafine condensation particle counter and aerosol electrometer in parallel with the WCPC. The lower cutpoint, defined as the particle size detected with an efficiency of 50% is 6.5 nm for oleic acid aerosol, 6 nm for ammonium nitrate, and below 5 nm for sodium chloride. For pure dioctyl sebacate the cutpoint is above 30 nm, but the cutpoint drops to near 10 nm when a trace of sodium chloride is added. For monodisperse fractions of ambient aerosols, the response of the WCPC was comparable to the TSI 3025 ultrafine CPC for particle diameters above 6 nm.