

from 2004 Annual AAAR Conference
6PD7

MATERIAL EFFECTS ON THRESHOLD COUNTING EFFICIENCY OF TSI MODEL 3785 WATER-BASED CONDENSATION PARTICLE COUNTER

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The TSI Model 3785 water-based condensation particle counter (WCPC) offers rapid number concentration measurements of airborne ultra-fine particles. Its unique design [1-3] allows this instrument to use water as its condensing fluid. Water is non-toxic, odor-free, non-contaminating, and inherently eliminates the water condensation problem seen with alcohols in a humid environment. These advantages make it important to fully characterize its performance in comparison with standard butanol condensation particle counters. One critical aspect of such a counter's performance is its material dependence, i.e., the effect of the material of particles on its threshold response. From the performance of the early General Electric water-based condensation particle detectors [4] it is known that for a water-based particle counter, there will be a difference in response to hydrophobic and hydrophilic materials.

The threshold behavior of the WCPC was measured in this study, for particles of several different materials including sucrose, emery oil, DOS, DOP, and silver. Sucrose and oil particles were generated using an electrospray (TSI 3480), and silver particles were generated using a tube oven. Monodisperse particles were selected with a nano DMA. The particle counts of the water-based CPC and a TSI 3022 CPC were compared to the readings of an electrometer (TSI 3068A) to obtain counting efficiencies. The D_{50} cut point, i.e., the size with a 50% counting efficiency, of the WCPC is 4.7 nm for sucrose. The D_{50} cut points for pure oil particles are much larger (> 50 nm) and are different for different types of oils.

References

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4. B. Vonnegut, Method and Apparatus for Measuring the Concentration of Condensation Nuclei, US Patent 2,684,008, issued July 20, 1954.