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Ultrafine Particles – Effects of Aerosol Material on Different Nanoparticle Counters

Axel Zerrath, Andrea Tiwari, Torsten Tritscher, Sebastian Schmitt, Thomas Krinke, Carsten Kykal, and Florian Dahlkoetter

TSI Incorporated, Particle Instruments, Shoreview, United States (axel.zerrath@tsi.com)

Atmospheric aerosol particles are quantified using different technologies, each of which focuses on a certain size range of particles. The number concentration of ultrafine particles is usually measured by Condensation Particle Counters (CPCs), while Mobility Particle Sizers are able to determine the size distribution.

CPCs utilize a condensation process to grow the nanoparticles into droplets, which makes them visible to counting optics. Different types of working fluids can be used in this growth process; the most commonly used liquids are butanol and water. In environmental and indoor air quality studies water-based CPCs have gained much attention due to the fact that use of organic solvents is avoided and distilled water is used instead. Under typical ambient conditions both liquids are able to activate and grow airborne aerosol particles identically.

However, at the small particle size threshold of an instrument, the activation process can be influenced by the chemical composition of the aerosol particle. This is a consequence of the chemical and physical interaction between the aerosol material and the working fluid. For this reason the so called detection efficiency (efficiency with which particles of a given size are successfully detected) for small aerosol particles (typically smaller than 20 nm) needs to be investigated as a function of both aerosol chemical composition and type of working fluid.

Historically in aerosol research, butanol-based CPCs have shown the lowest dependency on aerosol material, are generally perceived as reference counters and are well characterized [1]. A new development step in the water-based CPC technology has been published ([2]) and commercialized recently. In this study we present additional data focusing on the counting efficiency of various aerosol materials comparing water-based and butanol-based nanoparticle counters of the latest generation.

As atmospheric research has focused on new particle formation and nucleation events, the efficiency of particle detection in the 1 nm to 100 nm range has grown in importance. This study will also present size distribution measurement comparisons between butanol- and water-based systems, when challenged with laboratory model aerosols as well as urban air atmospheric aerosols.

References

[1] M. Hermann, B.Wehner, O. Bischof, H.-S. Han, T. Krinke, W. Liu, A. Zerrath, A.Wiedensohler (2007), Journal of Aerosol Science, 38:6, 674-682.
[2] Susanne V. Hering, Gregory S. Lewis, Steven R. Spielman, Arantzazu Eiguren-Fernandez, Nathan M. Kreisberg, Chongai Kuang & Michel Attoui (2017), Aerosol Science and Technology, 51:3, 354-362