First results of a new Gas Aerosol Nucleation Spectrometer: GANS

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Nucleation is currently a hot issue in the aerosol science field and much attention has been dedicated to the problem (e.g. special issue in the Journal of Aerosol Science and Technology in April, 2011). One of the most important difficulties for the study of aerosol nucleation is the lack of available instrumentation with good performance and enough sensitivity for size-classifying the sub-2nm nanoparticles.

GANS (http://www.gans-project.eu/) is a project whose aim is to develop a commercial mobility-based particle sizer based on a planar DMA. The new instrument covers the particle sizes where the nucleation phenomena take place and where particles and ions coexist (< 5 nm). Several important innovations can be found in GANS instrument. The first one is a multipurpose ion source suitable for inorganic and organic ions (Ultra-Violet (UV) light ion source and Atmospheric Pressure Chemical Ionization (APCI) source designed by Ramem/Ioner). As the ion source can be switched off, free ions can also be detected. The second innovation of GANS project is the development of an instrument achieving much higher resolution than the resolution obtained in conventional Ion Mobility Spectrometers (IMS). The expected resolution of new GANS instrument is 80, even though the actual state of the instrument allows a resolution around 60. GANS is available with two detectors. The first detector is an electrometer with a sensibility of femtoAmpers. The second detector, and one of the main innovations in GANS project, is the inclusion of a Particle Size Magnifier (PSM) developed by Airmodus. The PSM is a special type of Condensation Particle Counter (CPC) for ions smaller than 2nm (Lehtipalo *et al*., 2013).

In this work we present first results of GANS instrument performance. To test the instrument, an aerosol of tetraheptylammonium (THA) ions was formed from a solution of THABr with IONER® ES-3020 electrospray source. In order to optimize the Resolving Power (RP) various experimental conditions were tested. As can be observed in Figure 1, the instrument can achieve RP higher than 60.

Regarding the ion source, the inorganics will be ionized using an APCI source. The new Ramem/Ioner´s ACPI ion source was tested with ammonium sulphate under various experimental settings. The results are compared with a radioactive ion source in Figure 2. As can be seen, the APCI source can charge ammonium sulphate aerosol as efficiently as radioactive source under optimal setting.

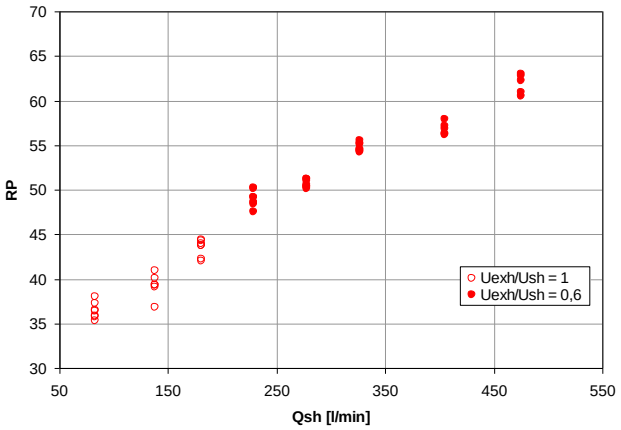

Figure 1: RP of GANS instrument for the monomer ion THA^+.

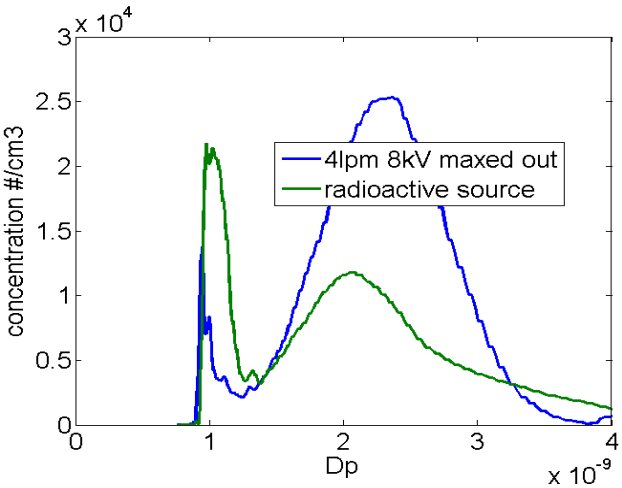

Figure 2: Comparison between Ramem/Ioner´s APCI and radioactive source for ammonium sulphate clusters.

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Lehtipalo,K., *et al.*, (2013) This abstract book.