PA60) Development of the Aerosol Mass Spectrometer with Various Heater Tip Configurations to Improve Collection Efficiency of Particles

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1. Introduction

The aerosol mass spectrometer (AMS) is a powerful real time instrument for the online detection of the chemical composition of atmospheric aerosol particles which have a vast impact on human health, global climate and the environment. In previous studies, there were significant improvements have been made in using the AMS however various issues on AMS collection efficiency including particle bounce that remains misunderstood. We modified the design of the GIST-AMS vaporizer to overcome previous limitations as well as to enhance the quantification of $PM_{2.5}$ non-refractory aerosol species. We determined the mass spectrum of ammonium sulphate particles from GIST-AMS with the current vaporizer. We are comparing collection efficiency of particles with various heater tips with different configurations and materials.

2. Experimental Methods

A schematic diagram of the GIST-AMS with various heater tip configurations is shown in Figure 1. The aerosol particles were impacted and flash vaporized on the heater surface producing vapour phase species that were subsequently ionized by the electrons emitted from the electron gun and the resulting ions were analyzed by time-of-flight mass spectrometer (TOF-MS). Seven types of experiments are being conducted: 1) surface texture effect (porous, smooth coated, grit blasted, and wire screened); 2) grit size effect (400 grit, 300 grit and 200 grit); 3) blasting angle effect (60°, 70° 80°); 4) depth of crevice effect (3 mm deep and 5 mm deep); 5) density effect (30% dense, 50% dense, 80% dense); 6) shape/geometry effect (flat, V-shape, U-shape and hexagonal); and 7) material effect (alumina ceramic, tungsten alloy and molybdenum alloy) using ammonium sulphate generated particles.

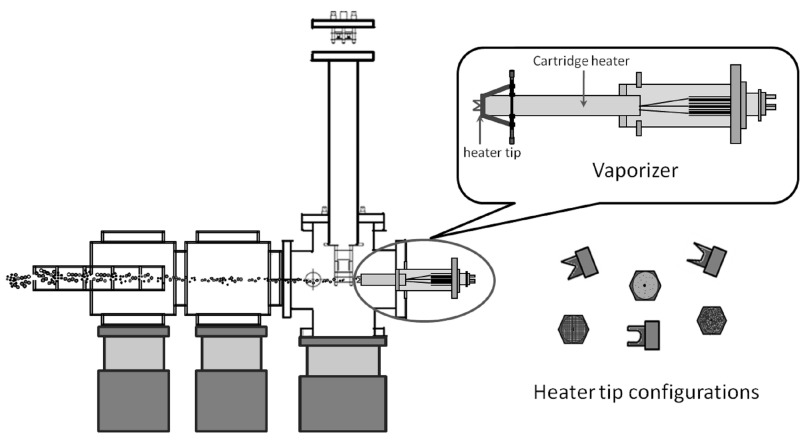

Fig. 1. Schematic of the GIST-AMS showing different heater tip configurations.

3. Results and Discussion

The mass spectrum of ammonium sulphate particles from GIST-AMS with the current vaporizer design is in good agreement with the corresponding spectrum from Aerodyne Q-AMS (see Figure 2). The GIST-AMS has comparable capabilities with the Aerodyne Q-AMS.

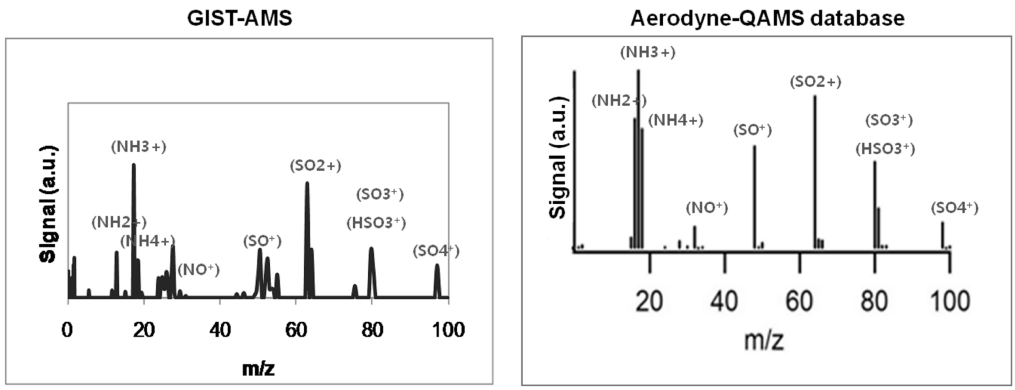

Fig. 2. The mass spectrum of ammonium sulphate particles from GIST-AMS with the current vaporizer design and Aerodyne Q-AMS.

The results of the comparison of collection efficiency of particles with heater tips with different configurations and materials will be presented here.

References

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