Single particle chemical analysis of various laboratory generated aerosols by using newly developed single particle mass spectrometer

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Atmospheric aerosol has great importance on atmospheric chemistry, global climate change, and adverse health effects. These impacts, which are mainly determined by physical and chemical properties of particles, are still in the question due to the complexity of their constituents and ever-changing properties. For this reason, Aerosol mass spectrometry (AMS) is a very powerful tool that can measure the size resolved chemical composition of particles. In this research, we set up a single particle mass spectrometer (SPMS), which is firstly developed by Mahadevan *et al* (2002), to analyse chemical mixing state of single particles from various sources.

As shown in the Figure 1 the AMS consists of two high vacuum chambers that are separated by a hole of 3 mm diameter. An inlet orifice with inner diameter of 100 μm was installed and particles were focused into the ~1 mm beam by passing through the aerodynamic lens. For particle desorption and ionization, Nd:YAG laser with a 532 nm of wavelength was used. The energy of laser beam was ~100 mJ/pulse before focusing and the power density was ~1 x 10^8 W/cm^2 at the focal point. The positive ions produced by LDI were analyzed by time-of-flight mass spectrometer installed perpendicular to the aerosol beam direction, and monitored by Lecroy oscilloscope (Waverunner Xi) with the sampling speed of 1 Gs/s.

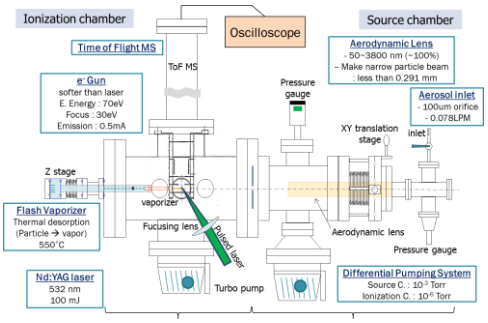

Figure 1. Schematic diagram of single particle aerosol mass spectrometer build up in this research.

SPMS has been evaluated with standard particles and applied to analyse chemical mixing state of single particles from various sources, road dust, biomass burning, and sea sprayed aerosol. Each single particles were classified into sub-categories manually. As a result, 152 single road dust particles collected from the tunnel and re-suspended by dust feeder (SAG 410, TOPAS) are subdivided into 6 groups. The majority of particles (~63%) had peaks in m/z 24 and 40 and about 24% of them contained m/z 54 either. Elemental carbon particles were also detected. There were particles showed strong intensity of peaks with the mass to charge higher than 100. Each peak will be identified.

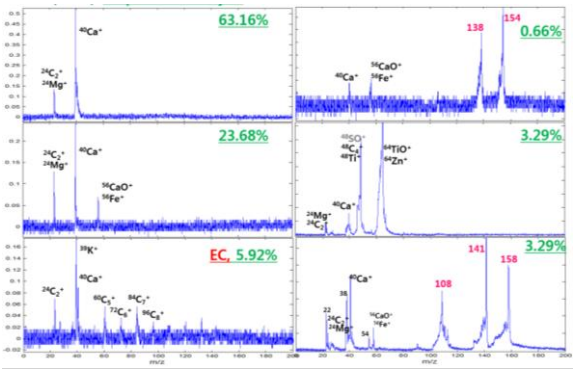

Figure 2. Example mass spectrum of dust particle from the SPMS classified into five subgroups.

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Mahadevan, R.; Lee, D.; Sakurai, H.; Zachariah, M. R. (2002) *The Journal of Physical Chemistry A.*