The characterization of ice nucleating particles by combined AFM, RMS, and SEM-EDX

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The aerosol – cloud interactions, remain as one of the most uncertain aspects in our understanding of the climate system [1]. It is in large part due to the lack of understanding in the characteristics (chemical composition, mixing state, and morphology) of ice nucleating aerosol particles in the actual atmosphere. In the present work, we investigated the characteristics of the atmospheric aerosols that form ice crystals through heterogeneous nucleation.

Aerosol particles sampled on Si wafer by impaction were exposed to supersaturated air. Following droplet activation by condensation, particles were cooled down to -30°C under optical microscope (Fig.1). The ice nucleating particles were analyzed individually by Atomic Force Microscopy (AFM), Raman Microspectrometry (RMS), and Scanning Electron Microscopy (SEM) coupled with Energy Dispersive X-ray spectroscopy (EDX). One can obtain the detailed 3D morphology of individual particles by AFM. RMS provides a nondestructive means to identify chemical compounds present within individual particles and ascertain how they are distributed relative to one another under atmospheric pressure. More examples of individual particles analyzed by the current method will be presented at the poster presentation.

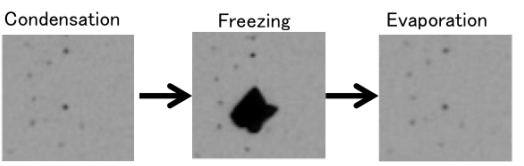

Figure 1: Single droplet freezing method

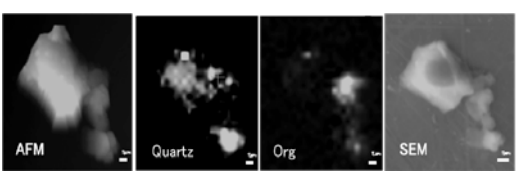

Figure 2: The mesurement results of the atmospheric aerosol by AFM, RMS, and SEM

[1] Flato *et al*. (2013) Cambridge University Press, 741–866