1A5b Investigations of hygroscopic properties of multicomponent aerosols by means of a laser trapping technique

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The fundamental knowledge about hygroscopic properties of aerosols is of primary importance for modeling cloud droplets formation processes. Various types of aerosols (i.e. mineral/soil dust, insoluble organics, water soluble nitrates, sulfates and organics, black carbon and sea salt) are present in the atmosphere, in which complex chemical reactions take place and give rise to the chemical and morphological heterogeneity within individual aerosol particles. Therefore, it is necessary to investigate hygroscopic properties of aerosol particles individually as a function of its chemical compositions and heterogeneities. Using the laser trapping technique, metastable liquid state such as supercooled or supersaturated droplets can be stably observed in air[1, 2]. Thus, the laser trapping technique is a powerful means to study aerosol particles during the efflorescence and deliquescence processes. In this study, we demonstrate a novel approach hygroscopic properties of aerosol particles which levitated in air by means of the laser trapping technique.

In this study, the hygroscopic properties of NaCl and $NaNO_3$ mixture particles (NaCl (1M): $NaNO_3$ (1M) = 5 : 5) both on a cover glass and in air were examined through a change in relative humidity (RH). Micrometer-sized aqueous droplets containing NaCl and $NaNO_3$ were generated by an ultrasonic nebuliser and introduced into a chamber set on the stage of an inverted optical microscope (Olympus, IX51). In order to control RH, dry and humidified nitrogen gases were mixed and introduced to the chamber. Both RH and temperature inside the chamber were monitored by a humidity probe (VAISALA, HM42). Bright-field images under the microscope were observed by using a CCD camera. The deliquescence and efflorescence processes of NaCl–$NaNO_3$ particles were analyzed on the basis of the changes in the size and morphology of the particles as a function of RH. The phase diagrams for the deliquescence and efflorescence processes of NaCl–$NaNO_3$ mixture were successfully obtained by using our experimental system.

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