4.036 Measurements of Mie scattering of single optically-levitated aerosol particles in air.

Early Career Scientist

Presenting Author:
Maho Nakagawa, Department of Chemistry, Graduate School of Science, Hiroshima University, Hiroshima, japan, mnaka66@hiroshima-u.ac.jp

Co-Authors:
Shoji ishizaka , Department of Chemistry, Graduate School of Science, Hiroshima University, Hiroshima, japan
Yuki Chikasue, Department of Chemistry, Graduate School of Science, Hiroshima University, Hiroshima, japan

Abstract:

Light scattering is one of the important properties of aerosol particles contributing to the radiation balance in the Earth's atmosphere. The aerosol particles are subject to many complex physical and chemical processes, which modify their morphology, chemical composition, and optical properties. To quantify the radiation balance, further understanding of changes in optical properties of aerosol particles due to heterogeneous reactions is urgently required. However, our current understanding of the effect of heterogeneous reactions on the optical properties of aerosol is not necessarily sufficient. It is necessary to investigate individually the optical properties of single particles as a function of its chemical compositions and morphology. Using a laser trapping technique, it is capable of measuring time-dependent changes in the chemical composition and morphology of an individual aerosol particle levitated in air [1]. The Mie scattering of individual aerosol particle provides useful information to determine its size and refractive index of particles [2]. Therefore, the Mie scattering measurements coupled with the laser trapping technique is a means to investigate change in the optical properties of aerosol particles during heterogeneous reactions in the atmosphere. We demonstrate in situ observation of Mie scattering of single aerosol particles levitated in air by means of the laser trapping technique.
Single micrometer-sized aqueous droplets containing sodium chloride or ammonium sulfate were levitated in air by a focused 532 nm laser beam. After trapping the droplets, 671 nm laser beam was irradiated to the droplets as scattering light source, and the spatial distributions of light scattering intensities of single optically-levitated aerosol particles were successfully observed with a CCD camera. The spatial distributions of light scattering intensities were analyzed to determine size and refractive index of the particles.
[1] S. Ishizaka et al., 2017, *Anal. Chem*., **89.23**: 12866-12871.
[2] M. Nakagawa et al. 2016, *Aerosol Sci. Technol.,* **50.4**: 392-404.