BNL-67279-AB

LABORATORY STUDIES OF THE COMPOSITION AND PHASE OF ATMOSPHERICALLY RELEVANT SINGLE AEROSOL PARTICLES

T. Onasch, J. Xu, J. Lightstone, and D. Imre
Atmospheric Sciences Division, Environmental Sciences Department, Brookhaven National Laboratory, Upton, NY 11973-5000

March 2000

Presented at the Chesapeake Biological Laboratory, Solomons, MD, February 2000.

Ammoniated sulfate particles are prevalent throughout the global troposphere as part of the ambient aerosol in continental air and have been observed in the upper troposphere. These particles may impact the radiative properties of the atmosphere directly by scattering incoming solar radiation and indirectly by acting as cloud condensation nuclei. They may also influence the chemistry of the atmosphere by facilitating heterogeneous reactions on their surfaces. Both of these effects are a function of the particles, composition and phase, which are in turn dependent upon the ambient temperature and relative humidity.

Hygroscopic salt aerosol, such as ammonium sulfate, will instantaneously take up water and deliquesce at a well-defined relative humidity at a given temperature. With a decrease in relative humidity, these solution droplets will become supersaturated and eventually crystallize or effloresce at a relative humidity lower than the deliquescence relative humidity. While models can simulate the deliquescence transitions of particles reasonably well, the kinetically-controlled efflorescence transitions cannot be presently predicted. This is particularly true if the phase produced upon efflorescence is unique to particles. To accurately model the atmospheric effects of inorganic salt particles, it is necessary to characterize these non-equilibrium phase transitions through laboratory experiments. Therefore, we are investigating the efflorescence rates of size resolved ammonium sulfate particles as a function of temperature, particle size, and heterogeneous inclusions. Preliminary results on the effects of organic compounds on the thermodynamics of these particles will also be presented.

Research by BNL investigators was performed under the auspices of the U.S. Department of Energy under Contract No. DE-AC02-98CH10886.