V-Q Ion-Molecule Reactions in the Troposphere

Ion chemistry in the troposphere is the most complicated among all level of earth's atmosphere because of the presence of a variety of trace compounds. We have been studying ion-molecule reactions in the troposphere by investigating ion mobility distribution and its dependence on reaction time, pressure and temperature using an ion mobility spectrometer.[1,2] In order to confirm the ion-molecule reactions occurring in the troposphere, we developed a high-resolution ion mobility/mass spectrometer which is capable of chemical identification of ion species forming ion peaks in mobility spectra. Using this spectrometer, we investigate the ion processes in conditioned laboratory air as well as in natural air.

References

1) K. Nagato and T. Ogawa, *J. Geophys. Res.* **103**, 13917 (1998).
2) K. Nagato, D. J. Tanner, H. R. Friedli and F. L. Eisele, *J. Geophys. Res.* **104**, 3471 (1999).

V-Q-1 Measurements of Mobility and Mass Spectra of Tropospheric Ions

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We have developed a high-resolution ion mobility/mass spectrometer that can make simultaneous measurements of mobility and mass spectra of cluster ions generated by ion-molecule reactions under atmospheric pressure. The spectrometer consists of a drift tube, a mass analyzer, and a interface chamber between the drift tube and the mass analyzer. Both positive and negative ions, which are generated by irradiation of laboratory air with an americium source, are investigated by measuring mobility spectra, mass spectra, and mass-resolved mobility spectra. The results provide new information on the tropospheric ion evolution. In the positive ion spectra, ammonium ions dominates at around a few tenth milliseconds after ionization. Then, they are converted into other ion species that have higher proton affinities than that of ammonia. Such ion species include pyridine, methylpyridine, methylamine, dimethylamine, trimethylamine, and isobutylamine. In addition, several ions are found in the mass spectra at masses 135, 149, 152, and 279, which have not been identified. In the negative ion mass spectra, we found new ion species at masses 45, 46, and 89, which were identified as ions of formic acid, nitrous acid, and oxalic acid, respectively.