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Chemical reactions of nitrite in dew accelerated during freezing and in ice.

Norimichi Takenaka and Yusuke Fujii

Graduate School of Humanities and Sustainable System Sciences, Osaka Prefecture University, Sakai-City, JAPAN
(takenaka@chem.osakafu-u.ac.jp)

Generally chemical reaction rates are suppressed at lower temperature and more inhibited in ice. However, we found that nitrite is immediately oxidized during freezing, and the reaction rate becomes much faster than that in solution under acidic condition. In dew, nitrite and ammonium ions are included at very high concentrations in Sakai, Japan. In the last meeting, we reported that ammonium nitrite is decomposed to produce nitrogen by drying due to concentration by water evaporation. Further, we evaluate the effect of drying dew on ozone concentration. The formation and disappearance of dew can depress ozone buildup. Usually evaporation of dew is observed in summer, spring, autumn and also winter in Japan. However, in winter, sometimes dew freezes or frost forms on the ground. We found that ammonium nitrite in ice is also decomposed to produce nitrogen for 24 hours under weak acidic and neutral conditions.

When ice forms from aqueous solution, solutes are rejected from ice lattice and concentrated around each ice crystals. When growing ice crystals, unfrozen solution is confined in some ice crystals, it is called “micro-pockets”. Here, solutes cannot escape from the micro-pockets, and concentrated very much, and as a result, the reaction is accelerated. In the presentation, we will explain the acceleration mechanisms of nitrite oxidation and decomposition of ammonium nitrite in detail. Also, general chemistry of freezing or in ice will be presented.

The reactions during evaporation of dew water and also freezing dew can effect on the atmospheric chemistry since nitrogen species has important role in the atmospheric chemistry.