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Vertical Diffusion of Ammonia Into Amorphous Ice Structure

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We examined ammonia diffusion on the surface of amorphous ice film through the measurement of decreasing residual quantity of NH_3 molecules compared to H_2O . The populations of NH_3 molecules on the surface of amorphous ice were monitored by using the techniques of temperature programmed reactive ion scattering (TPRIS) method. The ratio of intensity between ammonia and water was examined as a function of time at controlled temperature. When ammonia molecules were externally added onto an ice film at a temperature of 80 K, ammonia coverage with regard to ice was 0.12-0.16 ML. The intensity of ammonia molecules on the surface of ice decreased as time increased and the extent of decreased intensity of ammonia increased as controlled temperature increased. Moreover, energy barrier was estimated to be 51 kJmol^{-1} on amorphous ice film. The results of the experiment indicate that ammonia molecules have a property of vertical diffusion into amorphous ice and the energy barrier of ammonia diffusion into bulk of ice is higher than that of hydrogen bonding.

Keywords: Diffusion, Ammonia, Amorphous ice, Reactive ion scattering (RIS), Energy barrier