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Behavior of Hydroxide Ions at the Water-Ice Surface by Low Energy Sputtering Method

S.-Y. Kim, E.-H. Park, H. Kang

Department of Chemistry, Seoul National University, Seoul 151-747, South Korea

The behavior of hydroxide ions on water-ice films was studied by using Cs^+ reactive ion scattering (RIS), low energy sputtering (LES) and temperature-programmed desorption (TPD). A Cs^+ beam of a low kinetic energy (< 100 eV) from Cs^+ ion gun was scattered at the film surface, and then Cs^+ projectiles pick up the neutral molecules on the surface as Cs^+-molecule clusters form (RIS process). In LES process, the preexisting ions on the surface are desorbed by the Cs^+ beam impact.

The water-ice films made of a thick (> 50 BL) H_2O layer and a thin D_2O overlayer were controlled in temperatures 90～140K. We prepared hydroxide ions by using Na atoms which proceeded hydrolysis reaction either on the ice film surface or at the interface of the H_2O and D_2O layers.[1] The migration of hydroxide ions from the H_2O/D_2O interface to the top of the film was examined as a function of time. From this experiment, we show that hydroxide ions tend to reside at the water-ice surface. We also investigated the H/D exchange reactions of H_2O and D_2O molecules mediated by hydroxide ions to reveal the mechanism of migration of hydroxide to the ice surface.

Keywords: Hydroxide, LES, RIS, ice surface