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Thermal Stability of Photo-produced H3O+ in the Photolyzed Water-ice Film

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Hyperthermal ion scattering experiments were conducted with low kinetic energy (< 35 eV) cesium ion beams to analyze the UV-photolyzed water-ice films. Neutral molecules (X) on the surface were detected as cesium-molecule ion clusters (CsX^+) which were formed through a Reactive Ion Scattering (RIS) process. Ionic species on the surface were desorbed from the surface via a low energy sputtering (LES) process, and were analyzed [1]. Using these methods, the thermal stability of hydronium ion (H_3O^+) that was produced by UV light was examined. As the thermal stability of H_3O^+ is related with the reaction, $H_3O^+ + OH + e^-$ (or OH^-) $\rightarrow 2H_2O$, which is similar or same with the reverse reaction of the auto-ionization of water, the result from this work would be helpful to understand the auto-ionization of H_2O in water-ice that has not been well-understood yet.

However, as H_3O^+ was not detected through a LES method, the titration experiment of H_3O^+ with methylamine (CH_3NH_2, MA), $MA + H_3O^+ \rightarrow MAH^+ + H_2O$, was conducted. In this case, the presence of MAH^+ indicates that of H_3O^+ in the ice. Thus the pristine ice was photolyzed with UV light for a few minutes and this photolyzed ice was remained at the certain temperature for minutes without UV light. Then MA was adsorbed on that surface so that the population of H_3O^+ was found. From the calibration experiments, the relation of MAH^+ and H_3O^+ was found, so that the thermal stability of H_3O^+ can be investigated [2].

[1] H. Kang, Accounts. Chem. Res. 38 (2005) 893.
[2] E.-S. Moon and H. Kang, Manuscript in preparation.

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