Development of a high-sensitivity and non-destructive detection system for trace amounts of adsorbates on ice

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Molecular evolution on the surface of interstellar ice dust is important. In particular, the information of radical is crucial for understanding the formation process of complex organic molecule. Although many experiments have been performed [1], the detection of trace adsorbates like radicals is still difficult with conventional experimental methods due to the lack of sensitivity and thus little is known about behavior of such species on the ice surfaces.

Recently, we newly developed highly-sensitivity and non-destructive mass analysis apparatus for trace amounts of adsorbates on the amorphous solid water (ASW) surface. Based on a design in literature [2], we constructed an apparatus composed of a Cs^+ ion gun and Quadrupole Mass Spectrometer (QMS) in an ultra-high vacuum chamber. Using that, adsorbed species X (Mass: M) on ASW substrate were picked up with Cs^+ ion and mass-analyzed by the QMS as $Cs\text{-}X^+$ (Mass: 133 + M). As a result of various improvements, we have succeeded in detecting the trace of radicals adsorbates on ASW surface. As shown in Figure 1, we can monitor the behavior of OH radical on ASW upon the photolysis of H_2O.

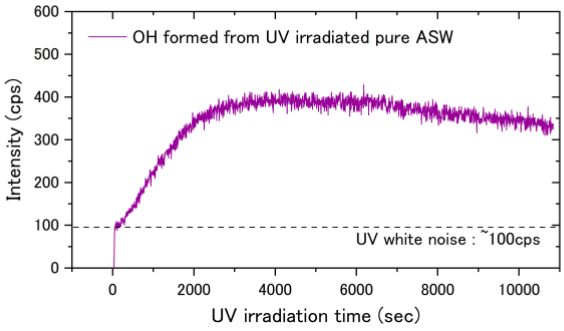

Figure 1: Variations in the pickup signal intensity of OH radical generated by ASW (10 ML) during UV irradiation at 10 K.

References

[1] T. Hama & N. Watanabe, 2013, Chem. Rev. **113**, 8783-8839.

[2] H. Kang, 2011, Bull. Korean Chem. Soc. 32, 389-398.