

Surface science of ice: Proton transfer from H_3O^+ to NH_3 , CH_3NH_2 , and $(\text{CH}_3)_2\text{NH}$ on D_2O -ice films

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We have studied protonation reactions of amine bases (NH_3 , CH_3NH_2 and $(\text{CH}_3)_2\text{NH}$) on D_2O -ice films at temperatures selected from 50 to 140 K. Although the proton affinity of amines in water or gas phase is well known, that on ice has not been reported yet. It is meaningful to study the protonation of amine bases on ice films. We prepare ice films by exposing D_2O water vapor on a Ru(001) substrate in an UHV chamber, and H_3O^+ ions are created by spontaneous HCl ionization on D_2O -ice at 140 K.¹⁾ Subsequently, NH_3 , CH_3NH_2 , and $(\text{CH}_3)_2\text{NH}$ are deposited on the film. Protons are transferred from hydronium ions to the amine bases, which form ammonium ions (RNH_3^+)²⁾ and are detected by low energy sputtering (LES). Non-protonated amines are also detected by Cs^+ reactive ion scattering (RIS). The elaborated calibrations of the ion intensities from RIS and LES give a reaction quotient at the selected ice temperatures. This work shows an unique capability of RIS and LES for identifying the proton motion between acids and bases on condensed molecular films.

[참고문헌]

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