Abstract ID : **51**

Acid-Base Chemistry of Ammonia at the Ice-Vapor Interface.

Content

Fueled by global climate change, Arctic environments are undergoing drastic changes, such as rising temperatures, melting sea ice and changing aerosol and trace gas compositions and transport patterns [1]. These changes can significantly affect the heterogeneous chemistry of the cryosphere, e.g. the formation of particulate matter. A recent study linked the presence of increased amounts of ammonia (NH₃) in the Arctic to the production of atmospheric particles capable to engage in cloud formation, thus affecting the cloud albedo [2]. Although ammonia and organic amines are well recognized for their role in atmospheric particle formation in dry and aqueous atmospheric chemistry [3], their influence on processes in the cryosphere is less understood. In the presence of water ammonia as a Brønsted base is in equilibrium with its acid form, ammonium (NH₄⁺). We therefore began to investigate the acid-base equilibrium of ammonia at the ice-vapor interface using ambient pressure photoelectron spectroscopy.
Here, we present our first APXPS data on the adsorption of ammonia at ice-vapor interface at -29 ℃ and -45 ℃. In addition, we present preliminary results on the co-adsorption of acetic acid (CH₃COOH) and ammonia at the ice-vapor interface. A comparison of N1s spectra with and without acetic acid suggest the interaction of the two adsorbates at the ice surface, possibly by formation of ammonium acetate.

[1] Abbatt, J.P.D. et al. Atmos. Chem. Phys., 19, 2527–2560, 2019.

[2] Croft, B., et al. Nat. Commun. 7, 13444, 2016.

[3] Ge, X., Wexler, A.S., Clegg, S.L. Atmos. Env. 45, 524, 2011.

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Track Classification: Environmental chemistry