Vibration spectroscopic signatures of ice at mineral surfaces

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Mineral-ice assemblages are of common occurrence in terrestrial environments of the cryosphere and play important roles in atmospheric ice and mixed phase clouds. They are also important for our planetary systems, such as in the polar ice caps of planet Mars. Studies of mineral-ice interactions also essential for probing ice reactivity towards adsorbing chemical species (e.g. atmospheric gases, organics) as well as related (photo)catalytic reactions.

In this work, thin ice layers formed at mineral surfaces were monitored by Fourier Transform Infrared Spectroscopy, a sensitive technique for probing the hydrogen bonding environments of mineral surfaces and water. A wide range of minerals with varied bulk and surface structure, shape, size and surface roughness were screened for their abilities at stabilizing ice overcoatings/films. These minerals include iron (oxyhydr)oxides, phyllosilicates, orthosilicates, tectosilicates, as well as natural samples including Arizona Test Dust and Icelandic volcanic ash. Our results provide insight into the molecular-level nature of mineral surface-ice interactions. Thin ice films adopt a weaker network of hydrogen bonds, seen through predominant O-H stretching modes at $\nu_{OH} \approx 3408$-3425 cm^{-1} compared to hexagonal ice ($\nu_{OH} \approx 3250$ cm^{-1}). Spectra of mineral surface-bound ice are, moreover, highly comparable to their of adsorbed water vapor at room temperature [1] [2]. This work emphasizes the distinct features of thin interfacial ice stabilized at mineral surfaces, and represents a target for future studies for our group, such as gas adsorption on mineral-ice admixtures.

[1] Song, X. and Boily, J.-F. (2013), *Environ. Sci. Technol.* **47**, 7171-7177. [2] Song, X. and Boily, J.-F. (2013), *Chem. Phys. Lett.* **560**, 1-9.