POSTER SESSION

DAY 2 – Feb.18, 2016
5:30 pm – 6:30 pm

PHOTOCHEMISTRY IN MOLECULAR CLOUD: EVOLUTION OF ICE AND ORGANIC RESIDUES THROUGH WARMING AND UV-IRRADIATION. L. Piani[1], S. Tachibana[1], T. Hama[2], I. Sugawara[1], Y. Oba[2], H. Tanaka[2], Y. Kimura[2], A. Miyake[3], J. Matsuno[3], A. Tsuchiyama[3], H. Yurimoto[1] and A. Kouchi[2], [1]Department of Natural History Sciences, [2]Institute of Low Temperature Science, Hokkaido University, Japan. [3]Division of Earth and Planetary Science, Kyoto University, Japan.

Introduction. In the interstellar medium (ISM), photochemical reactions in ice lead to the formation of relatively complex organic molecules [1]. These molecules are among the potential building blocks of our solar system and could be the precursor of a part of the organic matter found in comets and meteorites. However, it is not clear how the organic ice formed in the ISM may have evolved through temperature increase and irradiations by UV-photons and cosmic rays until their incorporation into the Solar System.

Method. To simulate the formation and evolution of organic ice through UV irradiation and heating under ISM conditions, we developed an experimental apparatus called PICACHU, an acronym for Photochemistry in Interstellar Cloud for Astro-Chronicle in Hokkaido University. Typical ISM gases (H_2O, CO, NH_3, and CH_3OH) are deposited onto the faces of a refrigerated substrate (~12K) and simultaneously irradiated by UV under high vacuum. Gases, desorbed from the ice during heating and post-irradiation, are monitored by a quadrupole mass spectrometer (QMS) in the vacuum chamber. The morphological evolution of the ice deposits during warm-up and/or irradiation is observed *in situ* using a microscope and correlated with desorbed gases measured by the QMS. Some organic residues formed after the ice sublimation were re-irradiated with UV photons at a room temperature for 65–235 hours. The residual organic materials were examined with a laser microscope, an atomic force microscope (AFM), FE-SEM, and TEM. Viscoelastic measurements were done with a Nano-indentation technique.

Results and discussion. *Ice and released gases*. We have previously reported [2] the occurrence of bubbles in the ice appearing from ~65 K during the warming-up to room temperature and associated with gas outburst (mostly H_2). Nucleation and growth of bubbles of volatile species thus occur in the ice, which behaved like a supercooled liquid at 65 K. We are now investigating this phenomenon by changing the heating rate and initial gas compositions. We also have replicated the experimental conditions with another experimental apparatus equipped with an *in situ* FTIR spectrometer to monitor the evolution of the ice.

Photo-processing of organic residues. Significant morphological changes were observed in the organic residues due to short-duration UV-irradiation: increase of porosity and roughness and, appearance of nanoparticles similar to the ones found in the organic matter within chondrites and cometary samples. The viscoelastic properties of the organic residues indicate that organic-coating on inorganic dust could play as efficient glue on dust aggregation but, at the same time, could also enhance the aggregate brittleness.

References. [1] Greenberg 2002. Surf. Sci. 500, 793–822. [2] Tachibana et al. 2015. 78th Met. Soc. Meeting, #5248.