Contribution ID: **54** Type: **Talk**

In situ observation of ice-water interfaces by advanced optical microscopy

Thursday, January 11, 2018 8:35 AM (20 minutes)

Ice crystallization from supercooled water, more generally, crystallization from its own supercooled melt (the so-called melt growth), is one of the fundamental phase transitions seen everywhere in nature. Despite its ubiquity, the microscopic view of the melt growth is still far from completely understood, contrary to the crystal growth from vapor and solutions. It is well-known that the kinetics of the interface is responsible for the ordering process of crystallization, especially after initial nucleation, because of its strong first order nature. However, it still remains elusive how the liquid and the solid (crystal) phase, of which densities are no more different than several percent, are microscopically distinguished each other at their interface. The main difficulty comes from the significantly high crystal growth rate in melt, hampering direct and precise observations of the interface. Moreover, effects of the latent heat diffusion often obscure the molecular uptake mechanism at the growth front, revealing the microscopic information on the interface.

Here we focus on two kinds of ice-water interfaces, ice/quasi-liquid layer (ice/QLL) and ice/bulk water interfaces. We performed in situ observations of these two interfaces by an advanced optical microscopy, whose resolution in the height direction reaches the order of an angstrom. We succeeded in making direct visualization of elementary steps at ice/QLL interfaces and bunching steps at ice/bulk water interfaces. These two exhibit characteristic behaviors different from each other although both systems are the same crystal-melt interface.

Significance statement

We performed in situ observations of two kinds of ice-water interfaces by an advanced optical microscopy (laser confocal microscopy combined with differential interference contrast microscopy). We made direct visualization of elementary steps and random bunching steps at their interfaces, which have not been experimentally accessible so far.

Primary author: Dr MURATA, Ken-ichiro (Institute of Low Temperature Science, Hokkaido University)

Co-authors: Prof. SAZAKI, Gen (Institute of Low Temperature Science, Hokkaido University); Dr NAGASHIMA, Ken (Institute of Low Temperature Science, Hokkaido University, Japan)

Presenter: Dr MURATA, Ken-ichiro (Institute of Low Temperature Science, Hokkaido University)

Track Classification: The surface and interface of ice