Inelastic neutron scattering of high-density and low-density amorphous ice

Hiroshi FUKAZAWA, Susumu IKEDA and Yoshiharu SUZUKI[1]

Institute of Materials Structure Science, High Energy Accelerator Research Organization (KEK) Oho 1-1, Tsukuba, Ibaraki 305-0801, Japan

[1] National Institute for Research in Inorganic Materials (NIRIM), 1-1, Namiki, Tsukuba, Ibaraki 305, Japan

In the hypothesis of liquid-liquid phase transition for the anomalies of supercooled water (Poole *et al*.: Nature 1992), the liquid exists in two phases of different densities; the high-density liquid (HDL) and low-density liquid (LDL). Mishima and Stanley (Nature 1998) investigated the decompression-induced melting of ice, and reported that the volumes of HDL and LDL is continuous with the volumes of the high-density amorphous (HDA) and low-density amorphous (LDA) phases of ice. Therefore, knowledge of physical properties in HDA and LDA, such as the structure and vibrational dynamics, would lead to an understanding of the anomalies of water (Fukazawa *et al*.: J. Phys. Soc. Jpn 2001).

We measured the inelastic neutron scattering of HDA and LDA ice that are produced by pressurizing and releasing the pressure. From the inelastic neutron scattering (INS) measurement on HDA ice, we observed two phonon dispersion curves, which assigned to the librational vibrations. Furthermore, we also found two phonon dispersion curves, which are similar to those in ice crystal, in LDA ice. These results indicate the existence of the collective excitation propagating on the hydrogen bond network along the amorphous ice.