408f Water Confinement in Carbon Nanotubes

Oleg Byl, Jinchen Liu, Yang Wang, Wai-Leung Yim, Karl Johnson, and John T. Yates

The effect of confinement of water in single wall carbon nanotubes was studied by means of infrared spectroscopy. It was found that water condensed at low temperatures on the outer surface of nanotubes is able to diffuse into the hydrophobic carbon nanotube interior during annealing and can be trapped there upon cooling. Due to confinement water molecules can not acquire the ideal tetragonal coordination with four hydrogen bonds. This results in a phase with much weaker hydrogen bonds relatively to the bulk water. An infrared OH-stretching mode detected at 3507 cm-1 is assigned to this phase. The assignment is based on the observation of the 3507 cm-1 mode disappearance in case of n-nonane preadsorption on the carbon nanotubes at 283 K. It is known that at this temperature n-nonane adsorbs only in the nanotube interior and therefore blocks the diffusion of water molecules inside the nanotubes and prevents the formation of the confined water phase.