The Fascination of Crystals and Symmetry

Unit 1.5

by Frank Hoffmann & Michael Sartor
Correspondence Principle (II)

water molecule

snowcrystals.com
Ice Crystals

Exception? No! ☺

snowcrystals.com
Ice Crystals – still a vivid area of research

- The smallest snowflake of the world....

   ... consists of 475 water molecules!

21 September 2012

A Fully Size-Resolved Perspective on the Crystallization of Water Clusters

Christoph C. Pradzynski, Richard M. Forck, Thomas Zeuch, Petr Slavíček, Udo Buck

The number of water molecules needed to form the smallest ice crystals has proven challenging to pinpoint experimentally. This information would help to better understand the hydrogen-bonding interactions that account for the macroscopic properties of water. Here, we report infrared (IR) spectra of precisely size-selected (H₂O)ₙ clusters, with n ranging from 85 to 475; sodium doping and associated IR excitation–modulated photoionization spectroscopy allowed the study of this previously intractable size domain. Spectral features indicating the onset of crystallization are first observed for n = 275 ± 25; for n = 475 ± 25, the well-known band of crystalline ice around 3200 cm⁻¹ dominates the OH-stretching region. The applied method has the potential to push size-resolved IR spectroscopy of neutral clusters more broadly to the 100–to 1000-molecule range, in which many solvents start to manifest condensed phase properties.
The Formation of Snowflakes
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