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Study of ice using synchrotron-based microtomography

T. Huthwelker (1), M. Hutterli (3), F. Enzmann (2), M. Ammann (1), M. Kersten (2), M. Stampanoni (1), and F. Marone (1)

(1) Paul Scherrer Institut, Villingen, Switzerland , (3) British Antarctic Survey, Cambridge, United Kingdom, (2) University Mainz, Geosciene Department, Germany

Natural ice in clouds and on the ground contains various liquid, solid and dissolved gaseous impurities. These impurities are reactants in many chemical processes in the atmosphere. For example, halogen containing acids and salts contribute to the ozone depletion in both the stratosphere and the polar troposphere. One specific example are the polar ozone depletion events, where salts in vapor grown frost flowers or in fresh Sea ice are believed to be key players, while the details of the reaction mechanism remain unresolved. When studying the chemical and physical processes related to impurities in ice, morphological issues are of key importance, as the accessibility of gaseous species to impurities in ice is key to the reactivity of the ice.

Using a new technique, synchrotron based X-Ray microtomography, we can study the three dimensional spatial distribution of impurities in ice. We apply this technique to frozen ice samples, such as artificially grown frost flowers, and show the distribution of impurities inside such frost flowers and on the surface of the sample. By growing samples in a small reaction chamber we can directly study the transport of salts by capillary forces through a vapor grown ice sample.