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# X-ray phase contrast tomography of Ice Cream

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Food microstructure is one of the most important parameter when it comes to sensorial perception of food. Accordingly, changes of the microstructure over time typically lead to a loss in product quality. The mechanisms behind these changes are not yet completely understood, mostly due to a lack of experimental methods to directly observe the structural modifications. We are using synchrotron tomographic microscopy at the TOMCAT beamline at the Swiss Light Source to follow the evolution of ice cream microstructure at constant temperatures.
The benefits of using x-ray tomography for time lapse studies on ice cream samples enriched with a contrast agent have been shown before (1). Propagation based phase contrast imaging (PCI) at a synchrotron allows us now to differentiate - without the addition of contrast agents and at a fifteenfold higher resolution - between sucrose solution and ice crystals. This method preserves the original chemistry in our samples, and with scan times on the order of several minutes we can investigate the dynamics of coarsening.
We present first results regarding the structural characterization and evolution of ice cream obtained with PCI under constant thermal boundary conditions. The four-dimensional data sets provide unique insight into the physical processes that lead to coarsening and quality degradation, making it possible to develop new strategies to avoid these effects in food.

(1) Pinzer, B. R., Medebach, A., Limbach, H. J., Dubois, C., Stampanoni, M., & Schneebeli, M. (2012). 3D-characterization of three-phase systems using X-ray tomography: tracking the microstructural evolution in ice cream. Soft Matter, 8(17), 4584-4594. The Royal Society of Chemistry. doi:10.1039/C2SM00034B

**Primary author:** MEDEBACH, Annabelle (Paul Scherrer Institut)

**Co-authors:** Dr PINZER, Bernd (Swiss Light Source, Paul Scherrer Institut (PSI), 5232, Villigen-PSI); Dr DUBOIS, Cédric (Nestlé Research Center); Dr LIMBACH, Hans Joerg (Nestlé Research Center); STAMPANONI, Marco (Paul Scherrer Institut); Dr SCHNEEBELI, Martin (WSL Institute for Snow and Avalanche Research SLF)

**Presenter:** MEDEBACH, Annabelle (Paul Scherrer Institut)

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