

 Consumer Products

CASE STUDY

Understanding the microstructure of ice cream

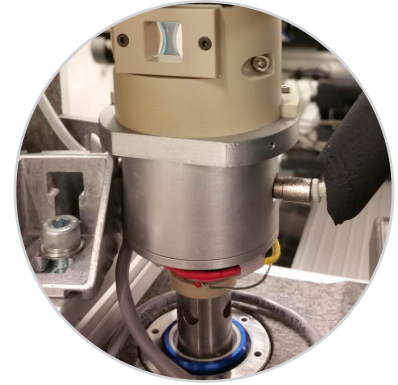
The quality of ice cream is considered to depend on the size of constituent air cells and ice crystals, the smaller and rounder the better. Product quality and shelf life can be strongly affected by the temperature variations that can commonly occur during storage and distribution, including by the end consumer.



The Challenge

Ice cream is a complex multi-phase soft solid material that consists of ice, air, fat and sugar, containing three states of matter; gas; liquid and solid.

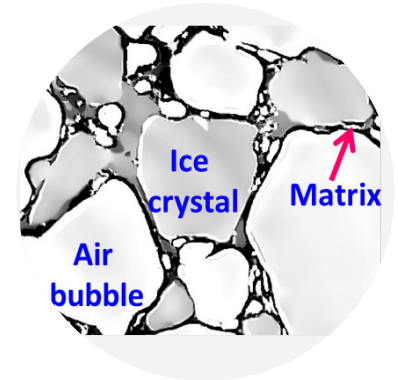
An understanding of how the freeze-thaw cycle can influence ice formation is important in controlling ice cream microstructure. The crystal size is small, the material is opaque and the structure easily disturbed by the modification required by most analytical methods, all creating challenges for detailed microstructural analysis.



The Solution

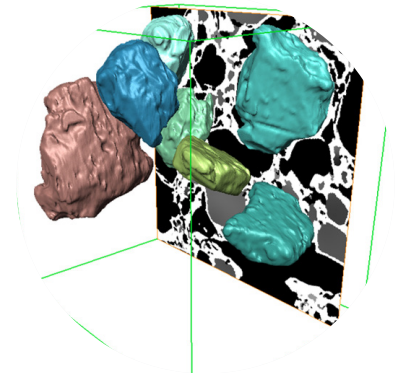
The team from The University of Manchester and Unilever performed X-ray tomography of the ice cream microstructure over temperature cycles from -20°C to -7°C .

The experiments were performed on I13-2 at Diamond, operating with a pink beam. The pink beam provides high flux X-rays with relatively small energy dispersion so that both high temporal and spatial resolution are available to perform 4D in-line phase contrast imaging.



The Benefits

A greater understanding of the mechanism of ice formation is important to aid determining the influence of processing conditions during manufacture and also to inform the development of formulations. The non-invasive experiments allowed investigation of the 3-D structure while largely maintaining the natural product environment.



“The unique qualities of the Diamond-Manchester branchline (in-line phase contrast in pink beam) allowed us to study how processing conditions and ingredients affect the taste of ice cream, helping us better understand our product. By collaborating with Manchester we developed an in situ rig that replicated the processing conditions making it all possible.” **Julian Bent, Unilever**



For further information

Diamond Industrial Liaison Team

+44 1235 778797

industry@diamond.ac.uk

diamond.ac.uk/industry

@DiamondILO

CS-CON-UNI-054-2