# Industrial Research on Food at Diamond

The food industry faces several challenges due to rising costs and ever-changing customer demands.  It is a very competitive environment; however, the relative spend on R&D is low in relation to annual turnover. Understanding the science behind a product can not only drive innovation, but it can also help manufacturers understand the implications of new formulations; to optimize processing, production or transportation conditions, or simply maintain a product's quality, taste and texture.

The food industry needs to move quickly to meet continued changes in consumer taste and lifestyles, including healthy alternatives to traditional food – meat alternatives, dairy-free and 'free from' alternatives. Legislation for lower levels of sugar or GM ingredients have also driven for change, as have demands for more sustainable packaging.

The research techniques available at Diamond, along with the expertise of the Industrial Liaison team, can help you to understand how ingredients, packaging and processing conditions are affecting food products at a molecular level. Through this insight, food companies can act quickly, innovate, increase profits and provide consistently high-quality products.

## How can Diamond help?

### Products & formulation

- Explore the behaviour of food additives in product formulation
- Understand phase behaviour in emulsions, suspensions & gels
- Examine emulsifiers and complex structures for reducing fat content in products

### Sustainability

- Map metal distribution in raw ingredients
- Detect the presence of and identify trace elements & contaminants
- Characterise novel sustainable ingredients
- Optimise processing conditions to minimise energy & waste

### Packaging

- Follow structural changes with thermal, mechanical & ageing treatments
- Characterise organic residues and trace materials
- Investigate novel packaging materials

### Food processing

- Monitor chemical and structural changes during processing to optimise product behaviour
- Image flow in powder and liquid systems
- Investigate friction, wear and lubrication in components

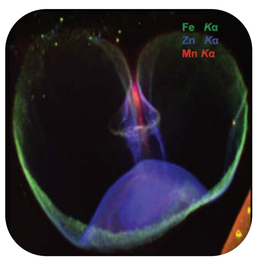
## Applications of Diamond for food research

### Elemental mapping of wheat grain

Iron and zinc deficiencies affect an increasing number of people worldwide, and is especially serious in Africa, the eastern Mediterranean and south-east Asia. Chronic health problems are related to the low intake of minerals from traditional diets comprising little or no meat, fruit and vegetables.

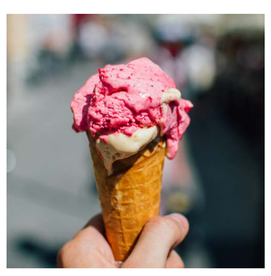
Elemental mapping of wheat grain cross sections was performed on I18 using X-ray fluorescence microscopy, providing localised information about metal complexation.

Speciation and location of metals such as Fe and Zn within wheat grain gives information about the bioavailability of nutrients in different strains of wheat, informing the process of breeding mineral enriched wheat.




ROTHAMSTED RESEARCH

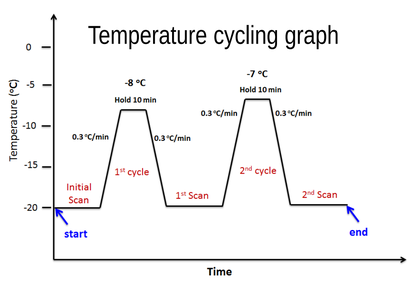
"Even today one billion people are still permanently hungry and millions die each year as a consequence of deficiencies of iron and zinc. This is not good enough. Whether this is a problem of politics, production or distribution doesn't matter: we must explore all avenues to correct this, and it starts with basic scientific investigation"
Dr Andy Neal, Rothamsted Research

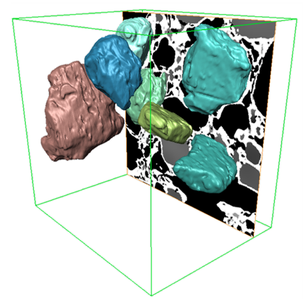


### Growth of ice crystals with freeze-thaw cycles of ice-cream

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.

Using I13-2 beamline at Diamond a team from the University of Manchester and Unilever were able to use tomography to study the microstructure of ice-cream over different temperature cycles from -20°C to -70°C, replicating typical consumer storage and usage conditions.



Unilever

"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."
Dr Julian Bent, Unilever

## Imaging of food products

The following experiments were performed as proof-of-concept measurements and the images are not related to any industrial experiments or clients




## Modes of Access for Industry

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