

Shining a Light on Formulations: Advanced Materials Characterisation at Diamond Light Source

Claire Pizzezy

The UK's synchrotron facility, Diamond Light Source, produces X-ray, infra-red and ultraviolet beams of exceptional brightness. The combination of brilliant light and technological platforms is extensively used by the scientific community to undertake structural and chemical investigations of a wide variety of materials on very fast timescales. The industrial user programme at Diamond is continuously growing with over 125 companies from 16 countries now making use of beamlines and offline facilities from formulation industries as diverse as consumer products, pharmaceuticals, foods and oil additives.

A suite of techniques available at Diamond includes small angle X-ray scattering (SAXS), X-ray diffraction (XRD), electron microscopy, imaging, tomography, infra-red and X-ray absorption spectroscopy (XAS). The techniques available at the synchrotron can be element specific, with low detection limits, provide very high spatial resolution, employed on very fast timescales or under *in situ* conditions and in some cases, all of the above.

With such a diverse array of different techniques and sample environmental conditions available, it is perhaps not a surprise that characterisation of a wide variety of materials (solutions, powders, suspensions, gels, solids, thin films) is possible, ranging from raw materials through to complex final product formulations. Investigations focus on issues such as long term stability or phase behaviour that are highly relevant to new product development. With the benefit of specialist larger scale facilities, it may also be possible to replicate and monitor production processes to understand how manufacturing issues can arise (for example porosity, flow through pipes, corrosion or other processing challenges).

An overview of the advanced characterisation techniques available at the synchrotron relevant to the understanding of formulated products will be presented along with illustrative case study examples.