diamond

Formulations

CASE STUDY

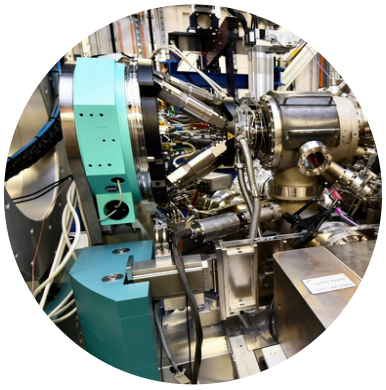
Fine tuning slip additives for industrial applications

Slip additives have been used extensively by many manufacturers to modify the surface structure of a wide range of materials. They work by reducing friction, but without compromising the material's other properties. The use of slip additives extends across a multitude of industries - from food packaging and textiles, dyes and lubricants, to hygiene products such as nappies.

Erucamide (13-cis-docosenamide, $C_{22}H_{43}NO$) is a common fatty acid amide slip additive. It functions well, even at low concentrations and is stable and transparent with low toxicity. It is well known for its use in the manufacture of polymers such as polyethylene and polypropylene, and has also been effective as an anti-fouling, anti-fogging, anti-viral and scratch-resistant agent.

University of BRISTOL

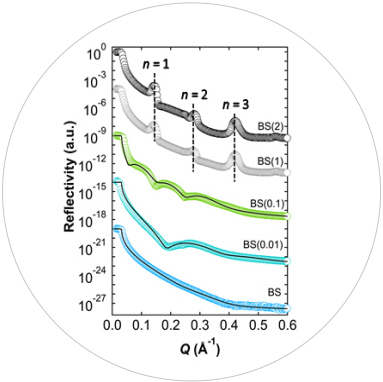
The Challenge



Although erucamide's industrial use is widespread, its performance depends upon the concentration and application method as well as the substrate surface chemistry.

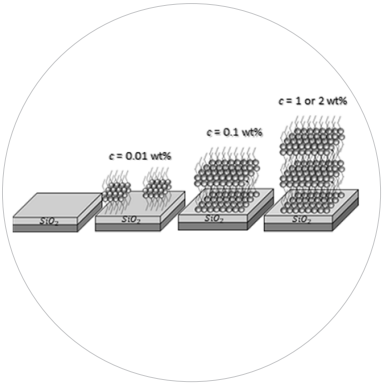
Manufacturers have been able to control the properties of the additive surface layer by varying the erucamide concentration used. However, scientists at the University of Bristol and Procter and Gamble wanted to get a fuller understanding of the structure of erucamide surface layers to determine its effectiveness across different applications and products.

The Solution



Using X-ray reflectivity (XRR) on beamline I07 at Diamond the team were able to perform a quantitative characterisation of the structure of the surface including determining molecular packing and layer thickness. They used a model system of erucamide layers prepared via spin-coating from non-aqueous solution on hydrophilic bare silica.

The XRR results were combined with complementary techniques to reveal insights into the nanostructure of organised erucamide surface layers. The data showed that the surface nanostructures changed with erucamide concentration. In all cases, the tails of the erucamide molecules pointed outwards creating a hydrophobic surface.



The Benefits

A better understanding of these surface properties will enable the fine-tuning of slip additives across a wide range of applications and enable the production of new and more environmentally friendly products.

> "Synchrotron X-ray scattering allows us to probe complex buried interfaces, providing unique nanostructural information and complementing other techniques. This is particularly relevant to industrial formulations with multiple ingredients and complex interfaces. Working with Diamond's skilled scientists has also provided highly valuable training experience for our PhD student Dajana Gubała who is passionate about solving real world problems."
>
> **Prof. Wuge Briscoe, University of Bristol**

For further information

Diamond Industrial Liaison Team

+44 1235 778797
industry@diamond.ac.uk
diamond.ac.uk/industry
@DiamondILO

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