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## The impact of N,N-dimethyldodecylamine N-oxide (DDAO) concentration on the crystallisation of sodium dodecyl sulfate (SDS) systems and the resulting changes to viscosity, crystal structure, shape and the kinetics of crystal growth

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### Abstract

### Hypothesis

At low temperatures stability issues arise in commercial detergent products when surfactant crystallisation occurs, a process which is not currently well-understood. An understanding of the phase transition can be obtained using a simple binary SDS (sodium dodecyl sulfate) + DDAO (N,N-dimethyldodecylamine N-oxide) aqueous system. It is expected that the crystallisation temperature of an SDS system can be lowered with addition of DDAO, thus providing a route to improve detergent stability.

### Experiments

Detergent systems are typically comprised of anionic surfactants, non-ionic surfactants and water. This study explores the crystallisation of a three component system consisting of sodium dodecyl sulfate (SDS), N,N-dimethyldodecylamine N-oxide (DDAO), and water using wide-angle X-ray scattering (WAXS), differential scanning calorimetry (DSC) and confocal Raman microscopy.

### Findings

The presence of DDAO lowered the crystallisation temperature of a 20 wt. % SDS system. For all aqueous mixtures of SDS + DDAO at low temperatures, SDS hydrated crystals, SDS·1/2H<sub>2</sub>O or SDS·H<sub>2</sub>O, formed. SDS hydrates comprising of layers of SDS separated by water layers. DDAO tended to reside in the vicinity of these

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