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Surface dilational rheological and lamella properties of branched alkyl benzene sulfonate solutions

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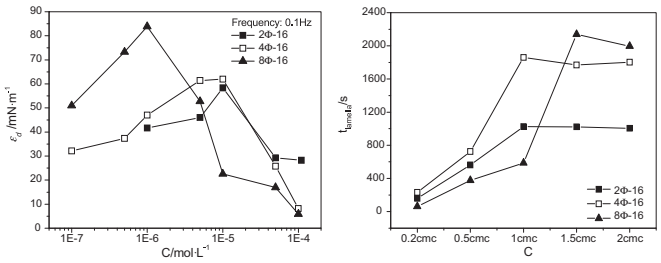
HIGHLIGHTS

- At low concentration, the dilational properties depend on the intermolecular interactions.
- As concentration increases, the diffusion-exchange process controls the dilational properties.
- The dilational elasticity increases with the increasing branching degree.
- The greater the branching degree of the hydrophobic chain is, the higher the lamella stability is.
- The surface dilational elasticity is crucial for lamella stability.

GRAPHICAL ABSTRACT

The greater the branching degree of the hydrophobic chain is, the higher the dilational elasticity and the more stable lamella are.



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ABSTRACT

The dilational properties of adsorbed film of three branched-alkyl benzene sulfonates at the air–water interface have been investigated by drop shape analysis method. The influences of time, dilational frequency and bulk concentration on surface dilational elasticity and dilational viscous component were expounded. The experimental results show that the change of surface dilational properties with time is accordant to the variation of surface tension with surface aging. At low concentration, the dilational properties are independent of frequency and the film behaves elastic in nature. As concentration increases, the surface film shows remarkable viscoelasticity, which means the diffusion-exchange process controls the dilational properties. Moreover, the position of the phenyl in the alkyl chains is one of the principal factors to control the nature of interfacial film: as the phenyl is moved from a terminal position to a more central position, the dilational elasticity increases. The surface elasticity was compared with the stability of lamella stability made with these surfactants. The results suggest that surface dilational elasticity is crucial for the ability of a surfactant solution to form a stable lamella.

1. Introduction

Interfacial rheology deals with the response of interface against deformations and is relevant in many technical applications, such as mass transfer, monolayer, foaming, emulsification, oil recovery or high-speed coating [1,2]. It can be defined for both dilational rheology and shear rheology. These two methods are complementary and focus on different aspects of the interfacial layer. Interfacial shear rheology is most useful for macromolecules solutions and yields only qualitative structure information, while interfacial dilational rheology is a very sensitive technique to monitor the interfacial structure and concentration of single chemical at the interface [3–10] or the relative concentration, the competitive

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