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含氟表面活性剂溶液的动态表面张力研究

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摘要 本文研究了阳离子氟表面活性剂 $\text{CF}_3\text{CF}_2\text{CF}_2\text{O}(\text{CF}(\text{CF}_3)\text{CF}_2\text{O})_2\text{CF}(\text{CF}_3)\text{CONH}(\text{CH}_2)_3\text{N}^+(\text{C}_2\text{H}_5)_2\text{CH}_3\text{I}^-$ (缩写FC-4)的动态表面性质, 利用Krüss K12和MBP动态表面张力仪分别测定了该体系的平衡表面张力和动态表面张力。由平衡表面张力测定结果得到了临界胶束浓度和表面吸附量。利用渐进的Ward and Tordai方程对动态数据进行了分析。结果表明: 在吸附的最初阶段符合扩散控制模型, 而在吸附的后期, 证明了吸附势垒的存在, 表明在吸附后期属于混合动力学模型。计算得出25 °C时, 该体系势垒约在25到35 kJ/mol。由于氟表面活性剂分子间作用力小, 表面压是导致吸附势垒的主要原因。

关键词 [动态表面张力](#), [吸附机理](#), [氟表面活性剂](#)

分类号

Dynamic Surface Tensions of Fluorous Surfactant Solutions

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Abstract Dynamic surface properties of aqueous solutions of cationic fluorosurfactant $\text{CF}_3\text{CF}_2\text{CF}_2\text{O}(\text{CF}(\text{CF}_3)\text{CF}_2\text{O})_2\text{CF}(\text{CF}_3)\text{CONH}(\text{CH}_2)_3\text{N}^+(\text{C}_2\text{H}_5)_2\text{CH}_3\text{I}^-$ (abbrev. FC-4) were reported. The critical micelle concentration (cmc) (3.6×10^{-5} mol/L) and equilibrium surface tensions γ_{eq} were measured by Krüss K12 tension apparatus. Dynamic surface tension $\gamma(t)$ was measured in the range of 15 ms to 200 s using the MBP tensiometer. The surface excess Γ , as a function of concentration, was obtained from equilibrium tensiometry using the Gibbs equation. Data from these experiments were combined to analyze the $\gamma(t)$ decays according to the asymptotic Ward and Tordai equation. The results show that at the initial adsorption stage, the dynamic surface tension data were all consistent with this diffusion-controlled mechanism, and at the end of the adsorption process, there were some evidences for an adsorption barrier, suggesting a mixed diffusion-controlled adsorption mechanism. Using measured quantities, the barrier strength was estimated as between 25 and 35 kJ/mol at 25 °C. The surface pressure plays an important role in contributing to the barrier.

Key words [dynamic surface tension](#), [adsorption mechanism](#), [fluorous surfactant](#)

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