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RESEARCH NOTES

利用最大泡压法研究扩散控制的溶液表面吸附动力学

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摘要 In studying the diffusion-controlled adsorption kinetics of aqueous surfactant solutions at the air/solution surface by means of the maximal bubble pressure method, Fick's diffusion equation for a sphere should be used. In this paper the equation was solved by means of Laplace transformation under different initial and boundary conditions. The dynamic surface adsorption F(t) for a surfactant solution, which was used to describe the diffusion-controlledsorption kinetics at the solution surface, was derived. Different from the planar surf aceadsorption, the dynamic surface adsorption Γ(t) for the short time consists of two terms: one is the same as Ward-Tordai equation and the other reflects the geometric effect caused by the spherical bubble surface. This effect should not be neglected for the very small radius of the capillary. The equilibrium surface tension γeq and the dynamic surface tension γ(t) of aqueous C10E6 [CH3(CH2)9(OCH2CH2)6OH] solution at temperature 25℃ were measured by means of Wilhelmy plate method and maximal bubble pressure method respectively. As t→0, the theoretical analysis is in good agreement with experimental results and the dependence of γ(t) on (√t+rb/√πD)^2 is linear.

关键词 扩散控制系统 吸附动力学 动表面张力 化学反应

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Diffusion-controlled Adsorption Kinetics at Air/Solution Surface Studied by Maximum Bubble Pressure Method

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Abstract In studying the diffusion-controlled adsorption kinetics of aqueous surfactant solutions at the air/solution surface by means of the maximal bubble pressure method, Fick's diffusion equation for a sphere should be used. In this paper the equation was solved by means of Laplace transformation under different initial and boundary conditions. The dynamic surface adsorption F(t) for a surfactant solution, which was used to describe the diffusion-controlledsorption kinetics at the solution surface, was derived. Different from the planar surf aceadsorption, the dynamic surface adsorption Γ(t) for the short time consists of two terms: one is the same as Ward-Tordai equation and the other reflects the geometric effect caused by the spherical bubble surface. This effect should not be neglected for the very small radius of the capillary. The equilibrium surface tension γeq and the dynamic surface tension γ(t) of aqueous C10E6 [CH3(CH2)9(OCH2CH2)6OH] solution at temperature 25℃ were measured by means of Wilhelmy plate method and maximal bubble pressure method respectively. As t→0, the theoretical analysis is in good agreement with experimental results and the dependence of γ(t) on (√t+rb/√πD)^2 is linear.

Key words diffusion-controlled adsorption kinetics; dynamic surface tension; maximum bubble pressure method

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