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研究论文

胶质液体泡沫(CLA)的形成及其稳定性研究

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摘要 以研究胶质液体泡沫(CLA)内部结构及其特性为最终目的, 对组成为十二烷基醇聚氧乙烯(3)醚(AEO-3)/正癸烷/十二烷基硫酸钠(SDS)/水的CLA体系形成过程和稳定动力学行为进行了电导率测定和光学显微观察. 通过上述两过程的电导率变化探明了CLA的形成和稳定性动力学行为, 并被光学显微照片所证实. 实验结果表明CLA的形成是一个低能量乳化过程, 经历了水相泡沫化→油相替代气泡乳化→CLA形成. 在整个乳化过程中, 没有发生相的转变现象, CLA呈O/W型乳状液. 其稳定性并不遵守一级动力学模型. 在常温下, 其电导率曲线呈直线关系; 当温度超过318.15

K时, 其电导率曲线近似于Langmuir等温线形. 并可用Sigmoidal模型$\sigma_t=(\sigma_1-\sigma_2)/[1+e^{(t-t_0)/S}]+\sigma_2$较好的拟合, 式中, σ_t表示t

时的电导率值(μS/cm); t表示时间(min); σ_1, σ_2分别代表存储过程中电导率最小值和最大值(μS/cm); t_0对应于σ_t等于

$1/2(\sigma_1+\sigma_2)$的时间t值(min); S描述了电导率曲线陡峭程度(min). 并提出了CLA的破乳过程包括液膜排液和液膜破裂两

个阶段, 同时伴随有絮凝过程发生的稳定性机理.

关键词 胶质液体泡沫(CLA) 形成 稳定性 电导率 光学显微镜
分类号

Study on Formation and Stability of Colloidal Liquid Aphrons

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Abstract In an attempt to explore the nature and structure of colloidal liquid aphrons (CLA), the formation and stability of CLA composed of polyoxyethylene 3 dodecyl ether (AEO-3)/*n*-decane/sodium dodecyl sulphate (SDS)/water were investigated using the conductivity technique and microscopic observations. The formation mechanism and the stability behavior of CLA were derived from the conductivity profiles and verified by the optical micrographs. It was found that the formation was a low-energy emulsification process including a foaming stage and then the exchange of the gas for oil phase. No phase inversion took place during the whole formation process, hence the CLA represented O/W emulsion type. The stability behavior determined by conductivity analysis was described using linear equation at 303.15 K. As the temperature is above 318.15 K, the conductivity profiles of CLA, which presents a different kinetics from the first order model, conformed to the sigmoidal equation $\sigma_t=(\sigma_1-\sigma_2)/[1+e^{(t-t_0)/S}]+\sigma_2$, where σ_t refers to the conductivity at time t, σ_1 and σ_2 refer to the minimum and maximum conductivity during storage, respectively, t_0 is the time for conductivity to reach the value of $1/2(\sigma_1+\sigma_2)$, and S is the parameter to describe the steepness of the curves. A new mechanism for CLA breakdown was proposed from analyses of the conductivity curves, which involves the simultaneous occurrence of flocculation and coalescence during CLA breakdown process. The coalescence displays two distinct stages including film drainage and film rupture driven by two independent mechanisms, respectively.

Key words colloidal liquid aphrons formation stability electrical conductivity optical microscopy

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