

Study on Interactions between Surfactant, Polymer and Dye in Solution and at Interfaces

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The interactions between surfactant, polymer and dye in solution and at interfaces were studied by tensiometry, UV/Visible spectroscopy and atomic force microscopy (AFM). The water soluble copolymer of 1-vinyl-2-pyrrolidone and 1-vinylimidazole (PVPVI) shows interactions with the anionic surfactant sodium dodecyl sulfate (SDS) not only at the air-water interface but also in the bulk phase. However, no interaction in solution was observed between the nonionic surfactant alkyl heptaglycoether ($C_{12}E_7$) and PVPVI. In the aqueous solution of acid blue 113, the addition of appropriate SDS, $C_{12}E_7$ and PVPVI led to a red shift in absorption spectra of the dye respectively. The ratios of surfactant or polymer to dye were determined.

At graphite-solution interfaces, the aggregates of SDS and $C_{12}E_7$ alone appear as periodic parallel stripes in AFM images, which are interpreted as hemicylindrical structures in previous researches of other authors [1-3]. PVPVI adsorbed on graphite shows globular structures at a concentration of 0.1 mM. By adding nonionic surfactant $C_{12}E_7$ into the PVPVI solution, the adsorption of polymer onto graphite is markedly inhibited. Thus, in presence of PVPVI the aggregate structure of $C_{12}E_7$ on graphite was not visibly changed. At the high SDS concentration of 100 mM, the added PVPVI did not alter the aggregate structure of SDS on graphite, whereas the globular structure of polymer was not observed. This indicates a stronger interaction between the surfactant and substrate.

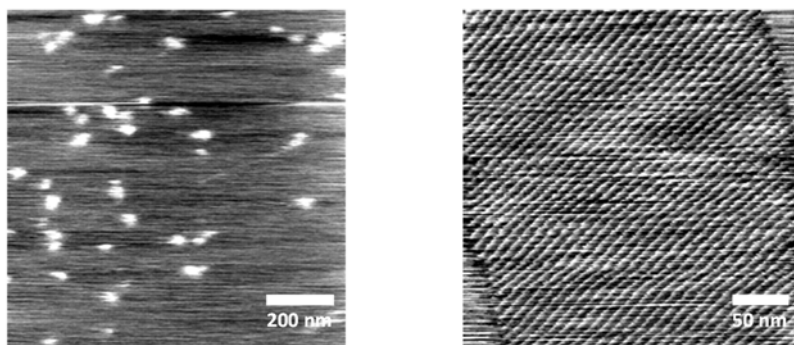


Figure 1. AFM images of 0.1 mM PVPVI (left) and 0.1 mM $C_{12}E_7$ + 0.1 mM PVPVI (right) at the graphite-solution interface. Measurements were performed at room temperature by contact mode.

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