From mushroom to brush: the dynamics of single diblock copolymer chain at the liquid-liquid interface

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The dynamics of polymer molecules at interfaces between immiscible liquids is a key factor regarding the rheological properties of multi-phase fluids, the structure and functionality of emulsions and further to the functionality of biological interfaces such as cell membranes. In this study, single chain of diblock copolymer adsorbed at such an interface (the interfaces between immiscible liquid of DMF and alkanes) was adopted as the probe of the local dynamics, and its relation with chain conformation as well as interfacial concentration. The interfacial diffusion rate of single diblock chains (polystyrene-b-polyisoprene) was measured by fluorescence correlation spectroscopy (FCS). A strong dependence of the diffusivity on the interfacial concentration is expected, demonstrating clearly a transition from isolated chain situation (mushroom) to the concentrated or crowded condition (brush), the interfacial diffusion coefficient experiences a drop at the interfacial concentration about $10^3 \mu m^{-2}$, corresponding to a mutual distance between the diblock polymer of 30 nm. A noticeable decrease of interfacial diffusivity is already recorded at a much lower surface concentration. The distance of the change of diffusivity is much larger or comparable to the Flory radius for a coil in a good solvent, indicating an effect to the chain dynamics appeared during the so-called mushroom-to-brush transition.

This observation indicates a jamming transition of the interfacial dynamics during the mushroom-to-brush transition.

![Figure 1](image_url)

**Figure 1** The interfacial diffusion coefficient of diblock copolymer (polystyrene-b-polyisoprene) as a function of interfacial concentration at the interfaces of DMF and linear alkanes.