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The Effect of Shearing Force on Interfacial Reaction and Morphology at Reactive Polymer/Polymer Bilayer

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We investigated the effect of oscillatory shearing amplitude and frequency, via atomic force microscopy and transmission electron microscopy, on the interfacial morphology at reactive polymer/polymer bilayer consisting of mono-carboxylated terminated polystyrene (PS-mCOOH) and poly(methyl methacrylate-ran- glycidylmethacrylate) (PMMA-GMA). When there is no oscillatory shearing (or very small values of amplitude and frequency), the interface roughness increases with reaction time. However, the interfacial roughness under large values of these two ? becomes smaller than that without shearing, because the shearing prevents chains located away from the interface from diffusing into the interface. However, the effect of these two on the interface roughness is different. Namley, once a large amplitude is reduced to a smaller one, the reactive polymer chains can diffuse into the interface again; thus the interfacial roughness increases further. On the other hand, once a large frequency is applied to the bilayer, the small interfacial roughness is maintained, even though a small frequency is employed again. This is because the oscillatory shear with large frequency generated a multilayer consisting of PS and PMMA layer. This layer became a permanent obstacle for the diffusion of both reactive polymer chains to react with each other further. The critical frequency above which smaller interfacial roughess is maintained is roughly the same as the cross-over frequency of neat PS-mCOOH.