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Conformational Relaxation of Polystyrene at Substrate Interface
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— The local conformation of polymer chains in a film at a substrate interface was examined by sum-frequency generation spectroscopy. When a polystyrene (PS) film was prepared on a quartz substrate by a spin-coating method, the chains were aligned in the interfacial plane of the substrate. A dissipative particle dynamics simulation revealed that a spinning torque induced the chain orientation during the film preparation process and the extent of the orientation was a function of the distance from the interface. This interfacial orientation of chains was not observed for a PS film prepared by a solvent-casting method. Interestingly, the local conformation of chains at the substrate interface was unchanged even at a temperature that was 80 K higher than the bulk glass transition temperature. This observation means that polymer chains at the substrate interface can be only partially relaxed under conditions where the bulk chains are fully relaxed. On the other hand, interfacial chains could be easily relaxed by solvent annealing.

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