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Relaxation of non-equilibrium entanglement networks in thin polymer films PAUL FOWLER, JOSHUA MCGRAW, MELISSA FERRARI, KARI DALNOKI-VERESS, Department of Physics & Astronomy and the Brockhouse Institute for Materials Research, McMaster University, Hamilton, ON, Canada, L8S 4M1 — It is well established that polymer films, prepared by spin-coating, inherit non-equilibrium chain conformations which can affect macroscopic film properties. Here we present the results of crazing measurements that elucidate the non-equilibirum chain configurations in spin-cast films. Furthermore, we find that the entanglement network equilibrates on a time scale comparable to one reptation time. In a second set of experiments, we confine polymers to films with thickness comparable to the molecular size. By stacking two such films at room temperature, a glassy bilayer film with a buried entropic interface is created. According to Silberberg's reflection principle, such an interface has an entropic cost associated with the restricted configurations of molecules that cannot cross the mid-plane of the bilayer. In the melt, the interface heals as chains from the two layers mix and entangle with one another. Crazing measurements reveal that it takes less than one bulk reptation time for a bilayer to become indistinguishable from a single film.

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