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Watching nucleation and growth of chain disentanglement in large-amplitude oscillatory shear of entangled polymer solutions P. TAPADIA, A. PHILIPS , SHI-QING WANG, Department of Polymer Science, The University of Akron — Our recent stress-controlled measurements show that a sufficient yet moderate level of chain deformation due to shear can produce spatial topological rearrangement to free chains from mutual dynamic constraint [1]. The chain disentanglement seems to occur catastrophically, resulting in an inhomogeneously sheared sample during rate-controlled shear [2]. Thus, chain disentanglement is also expected to take place during large amplitude oscillatory shear (LAOS) at frequencies higher than the overall chain relaxation rate. We applied our particle-tracking velocimetric technique to probe the state of chain entanglement during LAOS. We found that the chain orientation produced by LAOS led to a new environment in which the initially well-entangled chains managed to disentangle inhomogeneously in space. A layer free of chain entanglement developed to take the load of the imposed strain. As a result of this nonlinearity, the rest of the sample avoided significant deformation and its chain entanglement remained intact. [1] Tapadia, P.; Wang, S. Q. *Phys Rev. Lett*, **91**, 198301 (2003); Tapadia, P.; Wang, S. Q. *Macromolecules* **37**, 9083 (2004). [2] Tapadia, P.; Wang, S. Q. *Phys. Rev. Lett.* , in press (2005).

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