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The Effect of Crosslinking on the Microscale Stress Response and Molecular Deformations in Actin Networks BEKELE GURMESSA, ROBERT FITZPATRICK, JONATHON VALDIVIA, RAE M. R. ANDERSON, Univ of San Diego — Actin, the most abundant protein in eukaryotic cells, is a semi-flexible biopolymer in the cytoskeleton that plays a crucial structural and mechanical role in cell stability, motion and replication, as well as muscle contraction. Most of these mechanically driven structural changes in cells stem from the complex viscoelastic nature of entangled actin networks and the presence of a myriad of proteins that cross-link actin filaments. Despite their importance, the mechanical response of actin networks is not yet well understood, particularly at the molecular level. Here, we use optical trapping - coupled with fluorescence microscopy - to characterize the microscale stress response and induced filament deformations in entangled and cross-linked actin networks subject to localized mechanical perturbations. In particular, we actively drive a microsphere 10 microns through an entangled or cross-linked actin network at a constant speed and measure the resistive force that the deformed actin filaments exert on the bead during and following strain. We simultaneously visualize and track individual sparsely-labeled actin filaments to directly link force response to molecular deformations, and map the propagation of the initially localized perturbation field throughout the rest of the network (~100 um). By varying the concentration of actin and cross-linkers we directly determine the role of crosslinking and entanglements on the length and time scales of stress propagation, molecular deformation and relaxation mechanisms in actin networks.

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