Actin crosslinker density tunes mesoscale mechanics of actin-microtubules composites

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Actin and microtubules form interacting networks in the cytoskeleton

Dugina et al. (2016). Oncotarget, 7(45).

Ricketts. (2019).

Rankin et al. (2010). Journal of Cell Biology, 190(1).

Actin crosslinking serves roles in various processes

**Morphogenesis**

**Migration and Adhesion**
Higashibata et al. (2006). *BMC biochemistry, 7*(1).

**Growth**

**Division**
Burnette. (2016)
The mesoscale mechanics of actin-microtubule composites shows non-monotonic dependence on actin crosslinker density.
We create equimolar actin-microtubule composites with permanent actin crosslinks


We vary the actin crosslinker density in actin-microtubule composites.

Increasing Crosslinker Density, $R$

- $R = 0$
- $R = 0.02$
- $R = 0.04$
- $R = 0.08$
We use optical tweezers to measure the local force response of composites.
The resistive force shows surprising *non-monotonic* dependence on crosslinker density.
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Composite stiffness also shows surprising non-monotonic dependence on crosslinker density.
All composites exponentially dissipate force following strain.
$R = 0.02$ composites exhibit the slowest relaxation mechanisms over all timescales.
The degree of force dissipation displays non-monotonic dependence on crosslinker density.
Actin bundling at higher crosslinking densities increases the composite mesh size.
Non-monotonic dependence of mechanics on actin crosslinking arises from actin bundling at higher density.
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