

Abstract Submitted
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Measurement of depletion-induced force in microtubule bundles

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— Microtubule (MT) bundles formed in the presence of non-adsorbing polymers - poly-ethylene glycol (PEG) or Dextran - are widely used in experimental active matter systems. However, many properties of such MT bundles have not been studied experimentally. In this work, we combine optical trapping techniques with an umbrella sampling method in order to measure the depletion force acting on individual microtubule in the axial direction within the bundle. We find depletion force is independent of bundle overlap length and measure its magnitude to be on the order of tens of $\frac{k_B T}{\mu m}$. We explore the dependence of the depletion force on concentration of depletant (PEG 20K) as well as K^+ ions (necessary for screening electrostatic repulsion between MT filaments). We also verify additivity of depletion interaction and confirm that force is increased by a factor of two for three-MT bundles. Additionally, our experimental technique allows us to probe interactions between MTs within the bundle. Experimental data suggests that filaments in the bundle interact only hydrodynamically when depletant concentrations are low enough; however, we observe onset of solid-like friction when osmotic pressure is increased above a certain threshold.

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