Mesh size of DNA nanotube networks

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Studying the mechanics and dynamics of biopolymers has inspired many ideas and theories in polymer physics. One prominent example is actin, being the best-studied semiflexible polymer. Unfortunately, naturally occurring protein-based biopolymers are limited in their properties such as length, stiffness and interaction strengths. This highlights the advantage of having "programmable" model polymers at hand, which give the opportunity to experimentally test parameters otherwise unavailable in natural systems, and therefore expand theoretical approaches.

Nanotubes formed from synthetic DNA strands are an ideal match to this need [1]: they are semiflexible over their typical length scale and can be hybridized to have characteristics such as persistence length which are similar actin filaments or can be varied in a controllable way. We use this model system to measure the mesh size of entangled networks by observing the reptation of single filaments.

The results show a concentration scaling similar to the theoretically predicted scaling for flexible polymers, as opposed to the stiff rod approximation. These findings point towards a more complex description of semiflexible polymer reptation and demonstrate the applicability of this method.

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