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Tube Radius in Entangled Networks of Semiflexible Polymers

HAUKE HINSCH, JAN WILHELM, ERWIN FREY, Arnold Sommerfeld Center for Theoretical Physics and Center for NanoScience, Ludwig-Maximilians-University, Munich, Germany — The mechanical properties of the cytoskeleton play an important role in many cellular functions like locomotion or adhesion. One of the cytoskeleton's dominant constituents is a network structure composed of the semiflexible polymer F-Actin. To connect the single polymer properties to the macroscopic behavior of the network, a single polymer is considered to be constrained to a tube established by neighboring filaments. Here we focus on the tube's diameter in entangled networks. While scaling laws for the tube diameter are well established, the absolute value is still under debate and different theoretical concepts and experimental measurements exist. We present a new approach to the problem and have conducted extensive computer simulations to check the validity of our assumptions. A model of independent rods is used to describe the confinement of a single semiflexible polymer in the network environment. A self-consistency approach allows us then to derive an absolute tube radius for the network as a function of several parameters and compare our results to experimental measurements.

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