Line Tension of Carbon Nanotube-Based Lyotropic Liquid Crystal Microdroplets on Solid Surfaces

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Dispersions of long, rod-like particles such as carbon nanotubes are known to form spindle-shaped, cylindrically symmetric elongated nematic liquid crystalline droplets in coexistence with the isotropic phase. Their shape and director field structure depends on the size of the drops, the interfacial tension, anchoring strength and elastic constants. In contact with a wall, the droplets lose their cylindrical symmetry and flatten. By visualising hundreds of droplets of carbon nanotubes dissolved in chlorosulfonic acid and applying elasticity theory to fit the data, we find that the ratio of the line tension and the interfacial tension for this particular system equals −0.84 ± 0.06 μm. This ratio is 2 orders of magnitude larger than what has been reported for conventional fluids, in agreement with theoretical scaling arguments.

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