Mechanical properties of organic nanofibers

Intrinsic elastic and inelastic mechanical properties of individual, self-assembled, quasi-single-crystalline para-hexaphenylene nanofibers supported on substrates with different hydrophobicities are investigated as well as the interplay between the fibers and the underlying substrates. We find from atomic-force-microscopy-based rupture experiments a rupture shear stress of about 2 x 10^7 Pa for an individual fiber. Deflecting a nanofiber suspended across a gap results in a Young's modulus of 0.65 GPa. Translational motion of intact nanofibers across the surface is demonstrated for fibers on a silicon substrate with a low-adhesion coating, whereas such motion on a noncoated substrate is limited to very short (sub-micrometer) nanofiber pieces due to strong adhesive forces.

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