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Rings and rackets from single-wall carbon nanotubes: manifestations of mesoscopic mechanics YUEZHOU WANG, University of Minnesota, Twin Cities, MATTHEW SEMLER, North Dakota State University, Fargo, IGOR OSTANIN, University of Minnesota, Twin Cities, ERIK HOBBIE, North Dakota State University, Fargo, TRAIAN DUMITRICA, University of Minnesota, Twin Cities — We combine distinct element method simulations and experiments to understand the stability of rings and rackets formed by single-walled carbon nanotubes assembled into ropes. Bending remains a soft deformation mode in ropes because intra-rope sliding of the constituent nanotubes occurs with ease. Our simulations indicate that the formation of these aggregates can be attributed to the mesoscopic mechanics of entangled nanotubes and to the sliding at the contacts. Starting from the single-walled carbon nanotubes, the sizes of the rings and rackets' heads increase with the rope diameter, indicating that the stability of the experimental aggregates can be largely explained by the competition between bending and van der Waals adhesion energies. Our results and simulation method should be useful for understanding nanoscale fibers and self-assembling process in general.

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