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Cooperative adhesion and friction of compliant nanohairs[1] ALI DHINOJWALA, LIEHUI GE, The University of Akron, LIJIE CI, ANUBHA GOYAL, PULICKEL AJAYAN, Rice University, L. MAHADEVAN, Harvard University — The adhesion and friction behavior of soft materials, including compliant brushes and hairs, depends on the temporal and spatial evolution of the interfaces in contact. For compliant nanofibrous materials, the actual contact area of individual fibers make with surfaces depends on the preload applied upon contact. Using in-situ microscopy observations of preloaded nanotube hairs, we show how nanotubes make cooperative contact with a surface by buckling and conforming to the surface topography. The overall adhesion of compliant nanohairs increases with increasing preload as nanotubes deform and continuously add new side-wall contacts with the surface. Electrical resistance measurements indicate significant hysteresis in the relative contact area. Contact area increases with preload (or stress) and decreases suddenly during unloading, consistent with strong adhesion observed for these complaint nanohairs.

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