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Static and dynamic response of bucky sponges THEYARAMAN RAMATHASAN, California Institute of Technology, MEHMET KARAKAYA, RAMAKRISHNA PODILA, Clemson University, CHIARA DARAIO, University of California, San Diego, APPARAO RAO, Clemson University — Here we present the static and dynamic mechanical behavior of a three dimensional, interconnected, carbon nanotube (CNT) based, spongy material termed the bucky sponge. We adopted a facile top-down synthesis approach by judiciously mixing carbon microfibers with CNTs to create bucky sponges with controlled porosity and density. Static and dynamic tests were performed using a customized setup based on geometric Moiré interferometry and high-speed microscopic imaging. In both quasi-static and dynamic experiments, the bucky sponges exhibited highly nonlinear foam-like stress-strain response with hysteretic dissipation. The energy dissipated at 80% compressive strain is in the order of 500 kJ/m^3, which is nearly 25 times more than the energy dissipated by commercial foams with similar densities. Dynamic unloading modulus of bucky sponges varies between 25-250 MPa depending on the maximum strain attained and they show exceptional resilience to impact by recovering more than 70% of the deformation. Bucky sponges with tailored microstructure and mechanical properties have the potential to be used in applications requiring impact mitigation, vibration damping, and separating oil from water.

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