

Mechanically Assembled, Three-Dimensional Hierarchical Structures of Cellular Graphene with Programmed Geometries and Outstanding Electromechanical Properties

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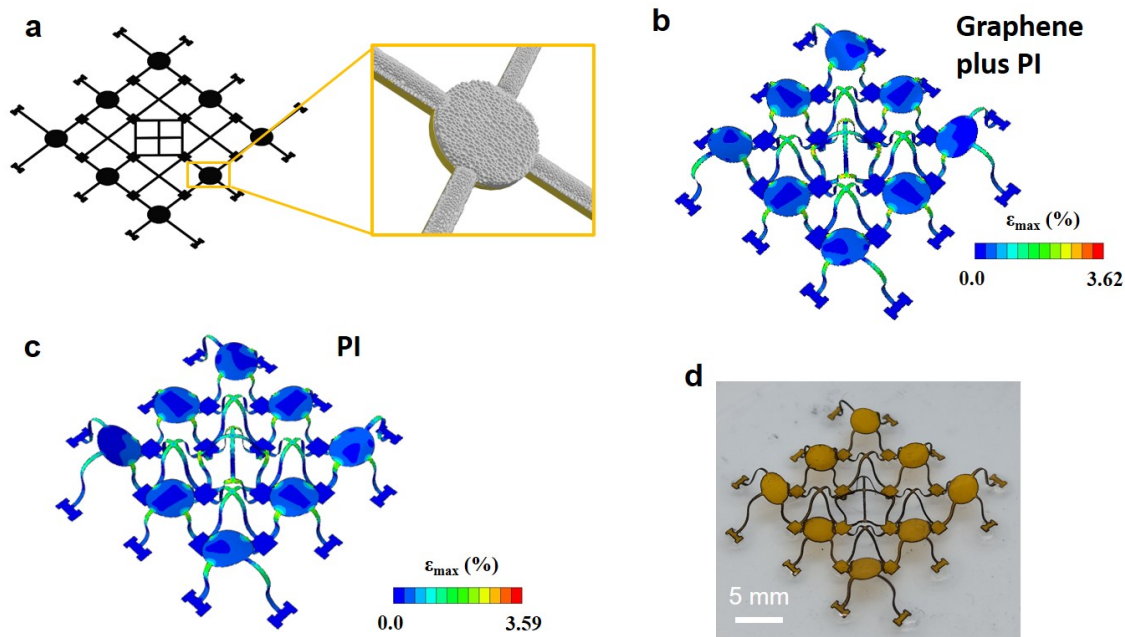


Figure S1. (a) Schematic illustration of the 2D precursor of the mixed table and tent of cellular graphene/PI bilayer. The FEA simulation results of the 3D structure of the mixed table and tent made of cellular graphene/PI bilayers (b) and PI (c). (d) Optical image of the 3D structure of the mixed table and tent of PI. The color in FEA results denotes the maximum principal strain.

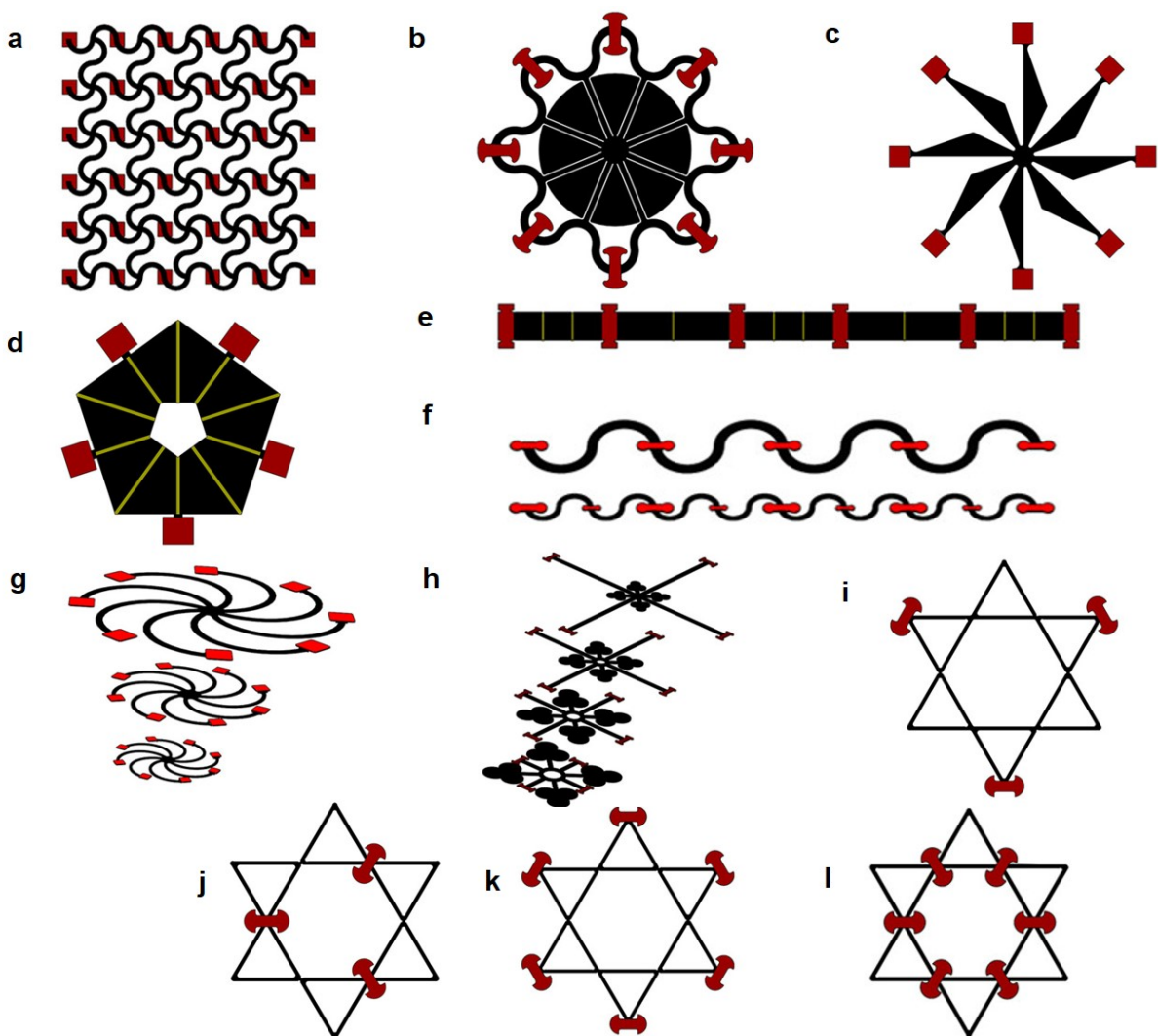


Figure S2. Schematic illustrations of the 2D precursors of various geometries with bonding sites (red parts) and crease of origami (yellow parts). (a) 5 x 6 array of double-floor helix. Kirigami-inspired, jelly fish-like (b) and windmill-like (c) structures. Origami-inspired, five-pointed star-like (d) and alternative mountain-like (e) structures. Structures with fully-separated multilayers: double-layer helical coils (f), trilayer cages (g) and four-layer trees (h). (i-l) Open-mesh structures.

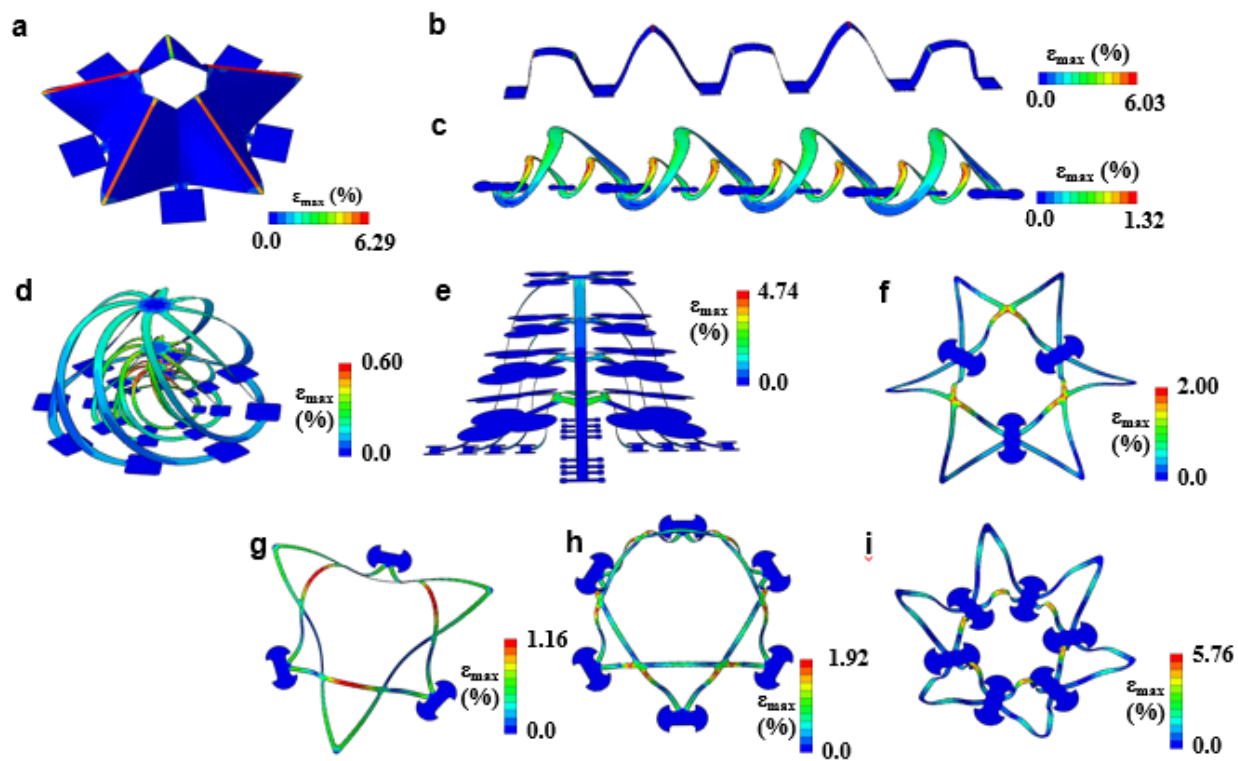


Figure S3. FEA results of 3D hierarchical structures with various geometries. Origami-inspired, five-pointed star-like (a) and alternative mountain-like (b) structures. 3D structures with fully-separated multilayers: double-layer helical coils (c), trilayer cages (d) and four-layer trees (e). (f-i) 3D open-mesh structures. The color denotes the maximum principal strains in the cellular graphene.

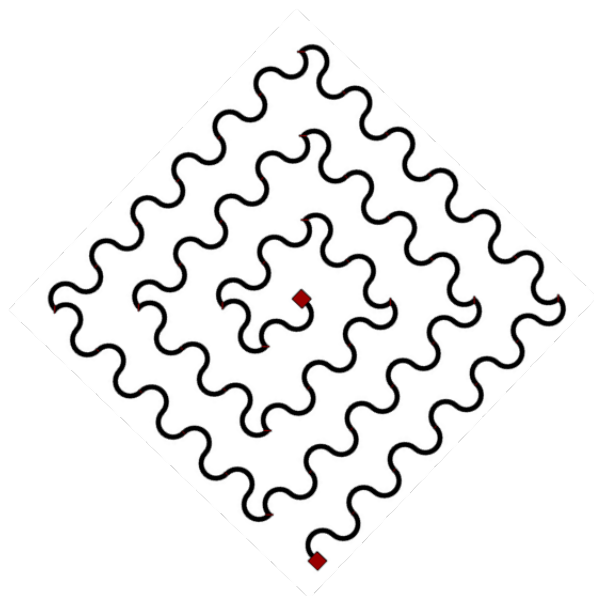


Figure S4. Schematic illustration of the 2D precursor design for 3D helical coils in Figure 3.

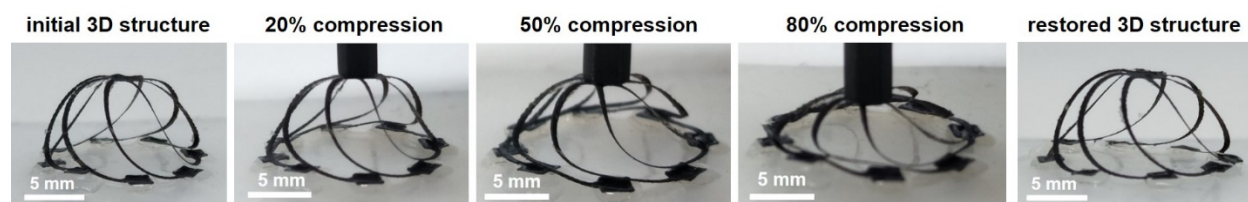


Figure S5. Optical images of cage-like 3D structure of cellular graphene (from left to right) before compression, at 20% compression, at 50% compression, at 80% compression, and after compression.

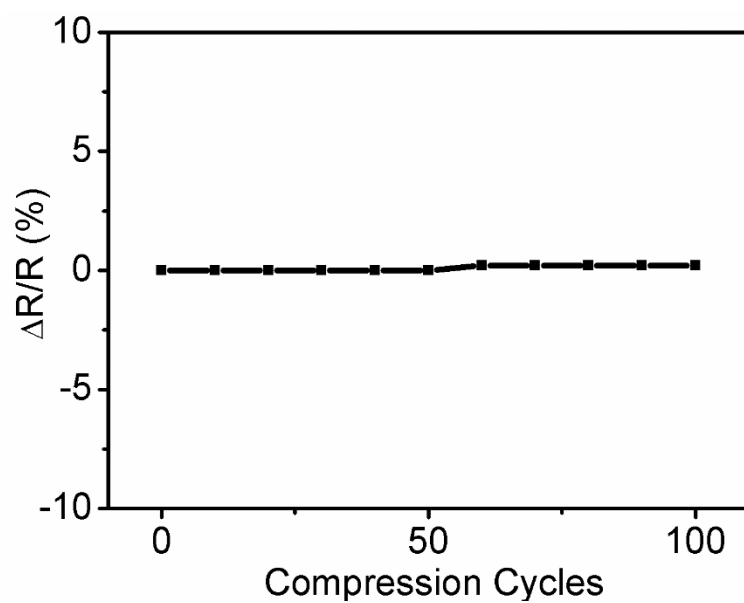


Figure S6. The electrical-resistance variation of 3D cage of cellular graphene, illustrated in Figure S5, as a function of compression cycles for 80% vertical compression.

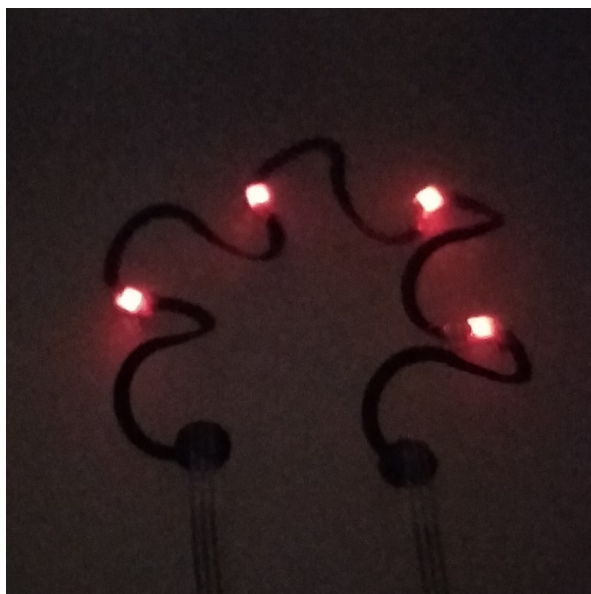


Figure S7. The LED arrays remain functional after 1000 cycles of biaxially stretching to 100%.