Assembly of Micro/Nanomaterials into Complex, Three-Dimensional Architectures by Compressive Buckling
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**Abstract:** Complex, three dimensional (3D) structures in biology (e.g. cytoskeletal webs, neural circuits, vasculature networks) form naturally to provide essential functions in even the most basic forms of life. Compelling opportunities exist for analogous 3D architectures in man-made devices, but design options are constrained by existing capabilities in materials growth and assembly. Here we report routes to previously inaccessible classes of 3D constructs in advanced materials, including device-grade silicon. The schemes involve geometric transformation of two dimensional (2D) micro/nanostructures into extended 3D layouts by compressive buckling. Demonstrations include experimental and theoretical studies of more than forty representative geometries, from single and multiple helices, toroids and conical spirals to structures that resemble spherical baskets, cuboid cages, starbursts, flowers, scaffolds, fences and frameworks, each with single and/or multiple level configurations.