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Buckliballs: Buckling-Induced Pattern Transformation of Structured Elastic Shells KATIA BERTOLDI, JONGMIN SHIM, SEAS, Harvard Univ, CLAUDE J. PERDIGOU, MIT, ELIZABETH R. CHEN, University of Michigan at Ann Arbor, PEDRO M. REIS, MIT — We present a class of continuum shell structures, the buckliball, which, undergo a structural transformation induced by buckling under pressure loading. The geometry of the buckliball comprises a spherical shell patterned with a regular array of circular voids. Moreover, we show that the buckling-induced pattern transformation is possible only with five specific hole arrangements. These voids are covered with a thin membrane, thereby making the ball air tight. Beyond a critical internal pressure, the thin ligaments between the voids buckle leading to a cooperative buckling cascade of the skeleton of the ball. Both precision desktop-scale experiments and finite element simulations are used to explore the underlying mechanics in detail and proof of concept of the proposed structures. We find excellent qualitative and quantitative agreement between experiments and simulations. This pattern transformation induced by a mechanical instability opens the possibility for reversible encapsulation, over a wide range of length scales.

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