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Self-assembled active elastic gels spontaneously curve and wrinkle similar to biological cells and tissues

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Abstract

Living systems from individual cells to entire tissues adopt diverse curved shapes, appearing on many length scales and commonly driven by active contractile stresses generated in the cell cytoskeleton. Yet, how these forces generate specific 3D forms remains unclear. By recreating the cell cytoskeleton from basic components, with precisely controlled composition and initial geometry, we demonstrate that the spontaneous buildup of stress gradients generated by these molecular motors drive shape deformation. We identify the shape selection rules that determine the final adopted configurations. These are encoded in the initial radius to thickness aspect ratio, likely indicating shaping scalability. These results provide insights on the mechanically induced spontaneous shape transitions in contractile active matter, revealing potential shared mechanisms with living systems across scales.

Keywords:

Active elastic matter Automorphing Actomyosin gels Wrinkling Buckling