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Buckling of stiff thin film on a prestrained bilayer substrate

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ABSTRACT

Controlled buckling enables stretchable characteristic for brittle materials by integrating stiff device films on a soft substrate. Being permeable to fluids, the soft substrate, however, cannot encapsulate the device well and the system is also hard to be integrated with liquid components. In addition, the strength of the device system with a soft substrate is unsatisfactory in many biomedical applications. By introducing a bilayer substrate, we are able to provide a robust, high strength system while maintaining the stretchable characteristic, with a soft layer on top of a relatively stiff layer in the substrate. Theoretical investigation shows the design requirement for each substrate layer and it can guide the experimental design for a device to be used in a target application.