Abstract Submitted
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Kirigami-based PVDF thin-film as stretchable strain sensor[1] NAN HU, DAJING CHEN, NANJING HAO, SHICHENG HUANG, XIAOJIAO YU, JOHN X.J. ZHANG, ZI CHEN, Thayer School of Engineering, Dartmouth College, Hanover, NH 03755, USA — Kirigami, as the sister of the origami, involves cutting of 2D sheets to form complex 3D geometries with out-of-plane patterns. Motivated by the development of the high-stretchable biomedical devices, we explore the stretchability of the kirigami-based PVDF thin film under tension. Our structural prototypes include a set of 2D geometry with kirigami-based pattern cutting on PVDF thin films. We first used paper models to generate a wide range of cutting patterns to study the deformation under compression tests, the results of which are compared with finite element simulations. We then proceeded to test different kirigami-based designs to identify geometric parameters that can tune the post-buckling response and strain distribution. Next, we fabricated and tested the PVDF thin film with kirigami pattern. Experiments showed that the PVDF film in the absence of cutting can be stretched to a limited extent and will break upon further stretching. In contrast, the kirigami-based films can be stretched up to 100% without failure. Our designs demonstrate the ability to significantly improve the strain range of the structure and sensing ability of a sensor. We envision a promising future to use this class of structural elements to develop highly stretchable materials, structures, and devices.

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