Bio-inspired Multifunctional Stimuli-Responsive Materials

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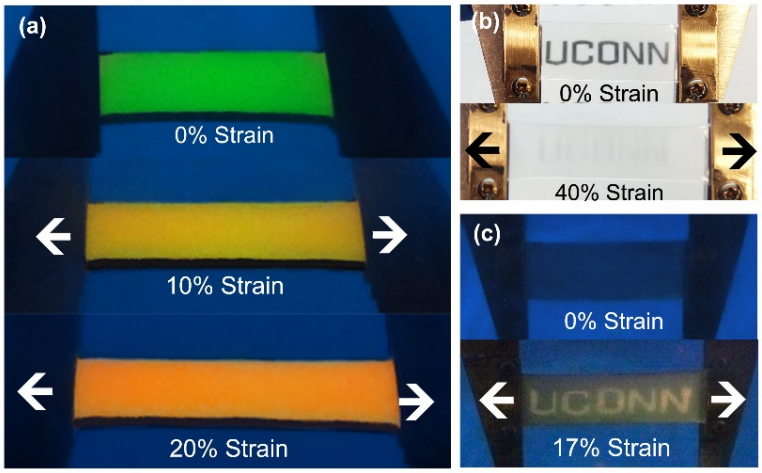
A number of marine organisms use muscle-controlled surface structures to achieve rapid changes in color and transparency with outstanding reversibility. Inspired by these display tactics, we develop analogous deformation-controlled surface-engineering approaches via strain-dependent cracks and folds. A bilayer structure composed of polyvinyl alcohol composite thin film atop elastomer substrate was designed and prepared to achieve dynamic strain-responsive optical properties. The transition between a transparent state to an opaque state can be easily achieved by uni-axially stretching and releasing the device. Also, a series of derivative mechanochromisms with capabilities of switch "on/off" fluorescence, change fluorescent color, reveal/hide information upon mechanical stimuli are prepared. These devices feature virtually no changes in optical/mechanical properties after being repeatedly stretched and released thousands of times, promising for widespread applications. Corresponding mechanics simulation was also explored, which helped to guide a more precise design of the bilayer structure.



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