

Abstract Submitted
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Spontaneous and Deterministic Three-dimensional Curling of Pre-strained Elastomeric Strips: From Hemi-helix to Helix JIANGSHUI HUANG, JIA LIU, BENEDIKT KROLL, KATIA BERTOLDI, ZHIGANG SUO, DAVID CLARKE, Harvard University — A variety of three dimensional curls are produced by a simple generic process consisting of pre-straining one elastomeric strip, joining it to another and then releasing the bi-strip. The hemi-helix, one kind of three dimensional curls, consists of multiple, alternating helical sections of half wavelength in opposite chiralities and separated by perversions. The hemi-helix wavelength and the number of perversions are determined by the strip cross-section, the constitutive behavior of the elastomer and the value of the pre-strain. Topologically, the perversions also separate regions of the helix deforming principally by bending from those where twisting dominates. Changing the prestrain and the ratio between the thickness and the width induce a phase separation of hemi-helical structure, helical structure and hybrid structure which have similarities to coiled polymer molecules and plant tendrils.

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