Mechanics of Hierarchical Chirality Transfer in Biomaterials

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Many biomaterials and self-assembled structures such as climbing plant tendrils and twisted petal or leaf have hierarchy of chirality. The transfer of chirality among different structural levels is crucial for the morphologies, properties and even functions of these materials. In this paper, based on experimental observations, a multiscale model is developed to investigate the chirality transfer in biomaterials with hierarchy of chirality.The physical mechanisms underlying these two chirality transfer phenomena are presented to elucidate why plant tendril and paper sheets can be twisted during the growth process and the wetting-drying process, respectively. The origins of the size effects of the twisting morphologies are also given. The results of the study is useful not only for understanding various interesting phenomena associated with chirality such as the chiral growth in biological world but also for optimal design and fabrication of novel materials and devices with enhanced properties and functions.

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