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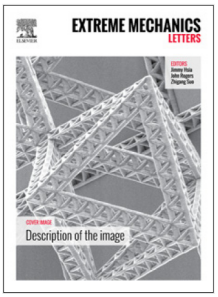

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Compression twist deformation of novel tetrachiral architected cylindrical tube inspired by towel gourd tendrils

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Abstract: Inspired by the coupling geometrical relations of left-hand (LH) and right-hand (RH) climbing towel gourd tendrils within single branch, innovative chiral architected cylindrical tube is proposed, which can convert axial compression loads into angular rotation deformation. Firstly, two series of tetrachiral cylindrical tube samples with rotation disk on the mirror plane (middle cross-section) are designed, where the numbers of unit cells and tetrachiral nodes radius are different. Secondly, the cylindrical tetrachiral tubes are fabricated with Selective Laser Sintering (SLS) nylon sintering techniques, and in-situ compression tests are performed for studying the relation between axial compression strain and rotation angle of the spinning disk. It is found that the proposed innovative tetrachiral cylindrical tube is able to generate lateral rotation, and linear relation between rotation angle and compression force can be harvested. With the progress of micro- and nano- manufacturing techniques, the proposed tetrachiral cylindrical tube with compression-twist deformation mechanism demonstrates robust mechanical performances for future industrial applications, such as: shape memory morphing structures in aerospace engineering, smart actuators and propellers, smart flexible microelectronics and biomechanical devices.

Keywords: chiral cylindrical tube, auxetic, compression-twist

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