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Modulating elastic band gap structure in layered soft composites using sacrificial interfaces QIANLI CHEN, Univ of Illinois - Urbana — A wide range of engineered and natural composites exhibit a layered architecture whereby individual building blocks are assembled layer by layer using cohesive interfaces. The enhancement of toughness in those biological materials is partially attributed to wavy surfaces and cohesive interaction along the interfaces between bulk materials. In this study, we present a novel mechanism for evolving acoustic band gap structure in a model system of these composites through patterning the microstructure in a way that triggers non-planar interfacial deformations between the layers as they are stretched. Through the controlled deformation and growth of interlayer channels under macroscopic tension, we observe the emergence of multiple band gaps due to Bragg diffraction and local resonance. The variability of the band gap width develops due to the competition between stiffness changes as the hyperelastic material is changed and the evolving geometry due to the non-uniform deformation of the interfaces which lead to complex channel shapes and scattering response. We describe these phenomena in details for three example microstructures and discuss the implications of our approach for harnessing controlled deformation in modulating band gap properties of composite materials.

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