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Harnessing deformation to realize topological phase transition in acoustic metamaterials[1] ZEYU WANG, HUA CHENG, The MOE Key Laboratory of Weak Light Nonlinear Photonics, School of Physics, Teda Applied Physics Institute, Nankai University, Tianjin 300071, China, CHUNYIN QIU, ZHENGYOU LIU, School of Physics and Technology and Institute for Advanced Studies, Wuhan University, Wuhan 430072, China, SHUQI CHEN, JIANGUO TIAN, The MOE Key Laboratory of Weak Light Nonlinear Photonics, School of Physics, Teda Applied Physics Institute, Nankai University, Tianjin 300071, China — We design a new class of acoustic metamaterials utilizing external force to realize topological phase transition. The proposed structure comprises a triangular array of steel cylinders coated by elastic rubbers in zigzag shape embodied in a water host. With numerical simulations, we show the topological phase of the band gap can pass from trivial to nontrivial when the shape of rubbers is axially compressed and a band inversion process occurs. The inherent link between the band inversion and the topological phase transition in the acoustic system of proposed structures is analogous to that in the electronic system of HgTe/CdTe quantum well structures. The helical edge states can exist along the interface between a topologically nontrivial acoustic metamaterial and a trivial one. Our work provides an easier way to realize topological phase transition in acoustic systems.

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