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Non-porous Elastic Sheets with Negative Poisson's Ratio FARHAD JAVID, School of Engineering and Applied Science, Harvard University, EVELYNE SMITH-ROBERGE, Department of Mathematics and Statistics, McGill University, MATTHEW INNES, ALI SHANIAN, Rolls-Royce Energy, KATIA BERTOLDI, School of Engineering and Applied Science, Harvard University, HARVARD UNIVERSITY COLLABORATION, ROLLS-ROYCE ENERGY COLLABORATION — Negative Poisson's ratio (NPR) materials—materials that contract (expand) in transverse directions when compressed (stretched) uniaxially—have attracted significant interest both because of their unusual properties and their many potential applications. However, complex fabrication processes, high porosity, and low structural stiffness of most of the proposed NPR materials have significantly limited their practical applications. In this work, a novel NPR material is designed by coupling the in- and out-of-plane (popping) deformations in an elastic sheet with a periodic distribution of dimples. As a result, such NPR material has zero porosity, relatively high structural stiffness, and can be made from both hard and soft materials using industrial fabrication techniques.

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