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Auxetic metamaterials with additive manufacturing from jammed networks[1] DANIEL REID, NIDHI PASHINE, University of Chicago, JUSTIN WOZNIAK, Argonne National Laboratoty, SIDNEY NAGEL, JUAN DE PABLO, University of Chicago — Recent work has shown that the mechanical properties of disordered elastic networks can be precisely tuned to show a range of exotic properties. Starting from jammed configurations, we develop algorithms in simulation which modify the topology of these networks through bond pruning to create highly auxetic metamaterials which show promise in impact mitigation. Materials developed in simulation are produced in experiment, and the two show excellent agreement. We develop criteria which ensure that experimental realizations are highly tunable and maximize material resilience. We show that the Poisson's ratio can be further decreased by precisely tuning the mechanical strength of particular bonds in these networks. Interestingly, optimization algorithms show that ideal morphologies consist of a small fraction of highly rigid bonds, with the rest remaining more pliable. We employ additive manufacturing techniques to experimentally realize these heterogeneous materials.

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