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MEMS based stencil lithography for mechanically tunable metasurfaces[1] JEREMY REEVES, THOMAS STARK, RACHAEL JAYNE, LAWRENCE BARRETT, RICHARD LALLY, DAVID BISHOP, Boston University — We present a scalable technique for nanoscale patterning on soft microstructured substrates. Polymer substrates are 3D-printed onto a microelectromechanical systems (MEMS) device which enables the precise alignment of a MEMS stencil relative to the substrate. With this technique, we fabricate optical metamaterials on two dimensional substrates with lattice geometries that allow for the deformation of the lattice unit cells by the application of mechanical strain. Unit cells can be designed to stretch or rotate, giving the substrate auxetic properties. Physical vapor deposition is used to apply metallic metamaterial patterns, defined on the stencil, to the polymer substrates. The fabricated surfaces demonstrate tunable infrared responses, enabled by the elongation or rotation of the substrate lattice unit cells. We discuss our fabrication technique, the potential for use with other types of substrates, and explore its scalability.

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Jeremy Reeves
Boston University

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