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Fabrication of tunable infrared metamaterials using atomic calligraphy[1] JEREMY REEVES, THOMAS STARK, LAWRENCE BARRETT, RICHARD LALLY, DAVID BISHOP, Boston University — Metamaterials with dynamically variable spectral response to incident radiation through the use of a deformable substrate have so far been limited to the IR and longer wavelength regimes. Such materials, with unit cells a few to tens of microns across, can readily be fabricated using existing lithography techniques. Extending these metamaterials to shorter wavelengths and into the visible spectrum requires a proportional shrinking of the unit cell to be patterned over a large area. The reduced structure size leads to a strong reduction in the throughput of the chosen fabrication technique [1]. Here, we investigate the prospects for the use of atomic calligraphy [2] to pattern arbitrary infrared metamaterials with high throughput. Atomic calligraphy provides a scalable technique for the manufacture of metamaterials with high precision while allowing for writing on a variety of substrates, including deformable materials. We consider the electromagnetic response of these tunable materials and possibilities to develop metamaterials with resonances in the visible spectrum.

[1] M. Imboden, and D. Bishop, Physics Today **67**, 45 (2014)
[2] M. Imboden, et. al., Nano Lett. **13**, 3379 (2013)

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