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Direct laser writing of three dimensional metal nanostructures using a femtosecond laser and various chemistries SEUNGYEON KANG, KEVIN VORA, SHOBHA SHUKLA, ERIC MAZUR, Harvard University — Metal nanostructures play important role in various areas such as catalysts or in plasmonics and especially for metamaterial applications. To generate these structures, most fabrication techniques can allow mass production but are either non-controllable, suffer from high cost and low throughput or are limited in two dimensions. Direct laser writing technique resolves these problems but has been mainly used to fabricate polymeric structures. We direct laser write 3D metal structures of tunable dimensions ranging from hundreds of nanometers to micrometers. With computer-controlled translation stage and by utilizing nonlinear optical interactions between chemical precursors and femtosecond pulses, we can limit the metal-ion photo-reduction process to a focused spot smaller than that of the diffraction-limit to create metal nanostructures in a focal volume. We study the chemistry that effects the photo induced metal growth to generate desirable metal structures. By varying the types of solvent, polymer and the concentration ratios of chemicals, we demonstrate our control over the morphology of the resulting metal structures and other features such as flexibility and conductivity. We plan to create diverse metal nanostructures for a wider range of metamaterial applications.

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