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**Two-Photon Absorbing Materials for 3D Microfabrication, Sensing and Imaging**

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The design of conjugated organic chromophores with large two-photon cross sections and how these chromophores can be used to develop highly efficient materials for two-photon 3D microfabrication, sensing and imaging applications will be described. Two-photon excitation of materials with focused laser beams allows for free-form patterning of materials in three dimensions with nanoscale ($<$ 200 nm) resolution. We have been developing efficient photoactive precursor materials for two-photon 3D patterning of polymers, in both positive and negative patterning processes. We have also developed a class of photoactive nanocomposites containing metal nanoparticles that allow for direct patterning of continuous metal features using lasers or electron beams. We are utilizing these two-photon materials and fabrication processes to prepare 3D microstructures that are of interest for photonic, microfluidic, and micromechanical applications, as well as others. An overview of our efforts to develop two-photon 3D microfabrication will be presented and the wide range of 3D microstructures that can be fabricated with this method will be highlighted. The coupling of two-photon chromophores to ligand receptors for sensing of metal ions, the assembly of two photon dyes on metal nanoparticles to make ultrabright nanobeacons, and the strong enhancement of two-photon excited fluorescence by coupling of chromophores to clusters of metal nanoparticles will also be discussed.