

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

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I will describe 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. 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. I will present an overview of our efforts to develop two-photon 3D microfabrication, and will highlight the wide range of 3D microstructures that can be fabricated with this method. I will also discuss 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.