

Two Photon Micro- and Nano-fabrication

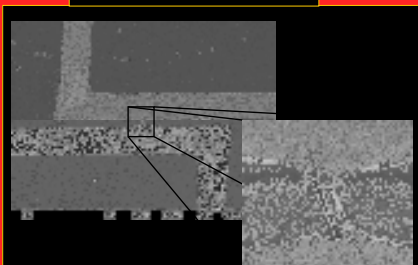
Juliet Znovena, Chris Lafratta, Linjie Li

The unifying theme of the research of the Fourkas group is studying and controlling the microscopic properties of condensed-phase systems. Within this broad area we are pursuing numerous experimental projects.

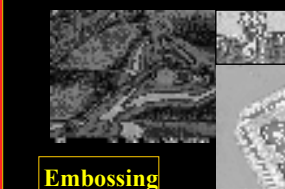


Direct Laser Writing

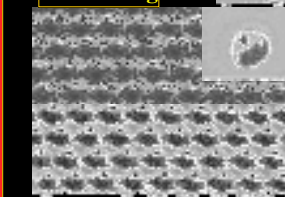
Nanorods are wired with silver using direct laser writing



Polymer Ablation



Embossing



Prepolymer resin is partially cured with UV light followed by laser irradiation

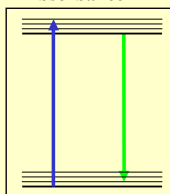
Multiphoton Absorption Polymerization (MAP)

Due to the nonlinear nature of MAP, photochemical or photophysical events can be localized within the focal volume of an ultrafast laser beam that has passed through a microscope objective. By translating the focal point of the laser relative to a sample, complex three-dimensional patterns can be created. The structures directly below were made with a viscous liquid prepolymer resin containing a photoinitiator. Multiphoton absorption by the photoinitiator induces polymerization, hardening the resin locally.

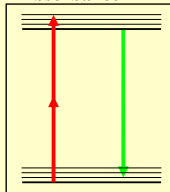
Multi-Photon Absorption



Absorbance $\propto I$

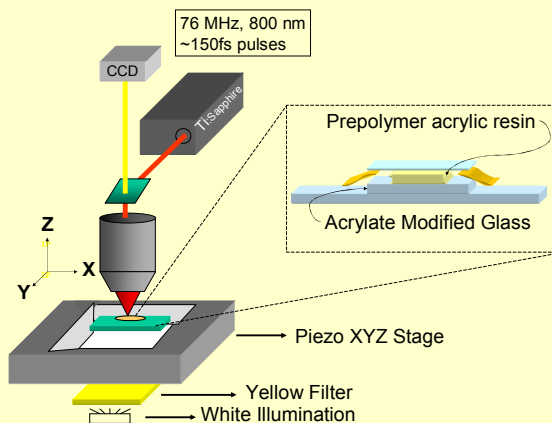


Absorbance $\propto I^2$

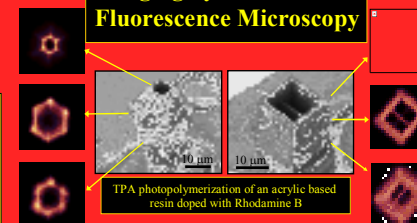


Two photon absorption will occur ONLY at the point of focal point

Experimental Setup



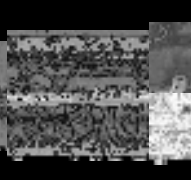
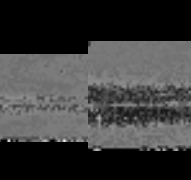
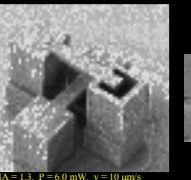
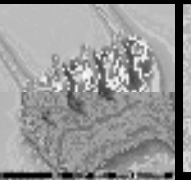
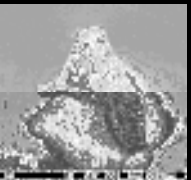
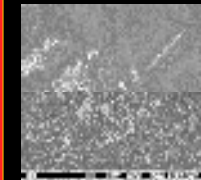
Imaging by Two-Photon Fluorescence Microscopy



Optical Data Storage

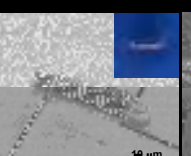
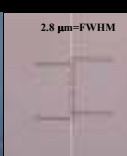


The above optical image is taken inside a molecular glass which can be used in high-density optical memory



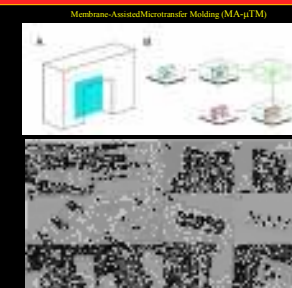
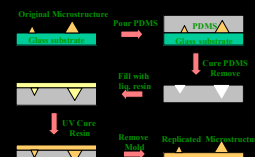
Metalization

electroless metal deposition can be used to modify the polymer surface



Microtransfer molding

Replication of microstructures is done by making an elastomeric mold of the original structure using poly(dimethylsiloxane) PDMS.



Membrane-Assisted Microtransfer Molding (MA-μTM)

For scale bars see 10 μm