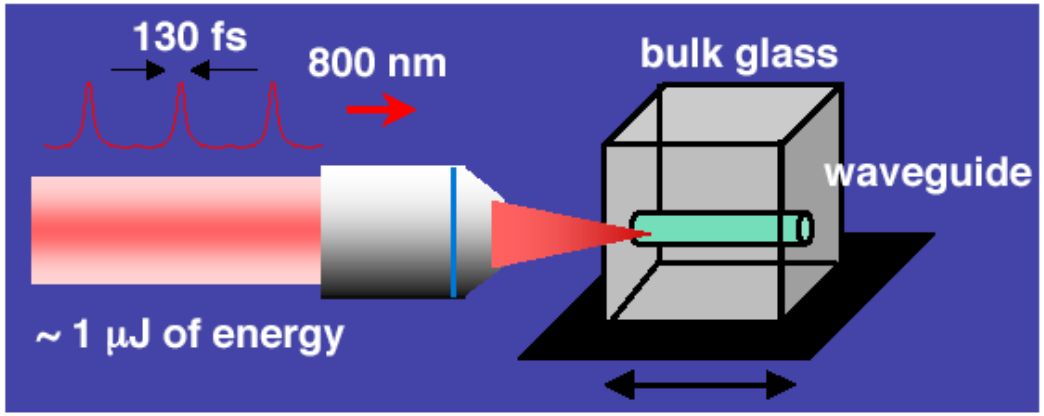
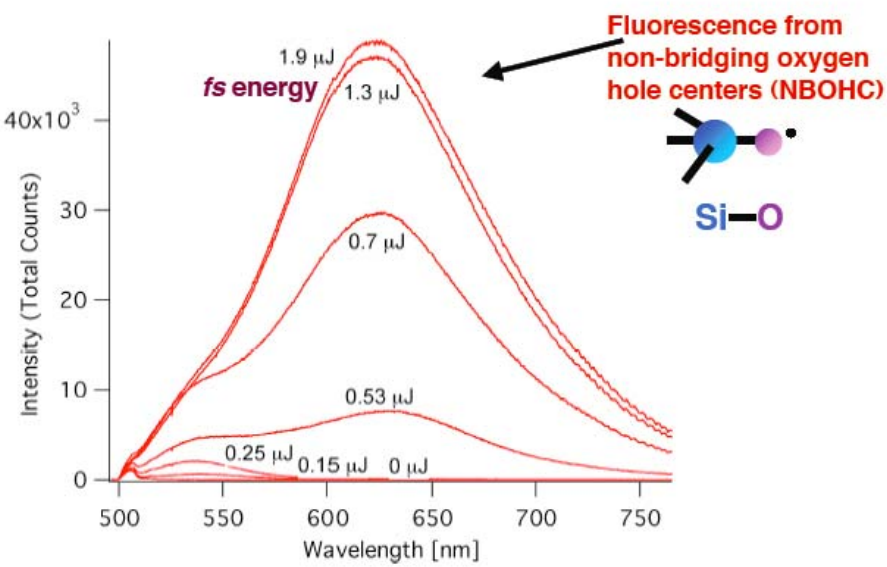
Role of glass composition in waveguide fabrication with femtosecond laser pulses

Denise Krol, University of California, Davis, DMR-0307002

Tightly focused femtosecond (fs) laser pulses can be used to modify the refractive index of glass within the focal region of the laser beam. By scanning the glass with respect to the laser focus waveguide structures can be fabricated inside the glass. This technique holds tremendous potential as a fabrication technique for 3-D all-optical integrated components with applications in the photonics industry. The ability to use this technique with different glass compositions- tailored for a specific photonics application- is critical to its successful exploitation.

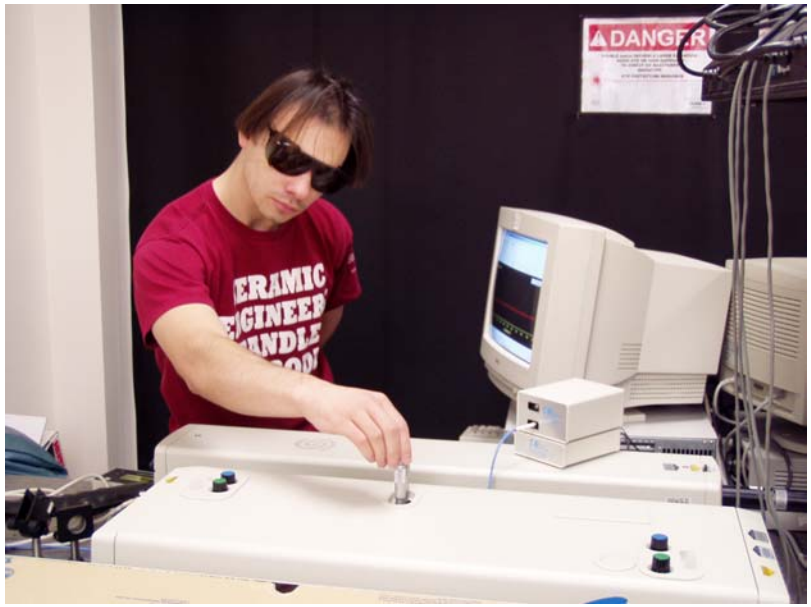




We have found that glasses with different compositions behave differently when exposed to the fs laser beam. We use confocal fluorescence and Raman microscopy to characterize atomic scale structural changes in the glass network after exposure to the fs laser pulses. We observe the formation of fluorescent defect centers in the region that has been exposed to the fs laser, as well as changes in the overall structure of the glass network.

Post-doc and students
Denise Krol, University of California, Davis, DMR-0307002

Several students(2 graduate, 2 undergraduate) and a post-doc have contributed to this project. Graduate student Wilbur Reichman's paper, "Confocal fluorescence and Raman microscopy of femtosecond laser-modified fused silica" W. Reichman, J. Chan, D. M. Krol, J. Phys: Condens. Matter 15, S2447-S2456 (2003), was selected by the Editorial Board as one of the best papers of the year in JPCM.



Post-doc Prissana Thamboon has been working in collaboration with the group of Prof. E. Mazur in Harvard. We are using our expertise in Raman spectroscopy together with Prof. Mazur's laser facilities to study the effect of laser repetition rate on fs laser waveguide writing in glass.