Syracuse University
College of Arts & Sciences

# Michael B. Sponsler

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## Research Interests

Organic and organometallic chemistry; holographic materials; liquid crystals; molecular electronics

## Education

- B.S., 1982, Bowling Green State University
- Ph.D., 1987, California Institute of Technology
- Postdoctoral Fellow, 1987-1989, University of California, Berkeley

## Honors & Awards

- National Science Foundation Graduate Fellowship, 1982-1985
- National Institutes of Health Postdoctoral Fellowship, 1987-1989

## Courses

- CHE 106: General Chemistry Lecture I
- CHE 275: Organic Chemistry Lecture I
- CHE 276: Organic Chemistry Laboratory I
- CHE 326: Organic Chemistry II Laboratory
- CHE 675: Advanced Organic Chemistry
- CHE 685: Organic Mechanisms
- CHE 406/606: Advanced Forensic Science
- FSC 444/644: Forensic Chemical Analysis
- FSC 498: Capstone Seminar in Forensic Science

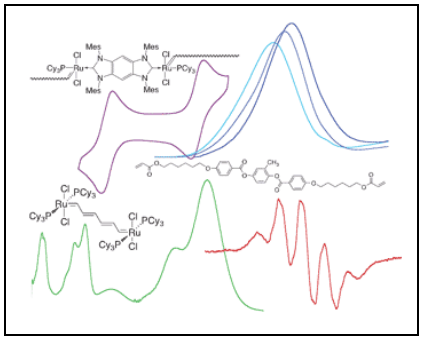
## Research Focus

Control of molecular reactivity and physical properties allows the design and realization of materials with new and useful capabilities. Research in our group involves both fundamental studies aimed at developing such molecular control and more applied studies on electronic and

optical materials. Projects include both conjugated organometallic complexes and holographic materials and sensors.

In the organometallic complexes (examples shown below), electronic interactions between transition metals linked by conjugated organic bridges can lead to conductivity and other useful electrical properties. These complexes can be thought of as molecular wires. We have used two efficient reaction types, stoichiometric olefin metathesis of dienes and Ru-H addition to diynes, for the synthesis of these wires. Applications we are now exploring include the preparation of conducting polymers with high levels of incorporated ruthenium and the installation of molecular jumper cables - making electrical connections on a molecular scale. The ability to make such connections is sorely needed in the growing field of molecular electronics. Control of electronic states is also important in the design of solar cell dyes, another area of research in the group.

Our work on holographic materials has targeted holograms that are electrically switchable. Electrically switchable liquid crystals are all around us in liquid crystal displays (LCDs), as found in calculator or wristwatch displays and laptop screens. We have used photopolymerization of liquid crystalline monomers to produce holographic LCDs, holograms that can be turned on and off. A current focus is the design of sequential multiphoton processes to increase the resolution of the hologram writing process. Advances in this area will be broadly applicable even beyond holography. Another recent focus is the use of holography in the design of hydrogel sensors.



The collage at right represents several of the methods and molecules used by our group. Clockwise from upper left, the methods are cyclic voltammetry (showing reversible transformations among three oxidation levels), IR spectroscopy (expanded spectra of three different redox levels), EPR spectroscopy (used to characterize mixed-valence states), and UV-Vis-Near IR spectroscopy (showing a variety of electronic transitions). The molecules, from top to bottom, are a molecular jumper cable, a liquid crystalline monomer used for switchable holograms, and an example of a conjugated diruthenium complex.

## Selected Publications


- Schuehler Sherwood, D. E.; Williams, J. E.; Sponsler, M. B. Ruthenium-Incorporated, Metathesis-Active Polyacetylene. *J. Polym. Sci., Part A: Polym. Chem.* **2009,** *47*, 1061-1072.
- Bolton, S. L.; Williams, J. E.; Sponsler, M. B. Stabilization of (Trialkylphosphine)Ruthenium Alkylidene Metathesis Catalysts Using Phosphine Exchange. *Organometallics* **2007,** *26*, 2485-2487.
- Seetharaman, S. K.; Chung, M.-C.; Englich, U.; Ruhlandt-Senge, K.; Sponsler, M. B. Temperature-Dependent Coordination of Phosphine to Five-Coordinate Alkenylruthenium Complexes. *Inorg. Chem.* **2007,***46*, 561-567.

- Bolton, S. L.; Schuehler, D. E.; Niu, X.; Gopal, L.; Sponsler, M. B. Olefin Metathesis for Metal Incorporation: Preparation of Conjugated Ruthenium Containing Complexes and Polymers. *J. Organomet. Chem.* **2006,** *691*, 5298-5306.
- Tucker, L. J.; Sponsler, M. B. Trithiocarbonate-mediated free radical photopolymerization: improved uniformity in hologram recording. *Appl. Opt.* **2006,** *45*, 6973-6976.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