

The Department of Chemistry  
Western University

*invites you to*

## THE PAUL de MAYO AWARD LECTURE

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### Semiconductor-Based Photocatalytic Organic Transformations and Efforts Toward Single-Molecule Catalysis

Photocatalytic excitation of a semiconductor like  $\text{TiO}_2$  leads to formation of electron hole pairs in the semiconductor nanoparticle, followed by charge transfer and migration of electrons or holes to the surface. Photogenerated holes are strong oxidizing species and can react rapidly with adsorbed substrates. We found that alcohol oxidation with doped  $\text{TiO}_2$  produces hydrogen that can be used in situ and selective hydrogenation of alkenes and alkynes. A  $\text{Ru/TiO}_2$  catalyst was prepared using photodeposition of Ru nanoparticles onto  $\text{TiO}_2$  and irradiated in the presence of methanol (acting as a hydrogen source) and alkenes or alkynes. Furthermore, we show that in the case of using deuterated methanol, deuterium-labeled compounds can be synthesized by employing the above approach for hydrogenation.

Recent advances in fluorescent imaging allow us to detect single molecules and investigate catalytic reactions on a single-molecule level. In this lecture single-molecule imaging techniques, including Fluorescent Lifetime Imaging Microscopy (FLIM) and Total Internal Reflection Fluorescence Microscopy (TIRFM), will be discussed and our preliminary studies on single-molecule hydrogenation over  $\text{Ru/TiO}_2$  will be presented.

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