**Single-molecule catalysis: nanoparticles and polymers**

Peng Chen

Department of Chemistry and Chemical Biology, Cornell University

This presentation will describe our efforts in developing single-molecule approaches to study catalysis, focusing on two stories. The first story will be about our single-molecule fluorescence imaging work on the catalytic properties of individual metal nanoparticles at single-turnover resolution and nanometer precision. I will describe the insights we gained into the catalytic activity and dynamics of individual metal nanoparticles, and the surprising spatial and temporal activity patterns and dynamics within single nanocatalysts. The second story will be about our work in using magnetic tweezers to track single polymer growth in real time under living polymerization catalysis conditions. I will describe how the real-time growth dynamics of single polymers reveal the formation and unraveling of conformational entanglements that play key roles in the polymerization kinetics and kinetic dispersion among individual polymers.

**Key references:**

1. W. Xu, J. S. Kong, Y.-T. E. Yeh, P. Chen\* "Single-Molecule Nanocatalysis Reveals Heterogeneous Reaction Pathways and Catalytic Dynamics" *Nature Mater.* **2008**, *7*, 992-996.
2. X. Zhou, N. M. Andoy, G. Liu, E. Choudhary, K.-S. Han, H. Shen, P. Chen\* "Quantitative Super-resolution Imaging Uncovers Reactivity Patterns on Single Nanocatalysts" *Nature Nanotech.* **2012**, *7*, 237–241.
3. C. Liu, K. Kubo, E. Wang, K.-S. Han, F. Yang, G. Chen, F. A. Escobedo,\* G. W. Coates,\* P. Chen\* "Single polymer growth dynamics" *Science* **2017**, *358*, 352-355.
4. N. Zou, X. Zhou, G. Chen, N. M. Andoy, W. Jung, G. Liu, P. Chen\* "Cooperative communication within and between single nanocatalysts" *Nature Chem.* **2018**, doi:10.1038/s41557-018-0022-y.