

ORGANIC SEMINAR

Professor Peng Chen

Department of Chemistry and Chemical Biology
Cornell University



Single Polymer Growth Dynamics at Single-Monomer Resolution

This presentation will describe our efforts in developing and applying single-molecule manipulation and imaging approaches to study living polymerization reactions of single polymer chains down to single-monomer resolution. In the first part, I will describe our work in using magnetic tweezers to track single polymer growth in real time and the discovery of nonequilibrium conformational entanglements that play key roles in controlling polymerization kinetics. In the second part, I will describe a new fluorescence-based imaging technique that enables following polymerization of individual polymers at single-monomer resolution, leading to microscopic sequencing of synthetic copolymers and discovery of copolymer sequence patterns.

Key references:

- 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.
- S. Baral, C. Liu, U. K. Chakraborty, K. Kubo, X. Mao, G. W. Coates, P. Chen* "[Single-chain polymerization dynamics and conformational mechanics of conjugated polymers](#)" *Chem* **2021**, 7, 2175-2189.
- S. Baral,[†] C. Liu,^{†,*} X. Mao, G. W. Coates, P. Chen* "[Tuning single polymer growth via hydrogen bonding in conformational entanglements](#)" *ACS Cent. Sci.* **2022**, 8, 1116-1124.
- R. Ye,[†] X. Sun,[†] X. Mao,[†] F. Alfonso, S. Baral, C. Liu, G. Coates, P. Chen* "[Optical sequencing of single synthetic polymers](#)" *Nature Chem.* **2024**, 16, 210-217.
- U. Chakraborty, M. Yang, S. Baral, C. Liu, A. Chen, P. Chen* "[Biphasic mechanochemistry of single-chain polymerization](#)" *Proc. Natl. Acad. Sci. U.S.A.* **2025**, 122, e2418844122.