Two Dimensional Polymers and Polymerizations

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**Abstract:** Synthetic chemists have developed robust methods to synthesize discrete molecules, linear and branched polymers, and disordered cross-linked networks. However, two-dimensional (2D) polymers prepared from designed monomers have been long missing from these capabilities, both as objects of chemical synthesis and in nature. Recently, new polymerization strategies and characterization methods have enabled the unambiguous realization of 2D, covalently linked macromolecular sheets. In the early realization of this synthetic challenge, polymerization conditions were identified empirically by screening polymerization conditions through powder x-ray diffraction analysis of the insoluble powder products, which provided polycrystalline samples with crystalline domains with average in-plane dimensions of 25-50 nm. More recently, we have developed tools to study these polymerizations experimentally and computationally, which has given rise to the first controlled two-dimensional polymerizations, along with materials of improved quality. I will present these approaches and the properties of high-quality 2D polymers that are now starting to emerge.

**Speaker Biography:** William Dichtel received a B.S. degree in Chemistry from MIT, where he performed research with Prof. Tim Swager. Dichtel obtained his Ph.D. degree from UC-Berkeley under Prof. Jean M. J. Fréchet. He was a joint postdoctoral researcher with Prof. Fraser Stoddart, UCLA, and Prof. James Heath, Caltech. He began his independent academic career at Cornell University in 2008 and was promoted to Associate Professor in 2014. In 2016, he moved to Northwestern University as the Robert L. Letsinger Professor of Chemistry. The unifying theme of Dichtel’s research is the use of organic synthesis and noncovalent assembly to control the structure and reactivity of molecules, materials, and interfaces across chemical environments. His research has expanded the study of polymerization processes into the second and third dimensions in an emerging class of polymers known as covalent organic frameworks (COFs), porous polymers for water purification, and new approaches to polymer recycling. Dichtel’s research has been recognized nationally and internationally. Dichtel has received a MacArthur Fellowship, a Guggenheim Fellowship, the Leo Hendrik Baekeland Award of the North Jersey Section of the ACS, and was named the 2020 National Laureate in Chemistry by the Blavatnik Awards for Young Scientists.

