Ladderane mechanochemistry towards force-responsive polymer materials

Presented by Dr. Zhixing Chen (Xia Group), Stanford University

In an effort to develop synthetic materials that transduce mechanical force into multifold drastic changes in their intrinsic properties, we demonstrate mechanochemically responsive insulating poly(ladderene) that unzips to form semiconductive polyacetylene via an extensive rearrangement of the macromolecular structure in response to force. The poly(ladderene) was synthesized by direct metathesis polymerization of ladderane, a natural product-inspired scaffold. The mechanochemically formed polyacetylene exhibited remarkably long conjugation length and uniform \textit{trans}-configuration and self-assembled into semiconducting nanowires. Mechanistic insight of ladderane unzipping process will also be discussed. The mechanochemistry of ladderane opens new avenue in force-responsive materials for connecting mechanical inputs with distinct optical/electronic properties and rich functions of conjugated polymers.