Building and Breaking Macromolecular Ladders to Develop Microporous and Force-Responsive Materials

Presented by Yan Xia, Stanford University

Our interest in utilizing and incorporating strained rings in ladder-shaped molecular structures led to the development of unusual polymers. We developed Catalytic Arene-Norbornene AnnuLation (CANAL) to synthesize rigid ladder polymers from readily available norbornenes and aryl bromides.\[1\] Efficient CANAL polymerization produced rigid ladder polymers with very high molecular weights, contorted conformations, and various functionalities. These ladder polymers exhibited high microporosity (pore width < 1 nm) and surprisingly high thermal stability up to 400 °C without detectable T_g. Membranes from these polymers were fabricated for gas separation and understanding gas transport in glassy polymers.

In the quest for synthetic materials that transduce mechanical stimulation to multifaceted signals in response to force, we developed a unique class of polyladderenes, which rapidly unzip under force into polyacetylene with long conjugation.\[2\] The force-induced breaking of macromolecular ladders opens new avenues for smart materials that transform their intrinsic properties drastically under stress and understanding details of mechatransduction in polymers.


Hosted by Colin Nuckolls and Luis Campos

Tea and cookies will be served prior to the lecture at 3:30pm in the Miller Room 328 Havemeyer
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