INORGANIC SEMINAR

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Molecularly Inspired, ALD-Driven Design of Hierarchical Hydrogenation Catalysts

Our multidisciplinary research group focuses on molecular inorganic synthesis, thin film materials via atomic layer deposition (ALD), and heterogeneous catalysis for fine chemical transformations. Our goal is the convergence of these subdisciplines of inorganic chemistry towards the synthesis of complex hierarchical catalyst systems that are active, selective, and highly reusable. Out of these efforts has emerged our parallel research thrusts on catalyst performance enhancement via selective ALD-overcoating, and the controlled growth of nanocatalysts on contiguous Ni foam monoliths, the latter of which frames our ongoing efforts.

Using this approach, and taking inspiration from design principles of molecular homogeneous catalysts, our group has explored the growth of highly reactive and robust platinum group-based nanocatalysts with low-to-ultralow metal loadings. Platinum group catalysts are critical enablers of numerous synthetic organic transformations. Their superior reactivity, tunable selectivity, and relative stability under broad-ranging conditions has bolstered their wide-spread adoption by the catalysis and synthetic organic chemistry communities. Conversely their low Earth abundance, and regions of production which can be impacted by geopolitical events can lead to a volatile market. Enhancing the efficiency and reusability of these catalyst systems has become an important, and fundamentally interesting avenue of research. The preparation of supported Pt, and Pd-based nanocatalysts and their application towards the catalytic hydrogenation of -NO_2, C=N, C=C, and C≡C moieties, in batch and flow, under mild conditions will be discussed.

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