Developing Stable Materials with Hyper-Active Sites

Extremely reactive sites are unstable. However, highly chemical/electro/photo-reactive sites are desired in several applications including sensitive sensors, batteries, photovoltaics, catalysts and optoelectronics. Having these sites in high density and controlling their uniform distribution in a pre-planned fashion are the additional challenges.

The focus of the talk will be on the design, synthesis and gradual improvement of materials that are replete with highly reactive sites at a high density; yet the material and the reactive sites withstand degradation. The density could be as high as $10^{13} - 10^{14}$ sites within a $1\text{ mm}^2$ region of $1\text{ µm}$ thick material, all arranged uniformly in the porous material (Metal-Organic Frameworks, MOFs). The distribution and density of sites are controlled by the materials design. The materials design and synthesis are pre-planned and amenable to atomic scale modifications based on their respective chemical/electrical activity. Each material is designed for a specific application.

Through a journey of molecular-materials by a chemist, the speaker hopes to demonstrate that freeing man-made pre-designed materials from the compromise between the seemingly opposing worlds of reactivity and stability is not far-fetched.