Multifunctionality in textiles using metal-organic frameworks

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Keywords: Metal-Organic Frameworks, Natural Fiber, Cottons, Textiles

Our research group at Cornell University has focused a significant portion of our efforts not only developing new materials, but also imparting new functionalities to materials that have been traditionally used as textile fibers. We use cotton as a primary substrate as cotton is a very challenging natural fiber with quite unique physical and chemical heterogeneities –heterogeneities that are amplified as cotton fibers are transformed into yarns and then into textile structures. Our research group was the first one to report on the decoration of cotton fibers and fabrics with Metal-Organic Frameworks (MOF). We were also the first to evaluate the potential use of these new textile substrates as sorbents for pesticides as well as antibacterial fabrics. We have expanded this work by using lantanide-based MOF structures to change the color of cotton from its traditional white to red, green, and blue (RGB) colors under exposure to UV. And lately, we ventured into post-modification strategies of MOF structures to expand the color palette of these materials under visible light, hence creating true panchromatic MOFs. Furthermore, we started using MOFs that are stable in water to remove toxic compounds such as arsenic from water streams. We believe that the potential of MOFs to add functionality to textile fibers is very significant and untapped. Our ultimate goal is to impart unique properties to natural fibers without affecting their comfort and textile properties. We believe that natural fibers will remain a large section of the textile market for years to come and that enabling them with unique properties is an avenue for creating revolutionary textile materials without significantly altering existing textile manufacturing processes. In this seminar, we will discuss our strategies on using MOFs to add multifunctionality to textiles.