DEPARTMENT OF MECHANICAL ENGINEERING COLLOQUIUM

UNIVERSITY OF CALIFORNIA
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The Department of Mechanical Engineering
PRESENTS

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Friday, October 9, 2015
WCH Room 205/206
11:10-12:00PM

Designable Matter: Shape-Shifting Materials for Energy Storage and Conversion

Abstract:
This talk will describe an interdisciplinary collaboration to engender a new class of responsive materials that change their shape and porosity by exposure to sunlight. To realize these materials our team is developing a design-led method for materials development that allies materials science and engineering design theory in order to systematically invent rather than discover new materials. These materials are able to shape-shift as a result of their molecular architecture, which is based on metal-organic-frameworks (MOFs), and are designed to act as a giant stochastic linkage actuated by photoisomerization (light driven shape change). We call these shape-shifting materials MORFs (metal-organic-responsive-frameworks). A major challenge that must be overcome is the geometric constraint that the framework imposes on the photoisomerizing actuators. In our approach we are looking beyond this challenge and seek to use constraint to our advantage—enabling us to tune previously immutable properties of the photoisomers such as their energy conversion efficiency. We envision this new material class enabling diverse applications with significant and lasting societal impact such as self-squeezing hydrogen sponges, active filtration and catalysis, gas separation and CO2 capture, environmental monitoring, and solar energy conversion and storage. This ambitious research collaboration is generously supported by the W.M. Keck Foundation.

About the Speaker:
Dr. Greaney's research is focused on using computation and theory to understand the fundamental structure-property relationships in materials. His group's research encompases thermal properties of materials, mechanical properties, functional nanostructures materials, and computational design of materials.