# How is electronic structure correlated with morphology and mesoscopic structural stability?"

## Opportunity

**Understanding how the mechanical and electronic properties evolve as the surface chemistry is manipulated is one of the fundamental questions in designing new porous materials for energy harvest, energy storage, actuation or catalytic applications. In many cases unique charge-transfer induced changes in the physical properties are observed as the surface chemistry is manipulated.**

## Approach

**We will characterize the mechanical response of the nanoporous materials due to changes of the surface stress (surface chemistry as well as electrochemistry induced changes). We will use macroscopic strain effects to assess charge transfer induced changes of the surface stress. Change in electronic structure will be measured with in-situ and time dependent synchrotron-based x-ray absorption and leverage recent developments in modeling and x-ray scattering characterization of porous material structure .**

## Meso Challenge

**The challenge is to develop a fundamental understanding of the microscopic processes which occur on the surfaces of porous materials (or meso-scale constructions of nanomaterials) under various environmental conditions. In this context it is crucial to understand the role of charge-transfer on surface stress, as well as the correlation between the change in electronic structure and morphology or structural stability.**

## Impact

**This research will be aimed at developing a fundamental understanding of the microscopic processes which occur on the surfaces of nanoporous materials under conditions relevant to energy applications. With the fundamental understanding of how nanoscale surface properties affect macroscopic performance, we will develop a predictive capability and feedback loop for designing new porous materials for energy storage.**

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