

**UNIVERSITY OF RHODE ISLAND**  
**Department of Chemistry**  
**SEMINAR**

**Room 105 Beupre Center**  
**3:00 p.m, September 23, 2019**

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**“On the Interaction between  
Mechanics and Chemistry: Two Case  
Studies”**

**HOST**

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## On the Interaction between Mechanics and Chemistry: Two Case Studies

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Chemo-mechanical coupling, i.e., interaction between mechanical fields (stress, strain, ...) and chemical phenomena is familiar in a number of problems in mechanics of materials. Examples include stress corrosion cracking, dislocation interaction with its local environment, the role of stress in microstructure evolution in alloys, etc. The basic idea is that the contribution of mechanical fields to the free energy and the chemical potential of certain species can tip the energy landscape to influence the chemical reaction rates in ways that may have practical implications. In this talk, two case studies will be presented to explore such coupling: (i) the role of stress in heterogeneous catalysis and (ii) the role of mechanical properties on the performance of energy storage materials/systems. In the former, we examine how externally applied stress fields on a catalyst can influence the catalytic efficiency in the context of oxygen reduction reaction (ORR) and the hydrogen evolution reaction (HER). In the latter, we present an experimental method to measure the mechanical properties of the solid electrolyte interphase in lithium ion batteries and their influence on surface roughening instabilities during lithium deposition.

**Bio sketch:** Prof. Guduru received his Ph.D. in Aeronautics (Minor: Materials Science) from California Institute of Technology in 2001. Following a postdoctoral position in the Division of Engineering at Brown University, he joined the Solid Mechanics faculty there as an Assistant Professor of Engineering in 2002. He is currently a Professor of Engineering at Brown University. Prof. Guduru's research focuses on experimental mechanics; current problems of interest are at the interface between mechanics and chemistry and impact dynamics of materials. Professor Guduru was a recipient of PECASE - Presidential Early Career Award for Scientists and Engineers – in 2007; and the National Science Foundation CAREER award in 2006. Prof. Guduru serves on the Editorial Advisory Boards of the *Journal of the Mechanics and Physics of Solids* and *Acta Mechanica Sinica*.