



## Keith Johnston

M. C. (Bud) and Mary Beth Baird Endowed Chair  
Lyondell Chemical Company Faculty Fellowship in Engineering  
McKetta Department of Chemical Engineering  
Texas Materials Institute and Center for Nano- and Molecular Science

**Keith Johnston** received his PhD in 1981 in chemical engineering at the University of Illinois (with Chuck Eckert) and joined UT after a year at Sandia National Laboratories. His awards include the Allan P. Colburn Award and Award for Excellence in Industrial Gases Technology from AIChE, and he was named by AIChE in a list of “One Hundred Chemical Engineers of the Modern Era.” He is a member of the US National Academy of Engineering and is a Fellow of the Am. Inst. of Medical and Biological Engineers. He directed UTs activities in the NSF Science and Technology Center: Environmentally Responsible Solvents and Processes through 2009. He conducts fundamental research combining materials chemistry, colloid and interface science and polymer science to guide the development of applications in a wide range of fields including drug delivery, biomedical imaging/therapy, electrocatalysis in energy storage and subsurface energy production. He has discovered/co-discovered various nanomaterials including water/CO<sub>2</sub> microemulsions, silicon nanowires, and highly active perovskite electrocatalysts and supercapacitors. He has made significant contributions in a new field of nanotechnology for subsurface green energy production which includes CO<sub>2</sub> sequestration, improved oil recovery, magnetic nanomaterials for electromagnetic imaging of reservoirs, nanocapsule delivery and greener fracturing with low water utilization.

### *“Helping Nanoparticles Reach Their Colloidal Potential”*

#### Abstract

Fundamental colloid and interface science plays a key role in the design of novel functional nanoparticles in a broad range of applications in energy and protein drug delivery. To guide the design and synthesis of nanocrystalline catalysts for electrochemical energy storage, the relationships between catalyst activities and structure will be described for highly active metal oxides. In particular, a new concept is being developed to relate the activities of cobalt and nickel based perovskite electrocatalysts for the oxygen evolution reaction to the covalency between metal 3d states and O 2p orbitals that governs the formation of oxygen vacancies.

For processing and subcutaneous delivery of monoclonal antibodies (~10 nm colloidal particles) it is challenging to achieve low viscosities and high stabilities at high concentrations from 100 to 300 mg/ml. Advancements in this field are being guided by a deeper understanding of protein-protein interactions and morphology at high concentration with small angle X-ray scattering (SAXS), static light scattering (SLS) and dynamic techniques (dynamic light scattering (DLS), and fluorescence correlation spectroscopy) combined with shear rheology.

Whereas numerous studies of stabilization of nanoparticles (NPs) and foams in electrolytes have examined biological fluids, there is significant interest in media with much higher ionic strengths including seawater and brines encountered in subsurface oil and gas reservoirs. The mechanisms relative to stabilization and transport of nanoparticle dispersions and foams will be presented for both low molecular weight surfactants and polyelectrolytes. Applications with enormous implications for global energy development and environmental impact include CO<sub>2</sub> sequestration/enhanced oil recovery, electromagnetic imaging, nanocapsules for delivery and green fracture fluids.

**Tuesday, January 30<sup>th</sup>, 2018 | 10:00 – 11:50AM**  
**2 Eaton Hall (Spahr Auditorium)**