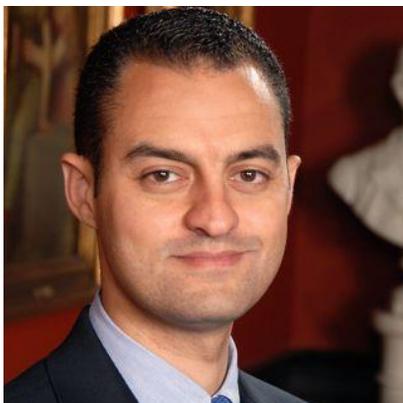


2018 Fall Chem 501 Seminar



Dr. Y. A. (Joe) Elabd



Professor, Director of the Undergraduate Program, Associate Department Head, Artie McFerrin Department of Chemical Engineering

Thursday – November 8, 2018
Refreshments 3:25pm, Buehler 513
Lecture at 3:45pm, Buehler 555

<https://www.egr.msu.edu/people/profile/dspence>

Hosted by: Dr. Alexei Sokolov

“Electric Cars for Everyone”

Currently, there are more than 1.1 billion vehicles in the world. Internal combustion engines power most of these vehicles. If a low-cost electric car with no greenhouse gas emissions could be produced and made broadly available, this would have a significant impact on our global carbon footprint. Currently, the only zero-emission vehicles are electric vehicles powered by rechargeable lithium-ion batteries (e.g., Tesla Model S) or hydrogen-fueled proton exchange membrane (PEM) fuel cells (e.g., Toyota Mirai). Fuel cell electric vehicles have several advantages over battery electric vehicles for driving ranges greater than 300 miles, such as significantly lower vehicle weight, six-times higher specific energy density, and instant re-fueling. Although automakers have engineered solutions to many of the major hurdles of bringing fuel cell electric vehicles to the market place, the high cost of the required precious metal platinum (Pt) electrodes remains one of the few major factors limiting the mass commercialization of low-cost fuel cell electric vehicles. In our laboratory, we have investigated two routes to overcome this limitation. In our first approach, we have developed a new process to fabricate high surface area fuel cell electrodes based on super proton conductive nanofibers, which results in high fuel cell power densities at ultra-low Pt loadings. These results were motivated by our exploration into the fabrication of Nafion nanofibers via electrospinning, where we observed super high proton conductivity of a single Nafion nanofiber (as high as 1.5 S/cm) relative to Nafion bulk film conductivity (~0.1 S/cm). The discovery, fabrication, properties, and fuel cell performance of super proton conductive nanofibers electrodes will be discussed. In our second approach, we have pursued solid-state anion exchange membrane (AEM) alkaline fuel cells (AFCs), which do not require the expensive components (Pt) of their PEM fuel cell counterpart, operating with much less expensive non-noble metal catalysts (e.g., Ni). We have developed a new AEM chemistry (hydroxide-conducting polymerized ionic liquid block copolymers), which addresses critical issues impeding AEM-AFC technology and provides a platform to investigate improving fuel cell performance. AEM synthesis, morphology, transport properties, and fuel cell performance will be discussed.

(Joe) Y. A. Elabd is a professor, holder of the Joe M. Nesbitt Professorship, associate department head, and director of the undergraduate program in the Department of Chemical Engineering at Texas A&M University. He received his PhD and BS both in chemical engineering from Johns Hopkins University (2001) and University of Maryland, Baltimore County (1995), respectively. From 2001-2003, Prof. Elabd served as an NRC postdoctoral fellow at the Army Research Laboratory.