Hybrid Nanocomposite Adsorbents for Gas Storage and Purification Applications

Fateme Rezaei
Assistant Professor
Department of Chemical & Biochemical Engineering
Missouri S&T

Abstract

The growing increase in energy consumption of transportation has sparked intense interest in the use of natural gas as a potential alternative fuel for vehicular applications over the past few years. The use of porous adsorbents as potential storage media for methane in the form of adsorbed natural gas (ANG) has been suggested as a safer, simpler, and more energy-efficient platform for advancement of natural gas vehicular systems than the current liquefaction and compression-based technologies. One of the strategies for advancing the current state-of-the art ANG adsorbents is to develop hybrid nanocomposites that enable integration of the unique properties of the two constituents, thus allowing the design of advanced materials with properties not possessed by either component. In the first section of this talk, the storage of methane in nanocomposite adsorbents comprising of metal-organic framework (MOF) and graphene oxide (GO) with varied surface characteristics and composition is discussed.

In the second section, development of another series of hybrid nanocomposites comprising zeolite and MOF adsorbents as potential candidates for hydrogen purification is presented. Hydrogen is considered as one of the most important clean and renewable energy sources for a sustainable energy future. However, its efficient and cost-effective purification still remains challenging. It is shown that through optimization of zeolite@MOF composition and properties, significant enhancement in hydrogen purification efficiency could be achieved for this type of hybrid nanocomposite materials.

Dr. Rezaei

Dr. Rezaei is an assistant professor of Chemical and Biochemical Engineering at Missouri S&T. She obtained her PhD degrees in Chemical Engineering from Monash University in Australia and LTU in Sweden in 2011. She worked as a postdoctoral fellow at Georgia Tech before she joined Missouri S&T in 2014. Her research focus broadly lies at the interface of chemical, materials science and environmental engineering, and the overall goal of her research group is development of advanced materials and processes for clean energy and sustainable chemical processes. She is the author of over 55 peer-reviewed journal articles and has recently received the *2018 ACS Energy & Fuels Award for Excellence in Publication*. She is also the associate editor of *Energy Technology* and *Adsorption Science & Technology* journals. Currently, she is leading several NSF and NASA funded as well as internal projects focused on advanced gas separation processes.