Unlocking the potential of HUMs for advanced methane production through carbon hydrogenation

PI: Mohamad Ahmad
Bahaa and Walid Bassatne Department of Chemical Engineering

The consumption of fossil fuel has drastically escalated the concentration levels of atmospheric carbon dioxide (CO2) over the last few years. This negatively contributes to climate change, escalating the likelihood of acute weather worldwide. CO2 methanation is an encouraging solution to decrease anthropogenic emissions. Natural gas (NG) can offer higher energy and a reduced amount of CO2 emission than other hydrocarbon fuels, with around 30% of global consumed energy being produced by NG today. Methane, CH4, as the key component of natural gas is critical to the dawning "Age of Gas" whereby new technologies are developing around the use of gases as fuels and feedstock chemicals.

This project focuses on a revolutionary novel category of physisorbents known as hybrid ultramicroporous materials (HUMs) the materials of which offer 1-2 orders of magnitude increase in selectivity towards CO2 against other widely used physisorbents. HUMs offer a huge promise as they offer an environmentally cleaner and economically viable alternative to amine-based CCS technologies [1]. HUMs were reported by international research leading groups for the first time in 2013, they are already gaining a lot of attention especially for the separation of difficult bulk and trace gases in industry such as direct air capture of CO2 and acetylene from ethylene [2]. The main deliverable of this multidisciplinary proposal will be proprietary HUMs that soon enable dramatic improvement on the aspects of overall efficiency, energy requirements and the environmental footprint for industrial trace levels of CO2 removal processes from natural gas. The full potential of HUMs will be examined by addressing the following: preliminary characterization (mainly morphologies and particle sizes which may affect the CO2 adsorption ability); bench-scale testing for methane production at low temperatures, stability and reusability. The strength and innovation of this project is to deliver significant impact on the research within the material and gas production in the MENA region.