ChE Graduate Seminar Series

Departmental Seminars Presented by Ph.D. Students

Recovering Fossil Energy and CO_2 Sequestration (Invited Talk)

Jyoti Phirani

8 August 2013, Thursday, 0400-0445 pm, ChE Seminar hall

Over the past few years, energy demand and efforts of CO_2 sequestration for climate change mitigation has increased manifold. The conventional energy resources are bound to be the primary source of energy for the near future because of the economy and efficiency of the fossil fuels. We study the mechanisms of flow of gas, water and oil in the rocks to find the efficient ways of recovering oil from oil reservoirs, gas from gas hydrate and storage of CO_2 in the form of hydrate in methane hydrate reservoirs. The CO_2 injection in methane hydrate reservoirs and the proposed work of enhanced oil recovery will be the focus of this seminar.

CO_2 can be injected into methane-hydrate reservoirs to produce methane and sequester CO_2 simultaneously. CO_2 replaces methane in the clathrate cages producing methane. A compositional, thermal, and kinetic simulator was developed to design and interpret lab and field scale CO_2 flooding experiments of methane-hydrate in porous media. The 1 dimensional simulations showed that, we need to keep the CO_2 mole fraction very high in the fluid phase or operate at a relatively lower pressure (shallower reservoirs of methane-hydrates) to dissociate methane-hydrate by CO_2 injection.

The ultimate oil recovery from conventional methods is estimated at 35%. The oil is left behind in the ground because of (1) low sweep efficiency (due to by passing of the oil by displacing fluid e. g. low permeability zones in layered reservoirs, matrix in fractured reservoir) (2) low displacement efficiency (due to high residual oil saturation, unfavourable mobility ratio). Surfactants and CO_2 are used as injection fluid to overcome these limitations. We will be studying how the surfactants change the flow behaviour of fluids (oil, water) in the porous media to improve the oil recovery.

Investigations into Shear Induced Coalescence in Liquid-Liquid Dispersions

Meenakshi Mazumdar (Advisor: Prof. S. Roy)

8 August 2013, Thursday, 0445-0510 pm (15+10 mins), ChE Seminar hall

Emulsions are common in enhanced oil recovery, solvent extraction, polymer manufacturing, the manufacture of paints and personal care products, and numerous other situations of engineering interest. A frequently encountered class of emulsions, particularly in the upstream petroleum industry, is oil-water (O/W) emulsions. While all emulsions are thermodynamically unstable, many of them have significant life-times owing to the stabilizing forces that govern their formation and preservation. This may be useful in many applications (where stable emulsions are required, by design), and in others this may pose severe problems (where the objective is to break or destabilize the emulsion into the constituent phases).

In the upstream oil industry, a key operation that is done to extract crude oils, particularly heavy crudes, is to extract the oil by flooding the oil well with high pressure steam and water. This process, known as Enhanced Oil Recovery (EOR), results in formation of very stable emulsions of crude oil with the water, in many cases stabilizes by natural surfactants like asphaltenes that are present in the crude. Post extraction, however, this poses an enormous challenge to break this emulsion before the oil can be sent for refining. Owing to the huge volumes involved, adding chemicals such as de-emulsifiers is not a viable option. Typically, the industry standard is to destabilize these emulsions using low shear, by passing the two-phase mixture through a so-called “coalescer”.

ChE Graduate Seminar Series

Departmental Seminars Presented by Ph.D. Students

It is known that under low to moderate shear rates, emulsions can be destabilized by action of the shear. What is not known very well today is the mechanism of how this happens, and how this translates to the engineering of large-scale coalescers (i.e., process equipment specially designed to induce the breakdown of oil-water emulsions). This research is an attempt to understand the process of droplet coalescence fundamentally at the scale of two droplets, and to establish the link to the larger scale of simple shear flow generated in laboratory scale equipment. This presentation would cover the experimental part of this two-fold approach. The details of the experiments would be followed by some typical results.

Experiments were carried out to study the phenomena of coalescence in a buoyant, surfactant-stabilized emulsion. The emulsion was subjected to simple shear in a cylindrical Couette apparatus. These experiments are so-designed such that the coalescence in the apparatus is solely due to shear. The evolution of the drop size distribution was measured by optical microscopy followed by image processing. It is seen that the unimodal initial distribution results to a bimodal distribution at lower shear rates, indicating the evolution of larger droplet sizes. The presentation will make a case for “extraction of kinetics of coalescence” from this data.

0510 pm High Tea

CC
All ChE Faculty
Department N. B.
PhD Students (near biometric device)
Mr. Krishna (for audio/video help)
ChE office: refreshment arrangements
Ms. Tajinder: for information/coordination