הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע"ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Special Seminar
Lecture Hall 6, Wolfson Department of Chemical Engineering,
Monday June 10th 2019 at 1:30pm

Dr. Xuezhong He

Department of Chemical Engineering, Faculty of Natural Sciences
Norwegian University of Science and Technology (NTNU), Norway

Membranes for CO_2 Separation: from Fundamental Researches to Industrial Applications

Although the main part of the world has now accepted the fact that the global climate change is due to human activities, we will not be able to switch gear and only go for "green energy" without fossil fuels for still many decades. One way of contributions to combat the climate change is hence to capture the CO_2 from fossil fuel flue gases, and either find ways to utilize the CO_2 or sequestrate it in aquifers or depleted oil fields, while we slowly develop a "green way of living" by using renewable and less carbon-intensive energies. Membranes will for sure represent one of the emerging technologies to be used for CO_2 capture/separation. This presentation will then report both polymeric membranes for post-combustion carbon capture, and carbon membranes for biogas upgrading.

The fixed-site-carrier (FSC) polyvinylamine (PVAm) membrane is based on facilitated transport of the CO_2 through the membrane, which means that water needs to be handled in the separation process – this has again a large influence on the engineering design of the process and process operation parameters. Going from lab tests using a few cm^2 up to several m^2 of a commercial scale module is extremely challenging. Two pilot tests have been performed with several 4.2 m^2 modules in parallel and/or an individual module for CO_2 capture from real flue gas, but not yet as a complete two-stage process. The presentation will highlight and report some testing results and challenges from these two pilot projects.

The second part is about carbon membranes for biogas upgrading. The main challenge of a membrane system for biogas upgrading is to get high CH_4 purity with low methane loss and low energy consumption. Using a multi-stage membrane system can produce methane of high purity, however, the methane loss will then be higher. A high methane loss has negative impact on economy and environment. Thus, the innovative cellulosic-derived hollow fiber carbon molecular sieve membranes were developed and tested for CO_2/CH_4 separation at a moderate pressure (10-20bar). The reported carbon membranes were evaluated for biogas upgrading with a two-stage system by HYSYS simulation, and a lower biogas upgrading cost was found compared to the state-of-the-art amine absorption technology.

Refreshments will be served at 1:15pm