New Advanced Membrane Technology for Post Combustion CO$_2$ Capture

The development of cost-effective CO$_2$ capture technologies for stationary power plants will reduce the adverse impact of CO$_2$ emissions on global climate. Chemical solvent scrubbing methods have been extensively studied and are considered viable for post-combustion CO$_2$ capture. However, the energy consumption for chemical solvent scrubbing is still much higher than D.O.E’s requirement for large-scale commercialized CO$_2$ capture. Tremendous efforts are being devoted to reduce energy consumption in this process.

Our research team is developing a solvent-based membrane for post-combustion CO$_2$ capture. The membranes can enrich the carbon content and act as a partial solvent regenerator. This membrane device is installed prior to a stripper (solvent regenerator) in the conventional chemical solvent scrubbing process. After the membrane separation, the carbon-lean solvent combines with the lean solvent from the stripper and is recycled to the scrubber for CO$_2$ re-capture, and the carbon-rich permeate solution is pumped to the stripper for regeneration. Compared to conventional CO$_2$ scrubbing, the developing membrane-based hybrid process provides a compact stripper and balance of plant (heat exchanger, pumps etc.) with significant energy savings and is expected to be a breakthrough for the future CO$_2$ capture sector.
Membrane Performances

Promising performance of the synthesized membrane in terms of flux and rejection rate has been shown on a small scale and confirmed the feasibility of the proposed technology for post combustion CO\textsubscript{2} capture.

Graph of Flux versus rejection rate of various membranes to test repeatability.