CO_2 capture by polymeric membranes over H_2: mechanism and opportunity

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CO_2 Capture & Storage (CCS) is one of the effective approaches to mitigate CO_2 emission from mass CO_2 emission sources such as thermal power stations, and *ca*. 20 CCS large-scale demonstrations have been carried out all over the world. Although "*energy intensive*" liquid amine scrubbing has been employed to capture CO_2 in the demonstrations, more effective capture technologies are required for implementation of CCS. Membrane separation holds potential as a promising alternative technology due to much lower energy separation processes and feasible operations. I^2CNER focuses on CO_2 capture by membranes, and the speaker is going to introduce recent results related to CO_2 separation over H_2 by amine-containing polymeric membranes.

As shown in Fig. 1, the integrated gasification combined cycle (IGCC) has gained attention as a next generation coal-fired plant, and CO_2 capture from the syngas after water-gas shift reaction (pre-combustion CO_2 capture) is one of the I^2CNER's target. Various amine-containing polymeric membranes developed showed excellent CO_2 separation properties over H_2 at ambient conditions, especially under humidity. However, the target gas is highly pressurized ($\Delta p(CO_2)$: 1.0 MPa). Thus, the gas transport properties were examined at Prof. Freeman's research group in UT Austin. The membranes exhibited very high CO_2 permeance > 100 GPU under pressure, and the mechanism of preferential CO_2 permeation was also confirmed.

Beside of pre-combustion CO_2 capture, the polymeric membranes can make H_2 production processes from biogas carbon-free. This would result in negative CO_2 emission as bio-energy with CCS/CCU and would be a key beyond 2030. The other opportunity of the I2CNER's membranes will be discussed.

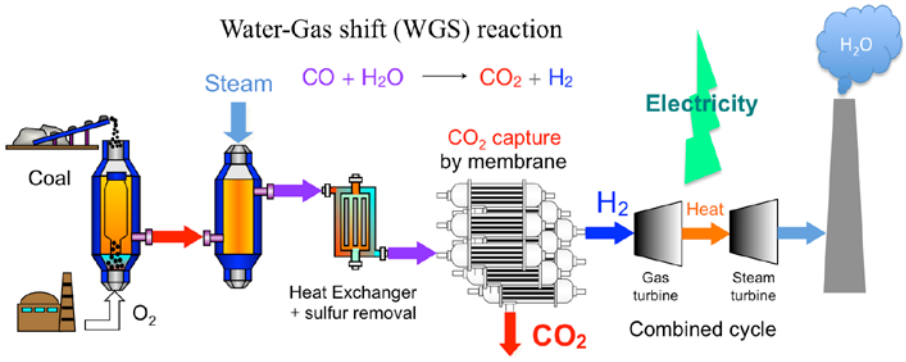

Fig. 1. Schematic drawing of CO_2 capture at an integrated gasification combined cycle (IGCC) plant