Hydrophobic tubular zeolite membranes for CO_2-separation at industrially relevant conditions

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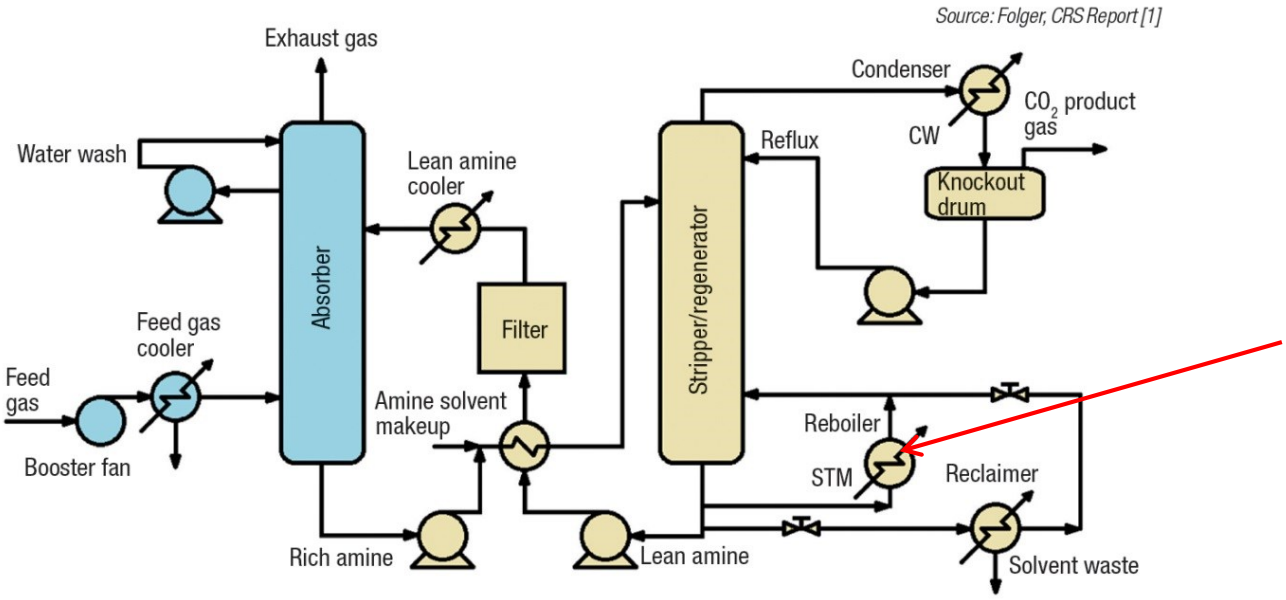
CO_2 separation from industrial gas streams

Some examples:

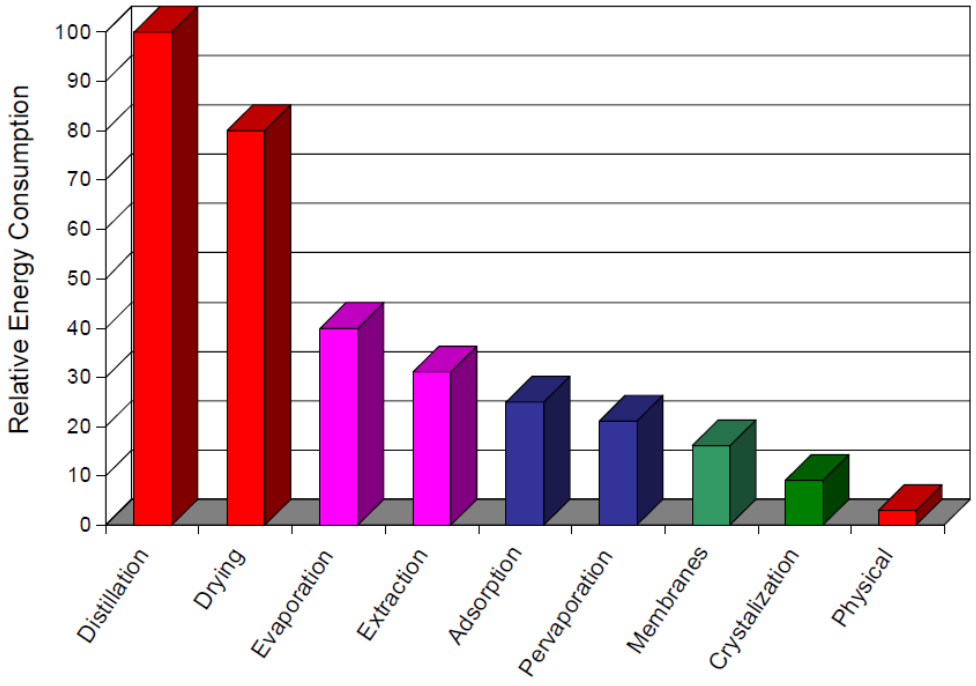
- Synthesis gas for production of ammonia, hydrogen, methanol, FT-fluids etc. (focus in this project)
- Biogas / natural gas
- Blast furnace gas

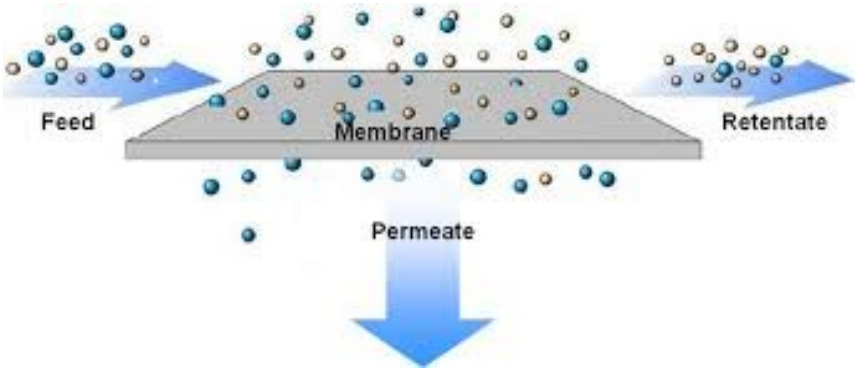
CO_2 separation often performed using absorption in liquids e.g. amines.



Much steam used here

Figure A: Relative Energy Use by Various Separation Technologies



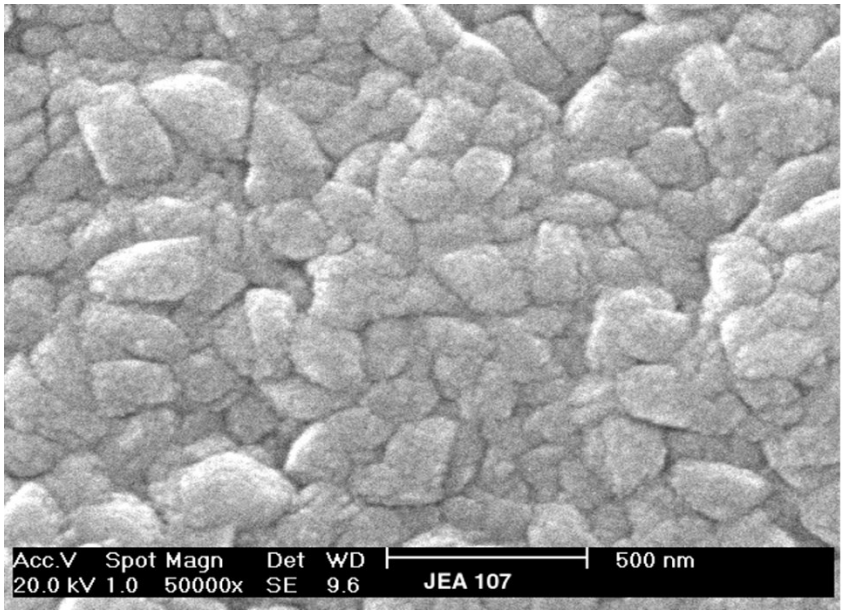


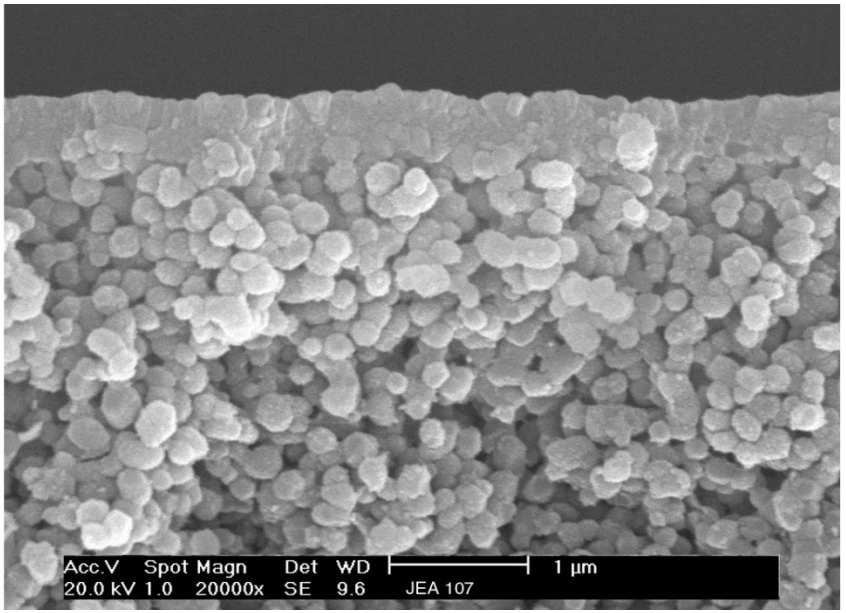
Polymeric membranes are used for CO_2 separation from industrial gas streams today, In particular for CO_2/CH_4 separation (holds ca 5% of market).

Main challanges for polymeric membranes are:

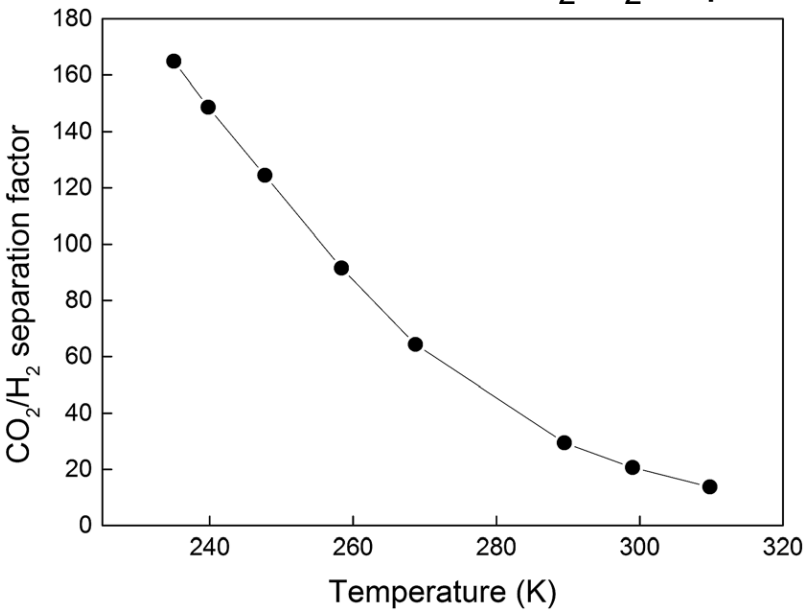
- Low flux and moderate selectivity (10-25).
- Often degrade at high partial pressures of CO_2
- Low thermal stability

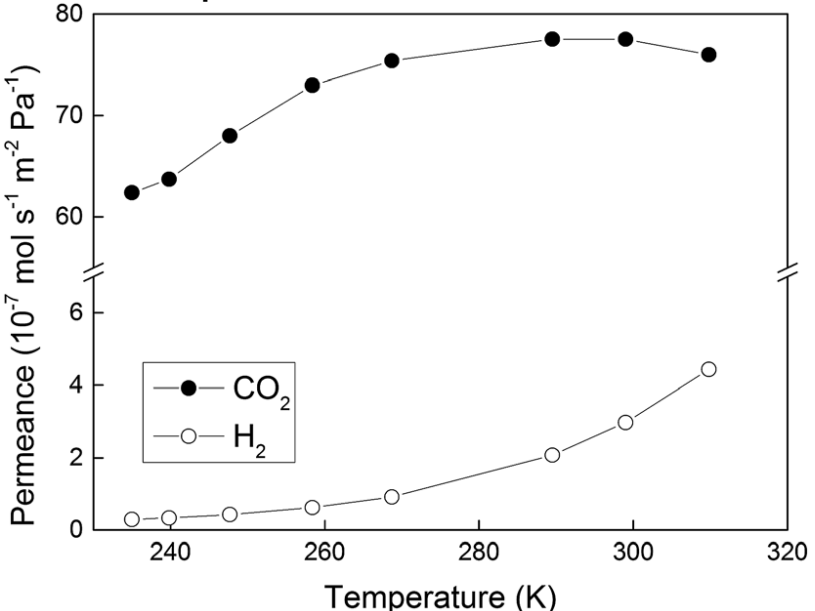
SEM images of surface and cross section of MFI membrane



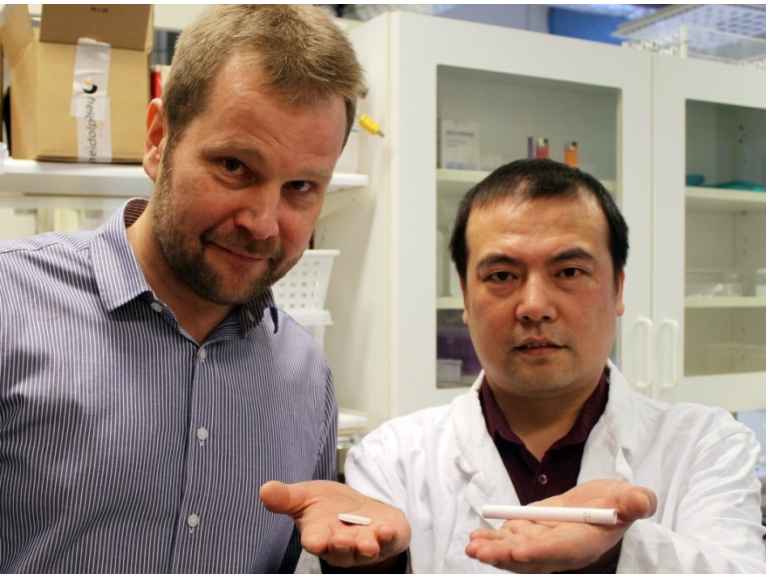


CO_2/H_2 separation at low temperature

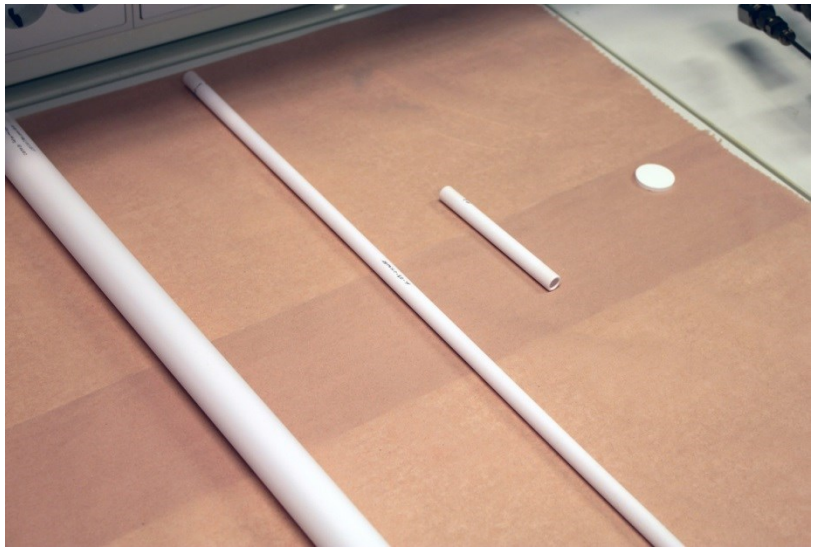




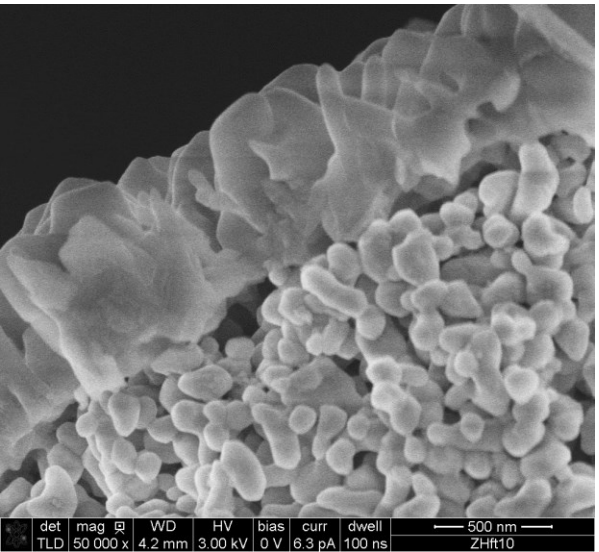
Scale up activities



Discs and 10 cm long alumina tubes with an area of 15 cm^2, 5 times larger than discs.



We are also preparing 50 cm long single channel and 19 channel alumina tubes with areas of 100 and 1000 cm^2, respectively. The later suitable for commercial applications.



SEM image of zeolite film on 10 cm tubular support.

Main purpose

The main purpose of the project is to demonstrate that hydrophobic, tubular zeolite membranes perform very well for separation of CO_2 from syngas under industrially relevant conditions, i.e. humid gas and high CO_2 pressures.

- Small tubular hydrophobic MFI and CHA membranes with high quality will be prepared and experimentally evaluated at LTU.
- Membranes will be scaled up by ZeoMem AB.
- LTU will model the process and estimate the achievable energy and cost reduction for CO_2 separation.
- Perstorp AB will evaluate the membranes for CO_2 separation from industrial synthesis gas at the Stenungsund site.