Karlsruher Institut für Technologie

Institut für Technische Chemie
Abteilung Technische Mineralogie
Prof. Dr.-Ing Dieter Stapf

CO_2/N_2 Separation for Utilization by Organo-Silica Hydrotalcite Mixed Matrix Membrane – *Potential for high temperature gas separation*

Lucas Bünger, Tim Kurtz, Krassimir Garbev, Peter Stemmermann, Dieter Stapf

Motivation

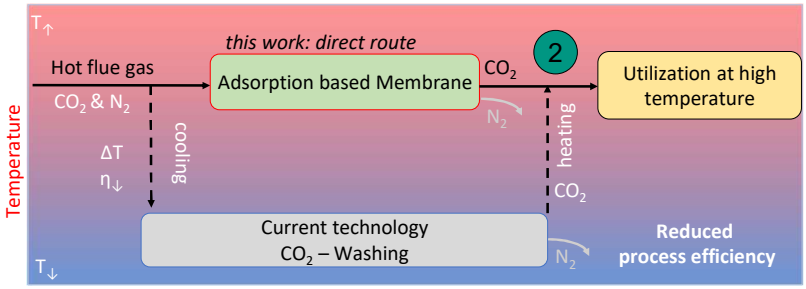
- Anthropogenic carbon cycle
- Material Use of CO_2 (CCU)
- Separation of CO_2 from flue gas

Requirements for Utilization of CO_2-Stream

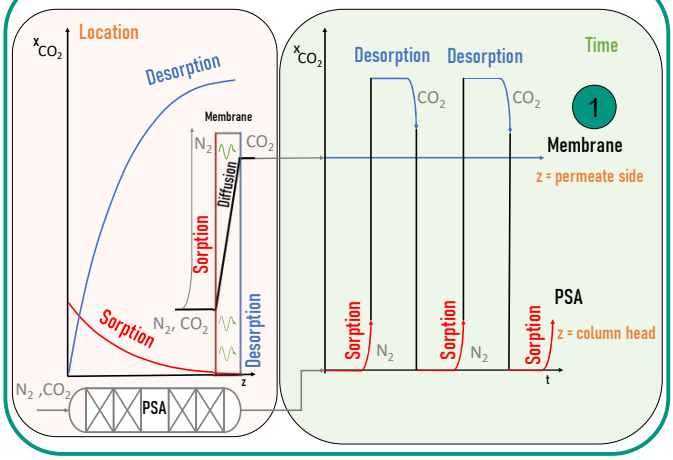
- High Throughput
- High Concentration
- Continious
- High Temperature

1

2

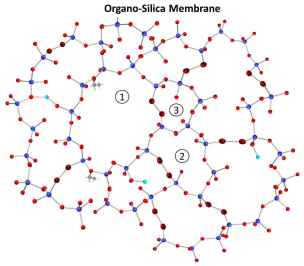


Membrane = PSA?

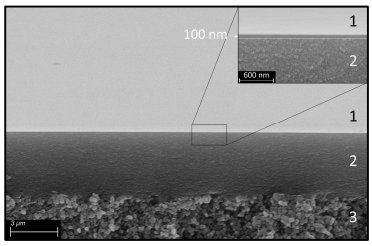


Pure Organo-Silica Layer

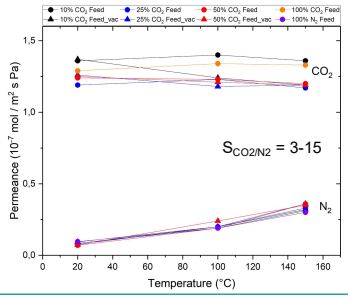
Organo-Silica



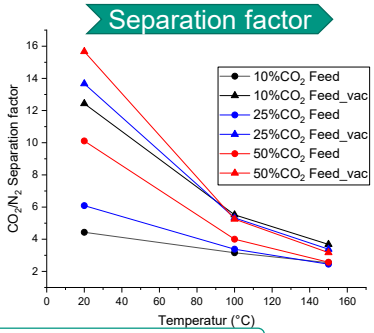
SEM Org-Sil Membrane



Permeance



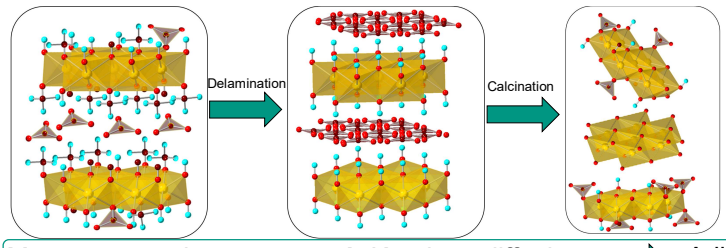
Separation factor



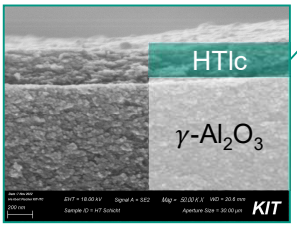
Good separation behavior reduced at high temperature → Hydrotalcit as high-temperature CO_2-sorbens

Pure Hydrotalcit like Compound (HTlc) layer

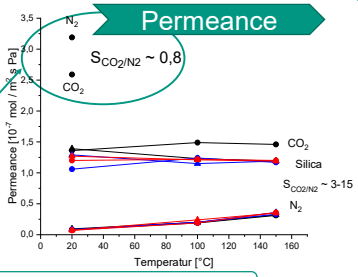
Layered HTlc / Delaminated HTlc / HTlc Nanosheet



HTlc Membran



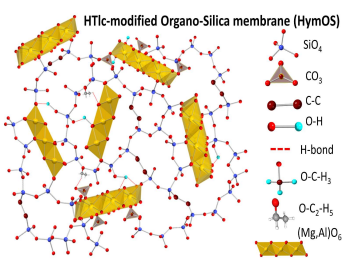
Permeance



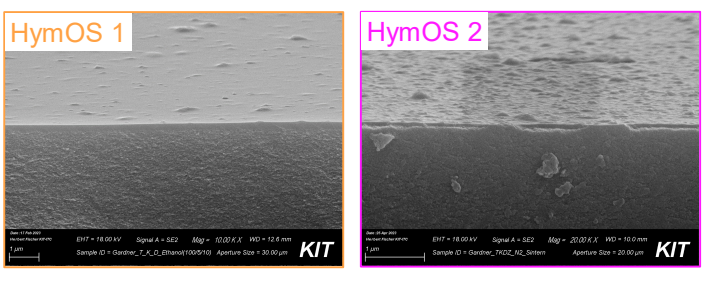
Mesoporous microstructure → Knudsen diffusion → Adjusting microstructure by mixing both approaches

HTlc modified Organo-Silica HymOS

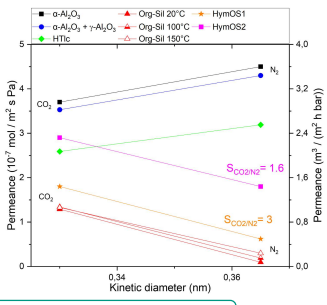
MMM Microstructure



SEM Mixed Matrix Membrane (MMM)



Permeance



MMM high permeance & low selectivity → Transformation into microporous structure incomplete