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A multi-stage fluidized bed system for Continuous CO₂ capture by means of temperature swing adsorption – First results from bench scale experiments

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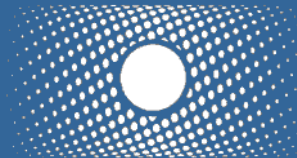
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A multi-stage fluidized bed system for continuous CO₂ capture by means of temperature swing adsorption

First results from bench scale experiments

G. Schöny, F. Dietrich, J. Fuchs, T. Pröll, H. Hofbauer

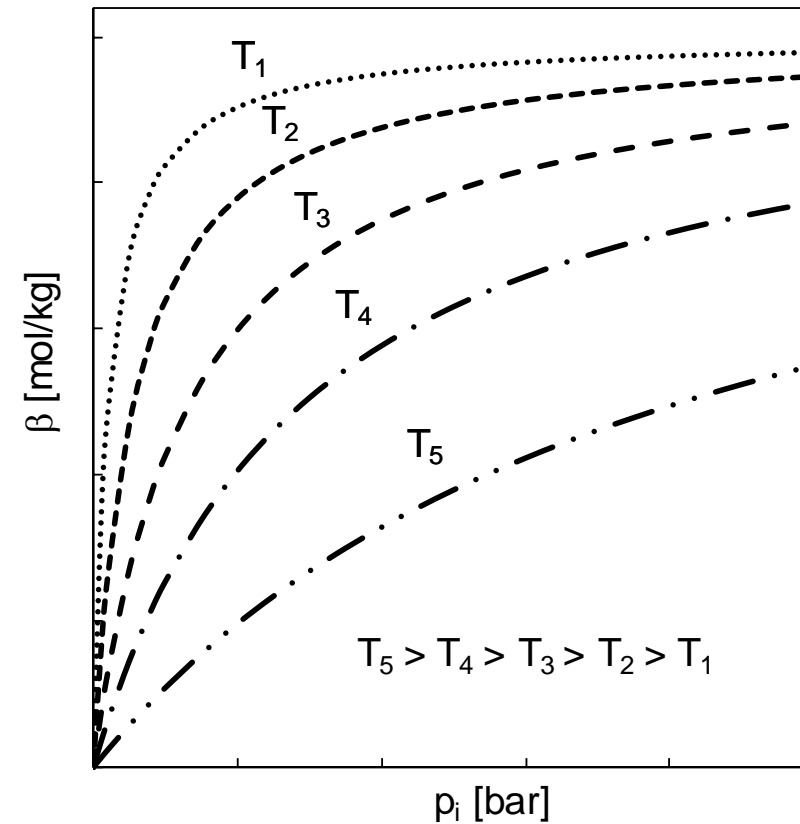
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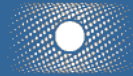




Temperature Swing Adsorption (TSA)

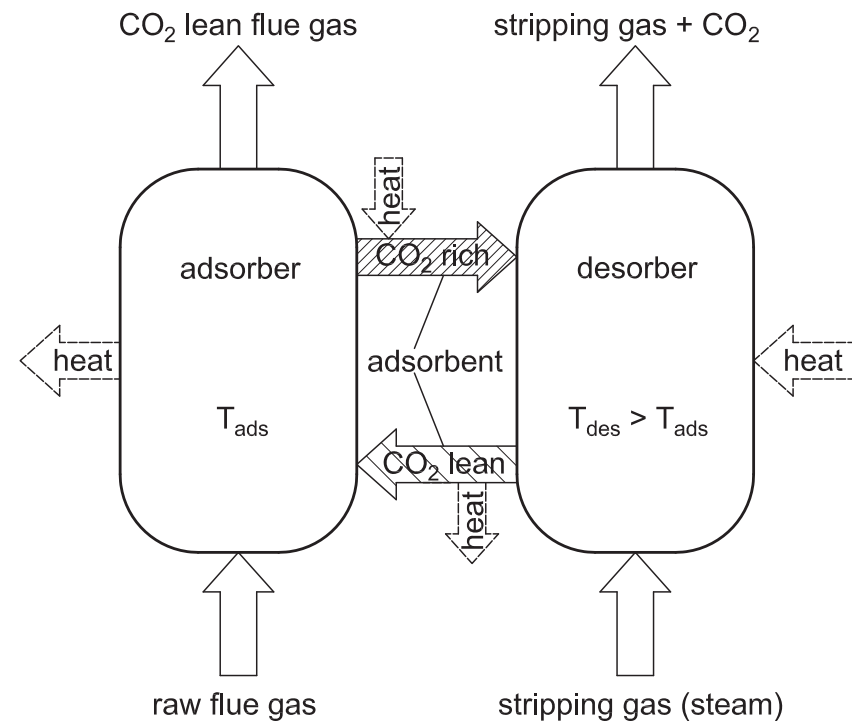
- Sorbent material:
 - selective towards CO₂
 - CO₂ capacity strongly temperature dependent

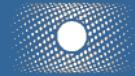




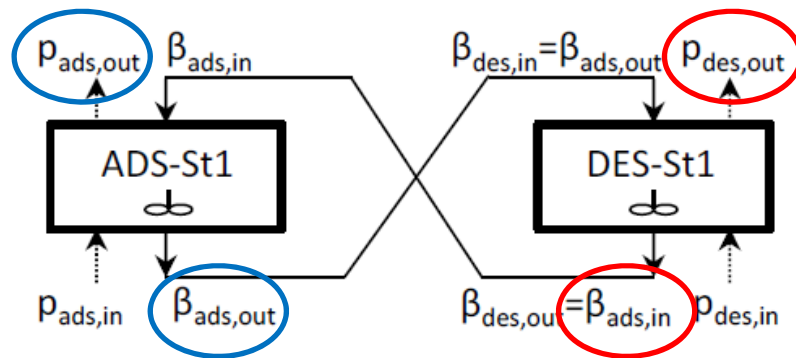
Temperature Swing Adsorption (TSA)

- Sorbent material:
 - selective towards CO₂
 - CO₂ capacity strongly temperature dependent
- Continuous process:
 - cooled adsorber
 - heated desorber
- Fluidized bed reactor system:
 - heat transfer
 - mass transfer
 - scalable

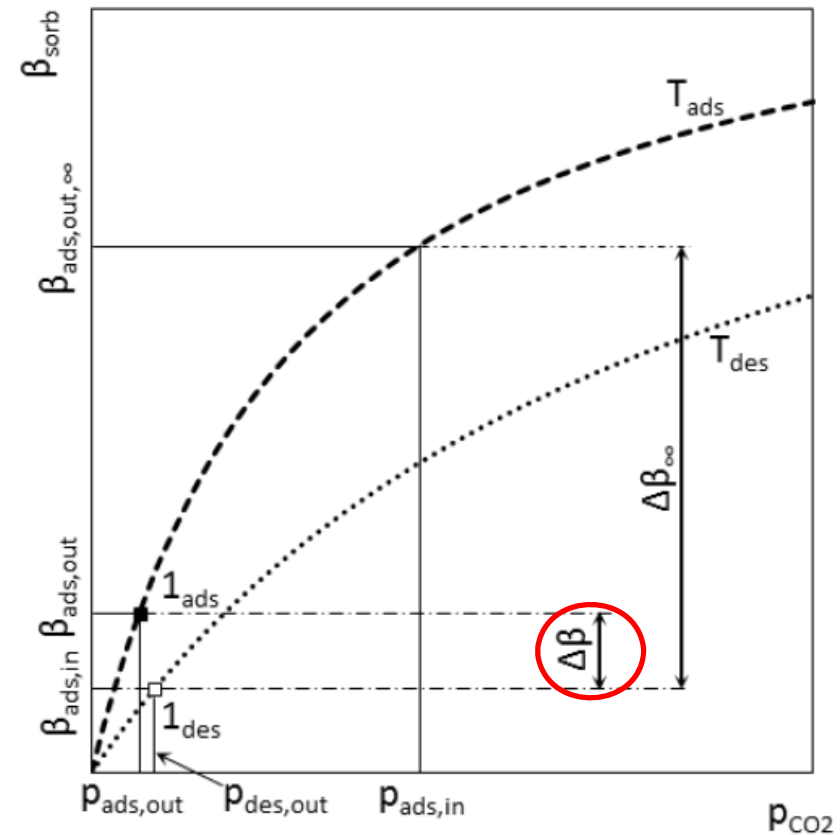




TSA in fluidized beds

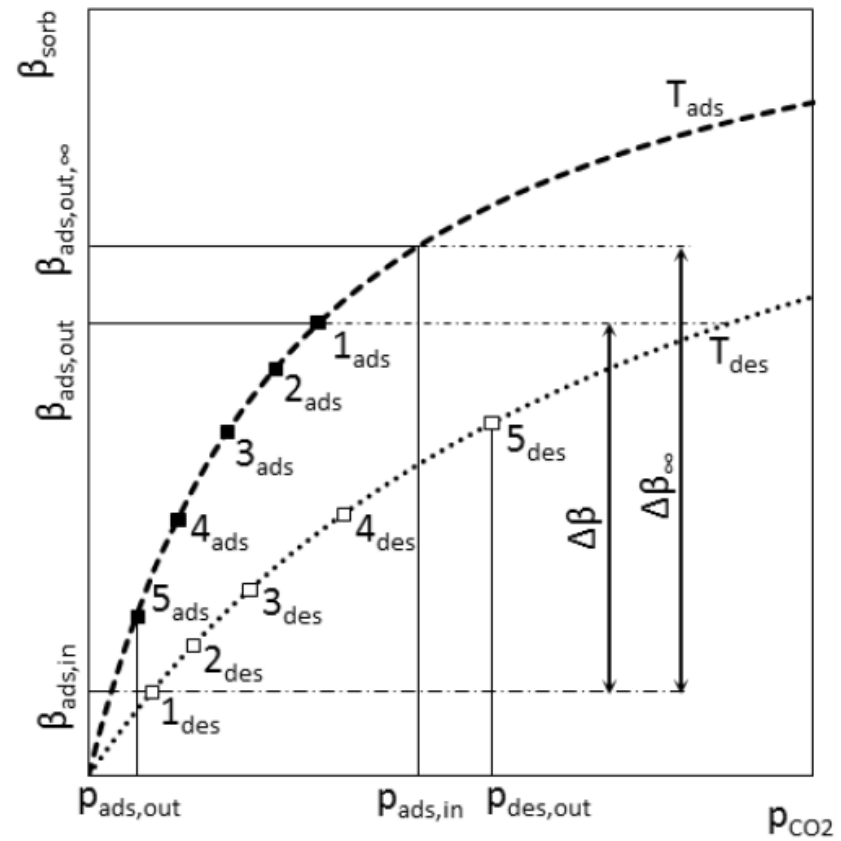
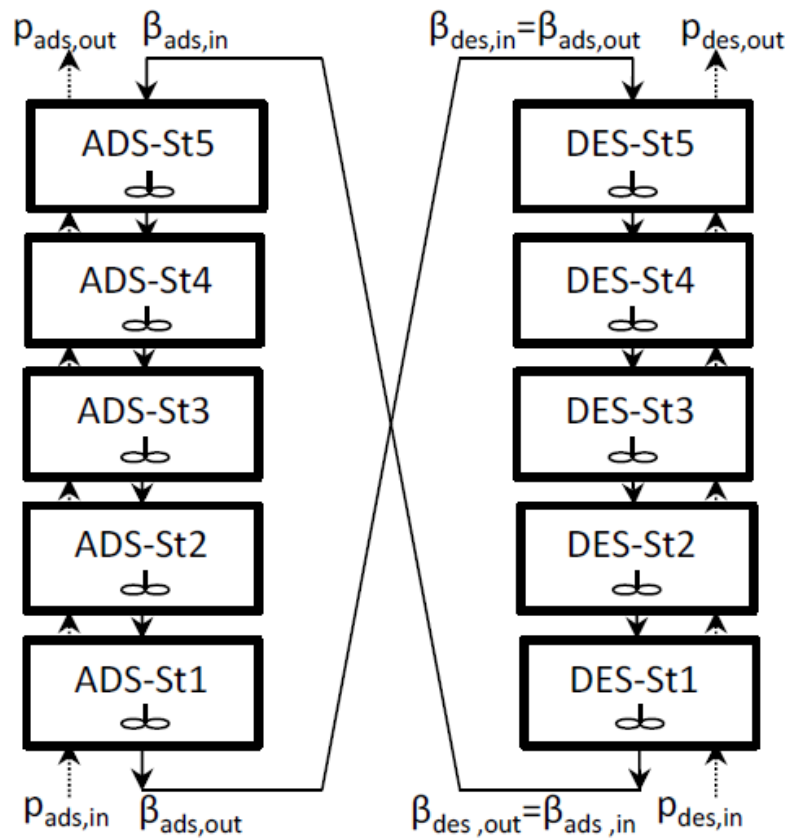


Virtually ideally mixed solids



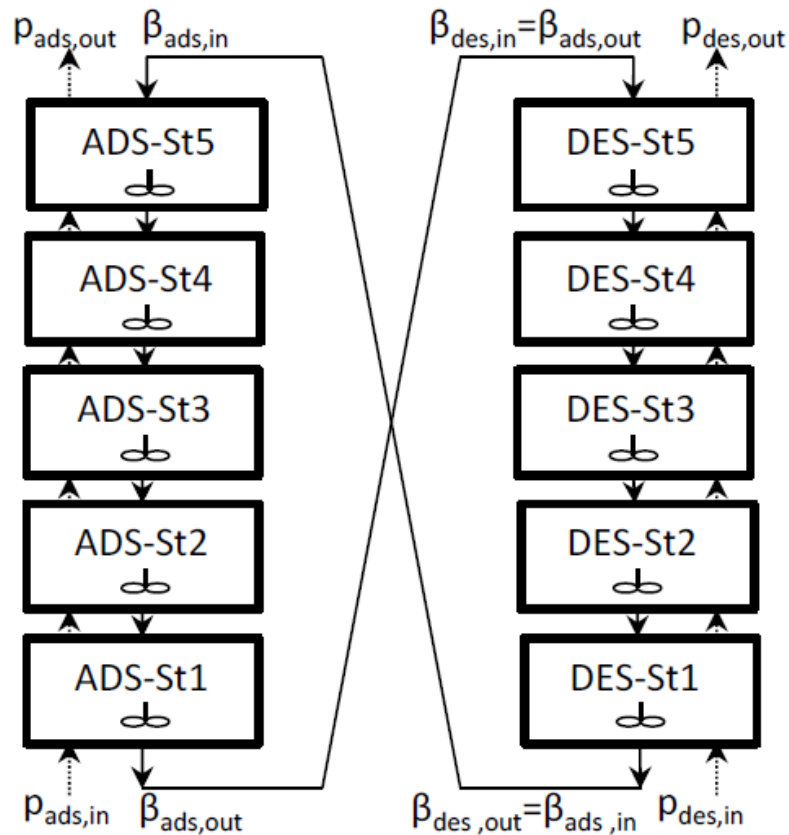


TSA in multi-stage FB





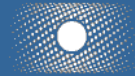
TSA in a multi-stage FB



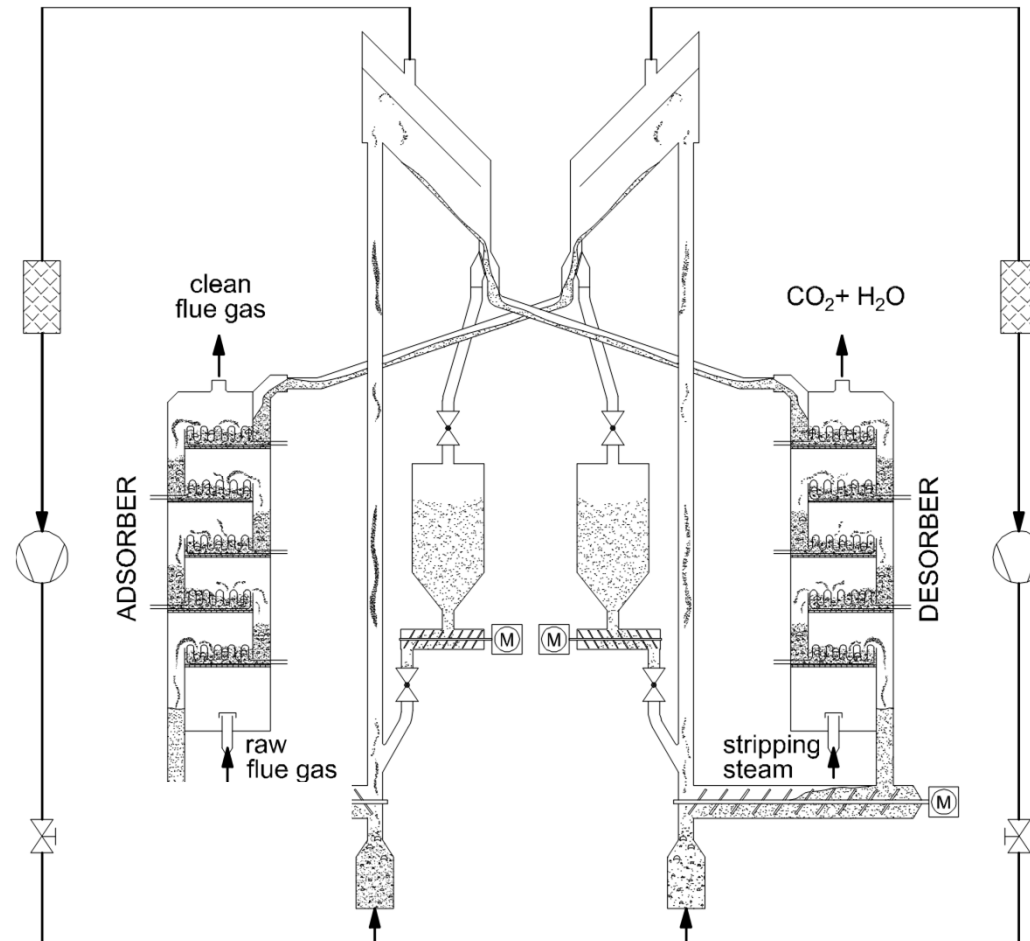
Increased sorbent working capacity

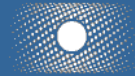
Reduced sorbent circulation rate

Reduced process energy demand

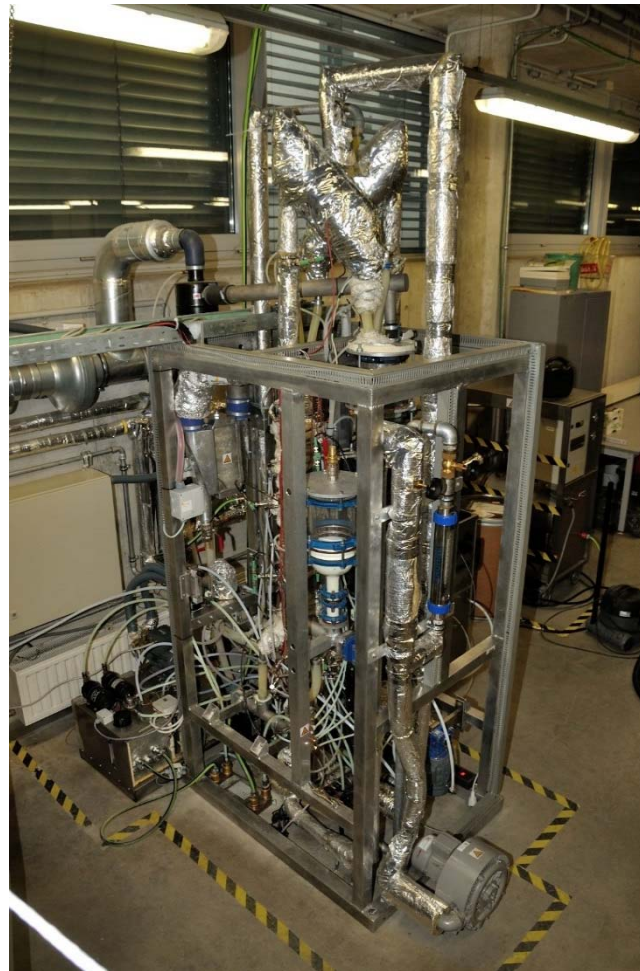


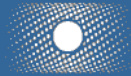
TSA bench scale unit



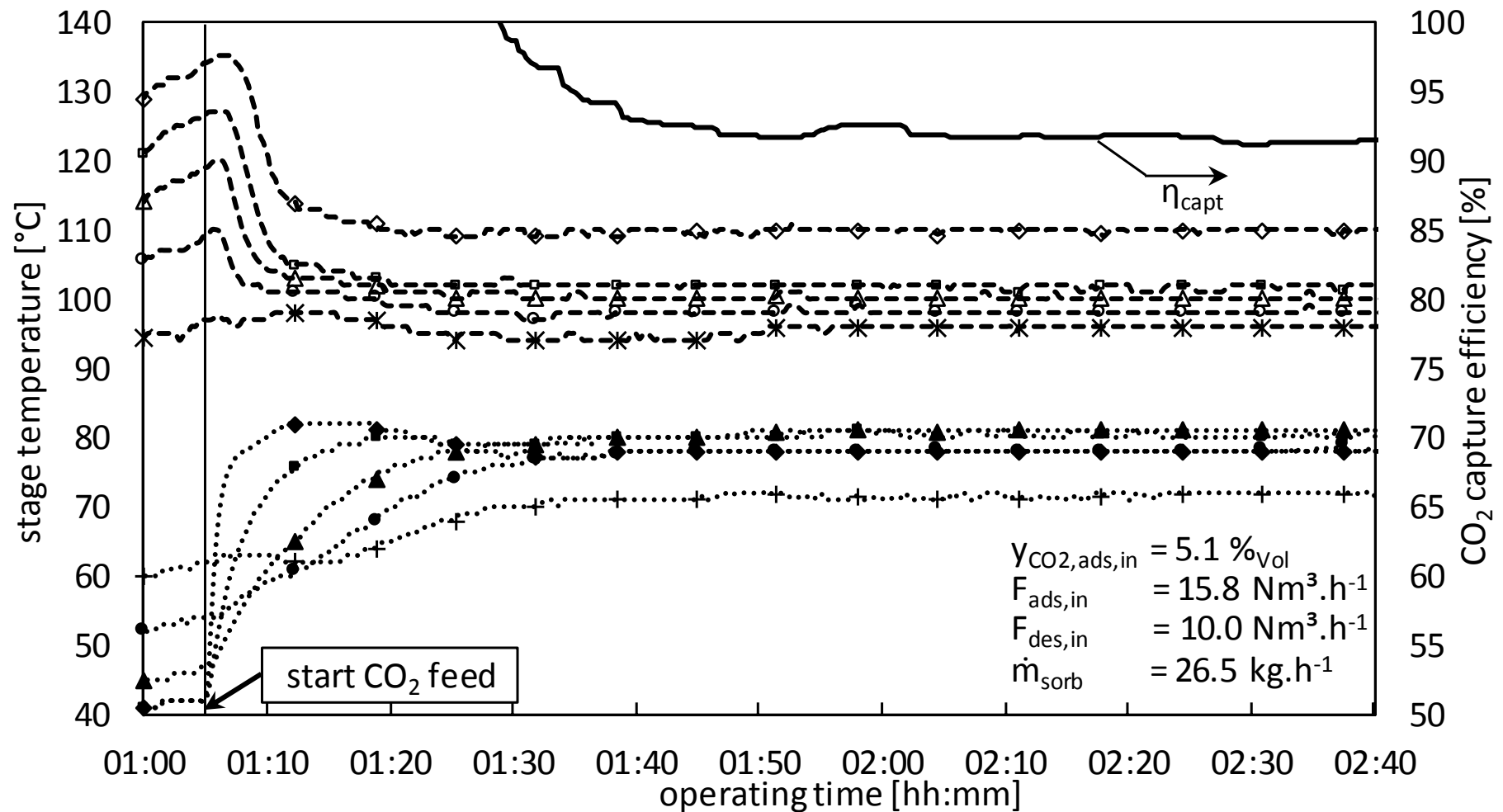


TSA bench scale unit





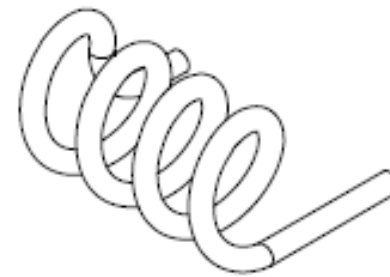
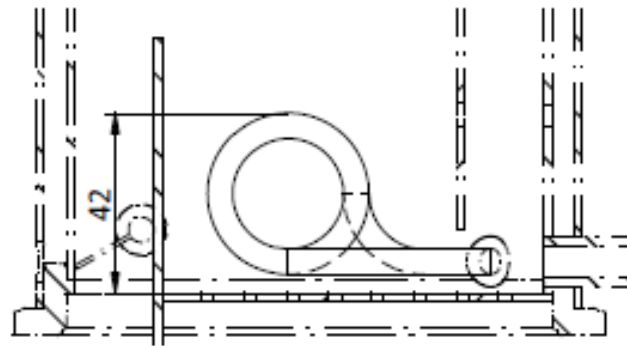
First Experiment



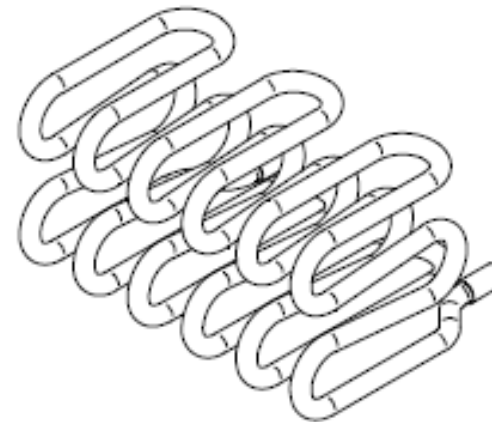
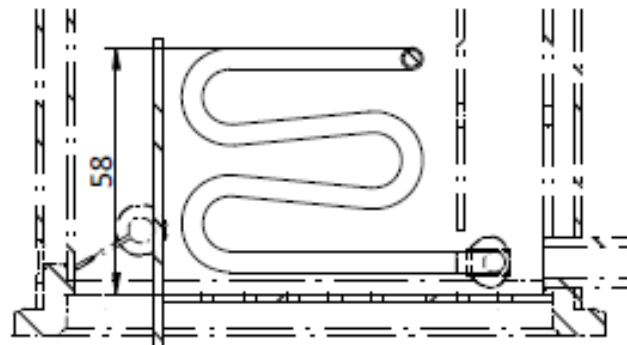


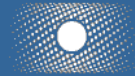
New Heat-Exchanger design

HEX Desorber: old design
A=8870mm²

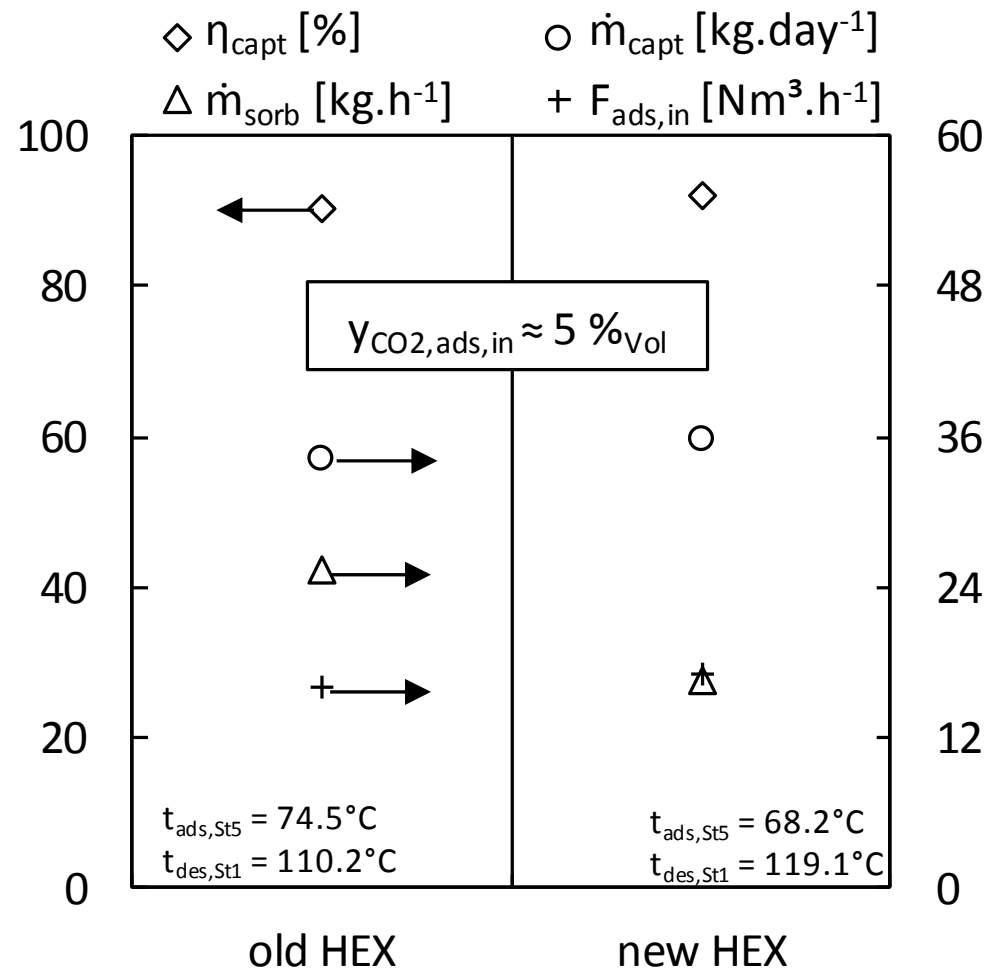


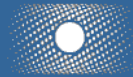
HEX Desorber: new design
A=25260mm²





Benchmark Test





Conclusions

- Successful proof of concept
- Capture efficiency increases with increasing solids circulation rate
- Performance limitation attributed to insufficient heat exchange
- Fast adsorption kinetics and sufficient mass transfer



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Thank you!

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Future Energy Technology
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