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Cold flow modelling of char concentration in the recirculated bed material stream of a dual fluidized bed steam gasification system

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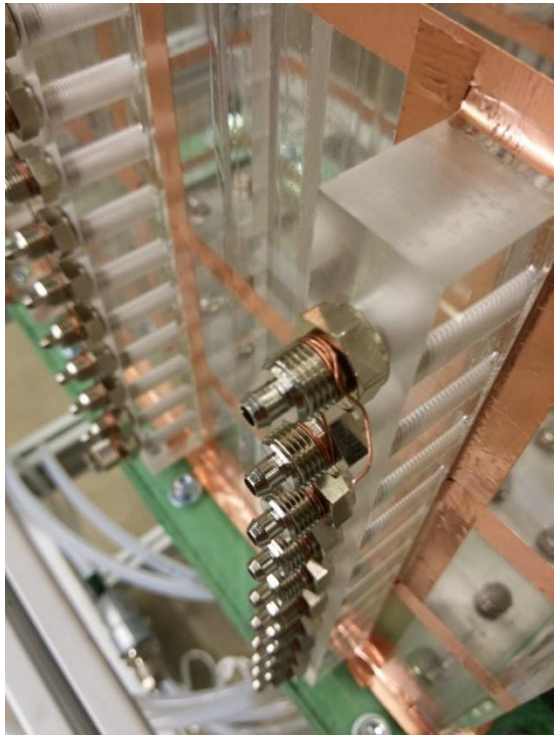

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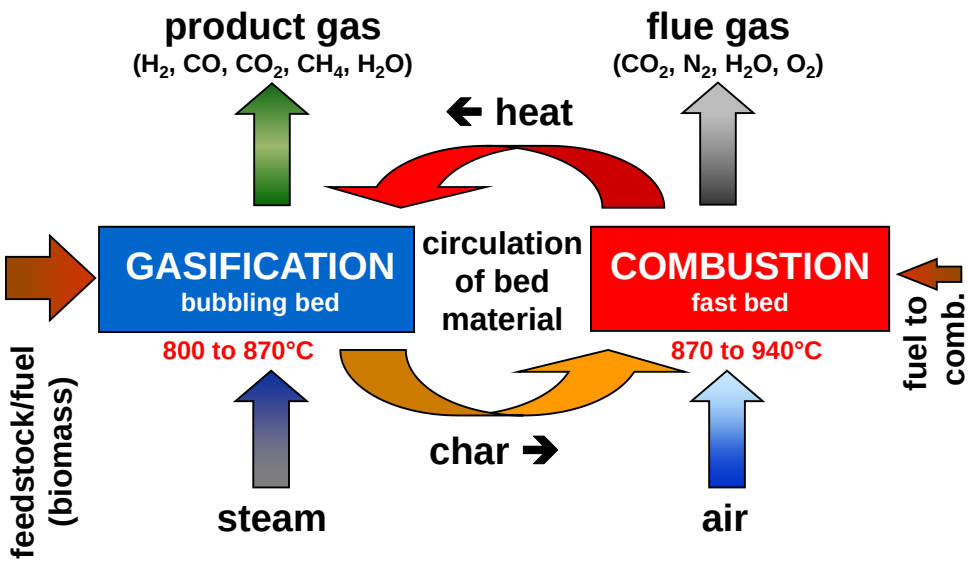
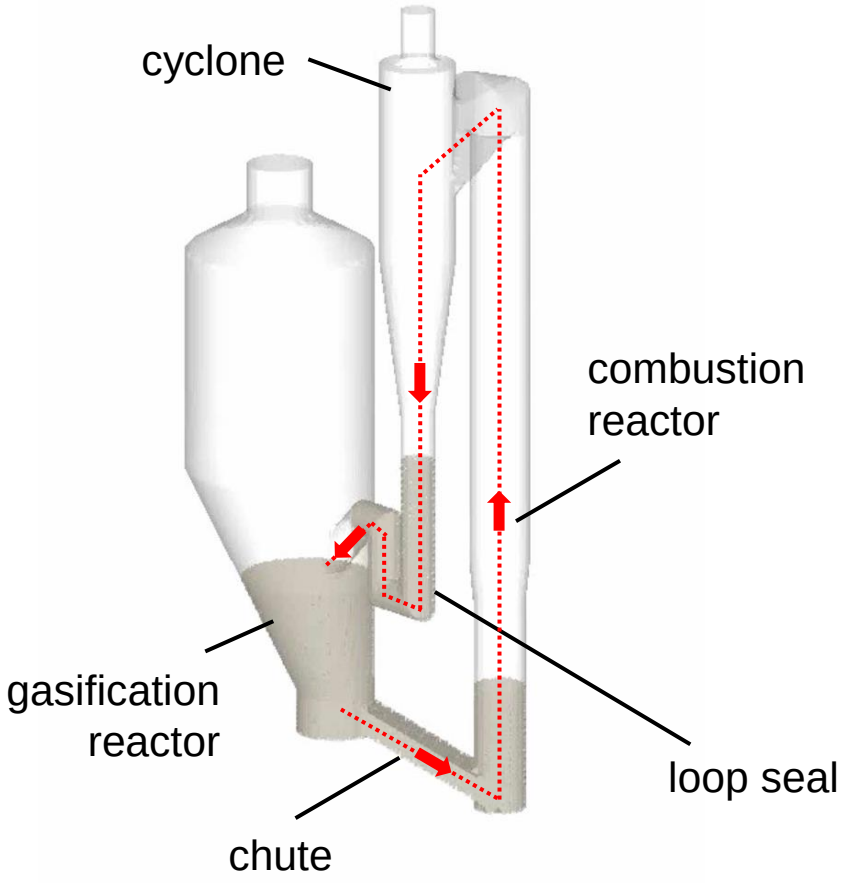
Dual Fluidized Bed (DFB) steam gasification





simulations carried out
with Barracuda VR®

Motivation

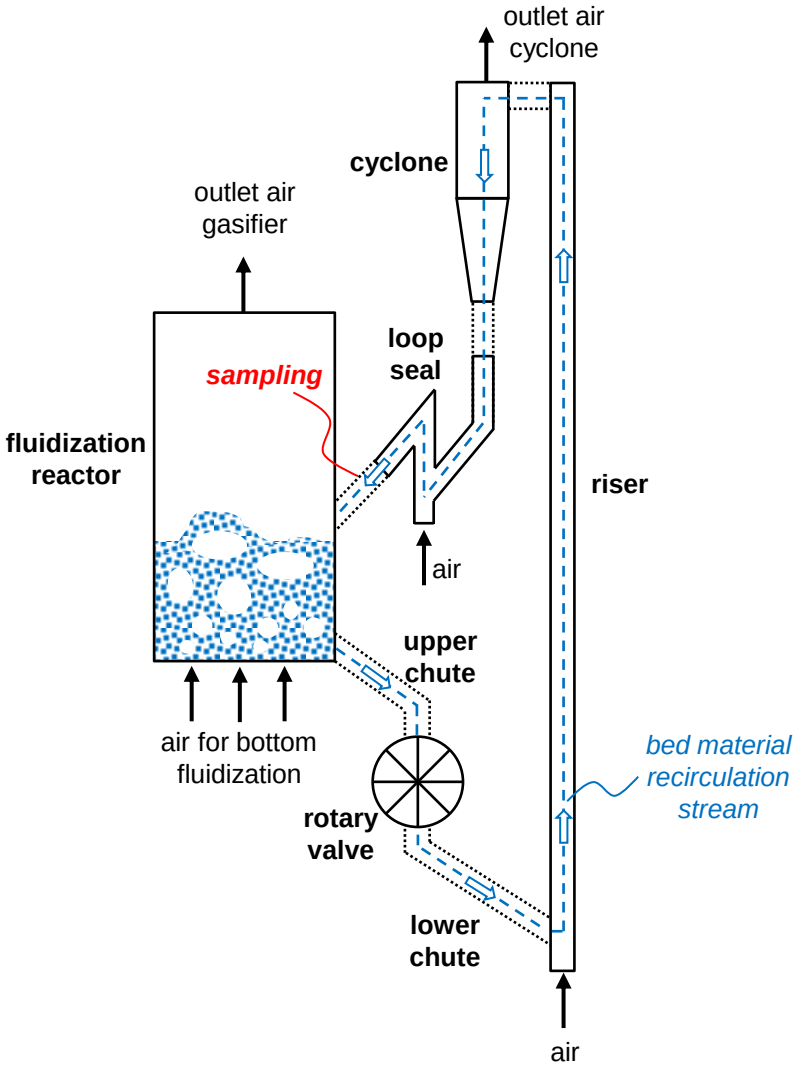
- many particle species: fresh & partly converted biomass, wood char, ash, bed material
- investigation of char concentration in bed material recirculation stream
- influence of operating parameters
  - fluidization rate
  - recirculation rate
  - char concentration
  - bed height

Cold flow model. Design

- **requirements**
  - same fluidization conditions as in DFB plant
  - control the bed material recirculation stream
  - sampling during operation
    → determine char concentration

- **particle species**
  - bed material: bronze, d_p = 118 µm
  - char: polyethylene (PE), d_p = 3 mm

Cold flow model. Operating principle



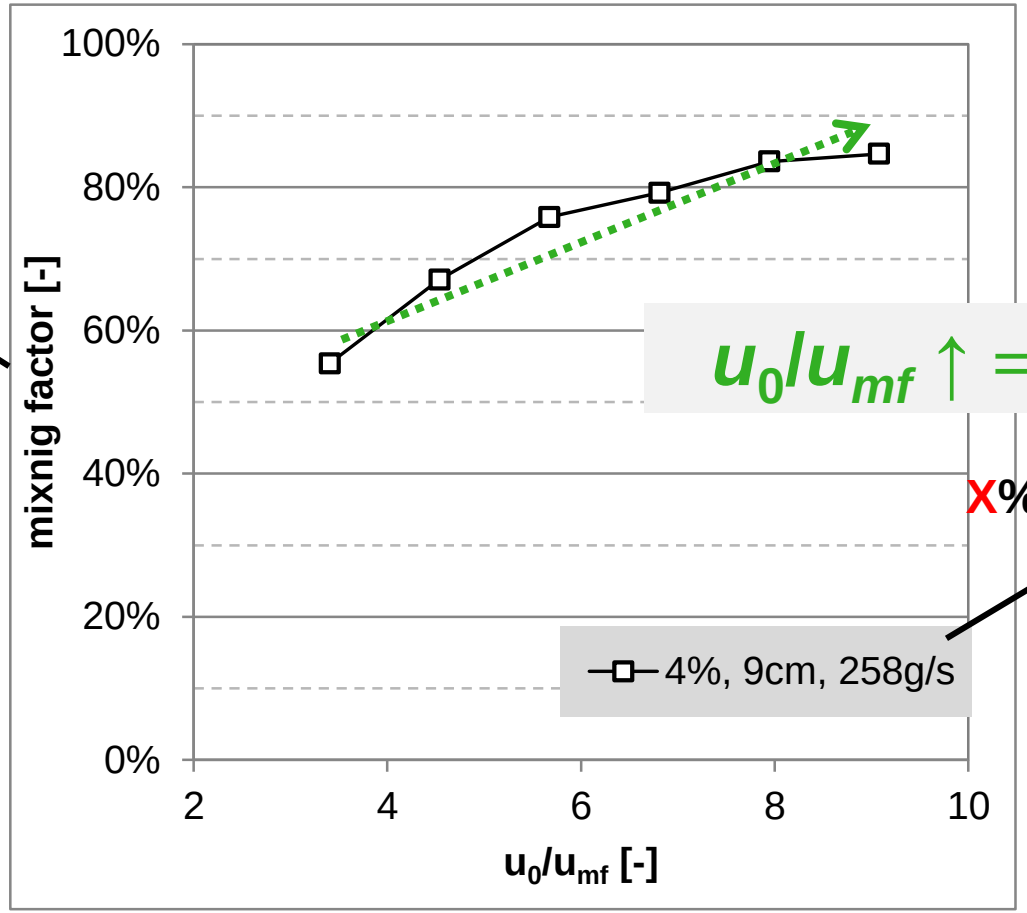
Char concentration

Quarzsand

Acrylic glass

Influence of fluidization rate

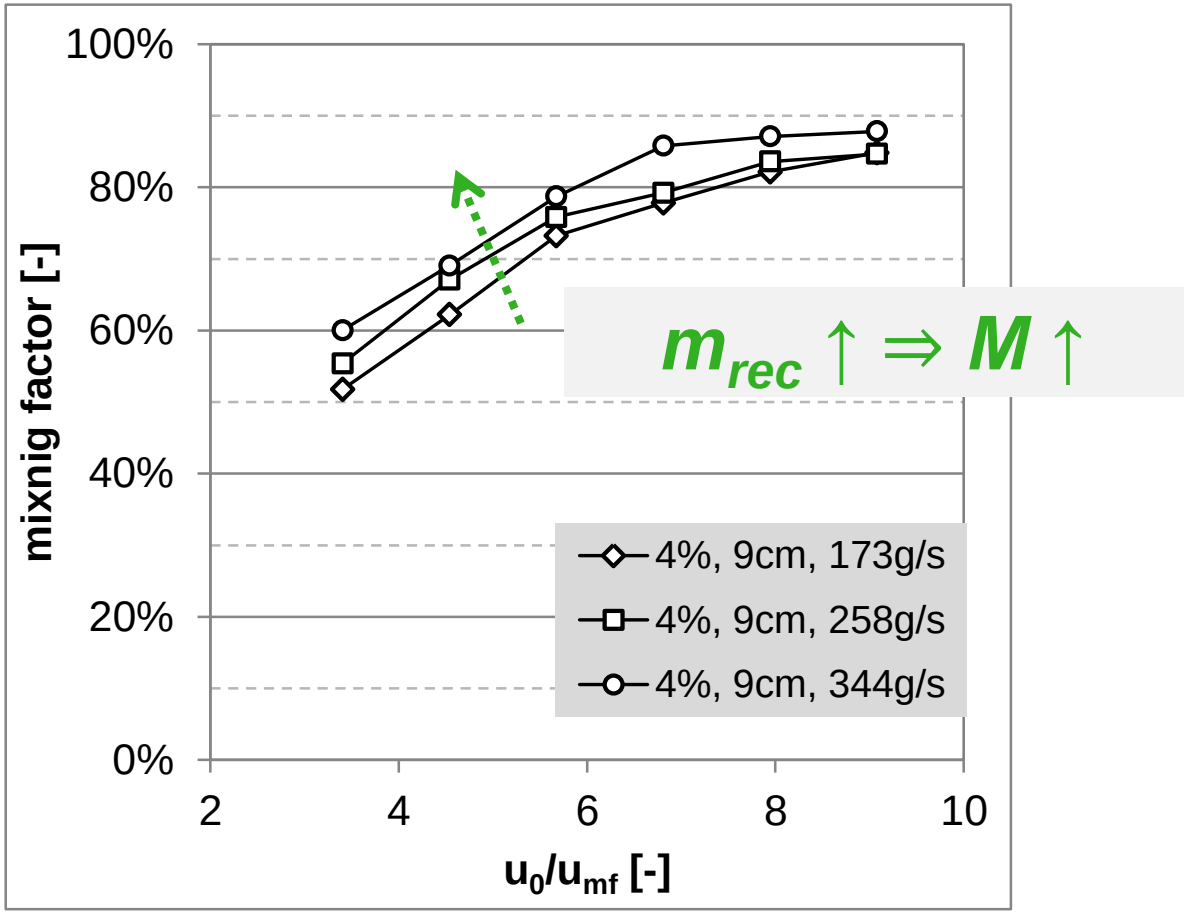
$$M = \frac{c_{char,sample}}{c_{char,system}}$$



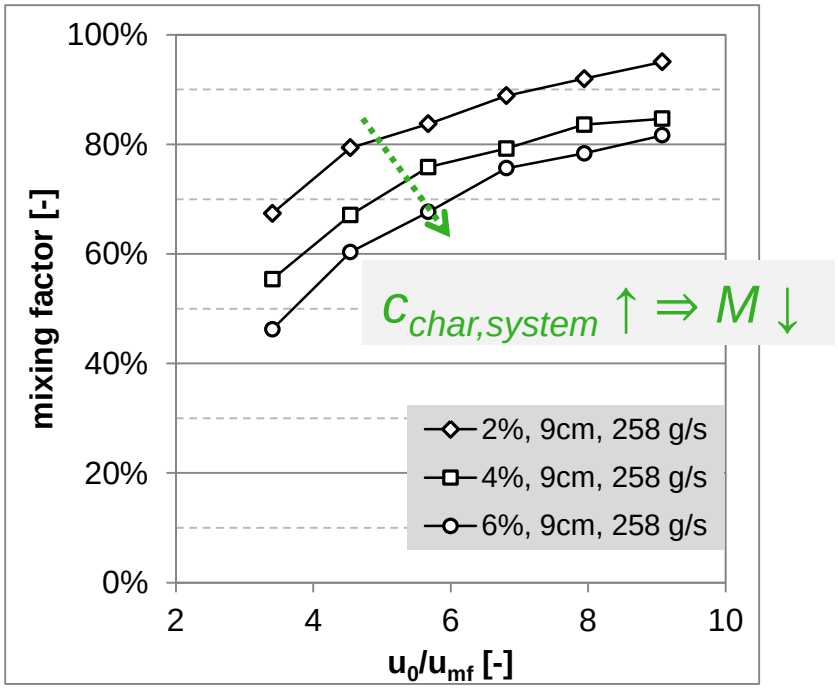
$u_0/u_{mf} \uparrow \Rightarrow M \uparrow$

X% Ycm ZZZg/s

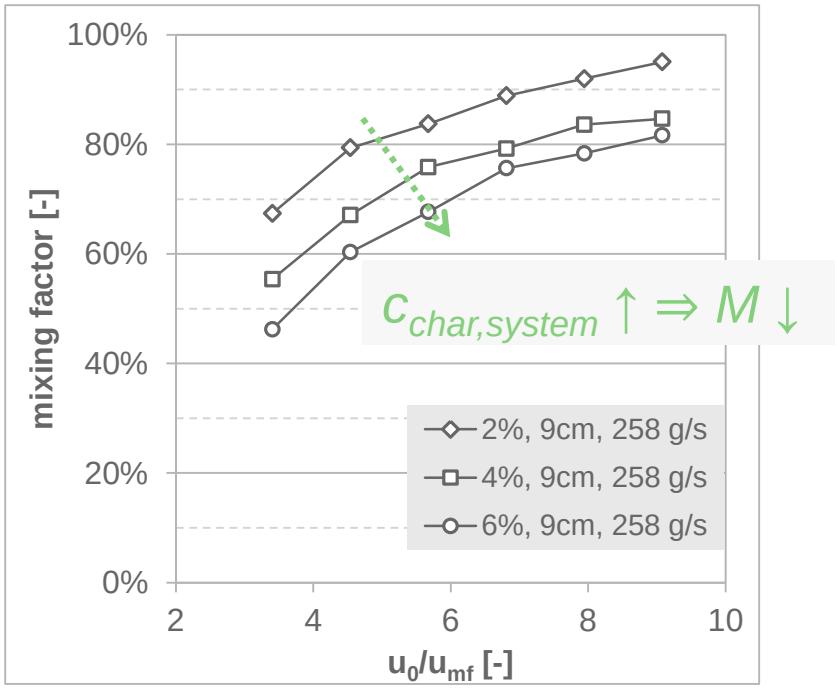
Influence of recirculation rate

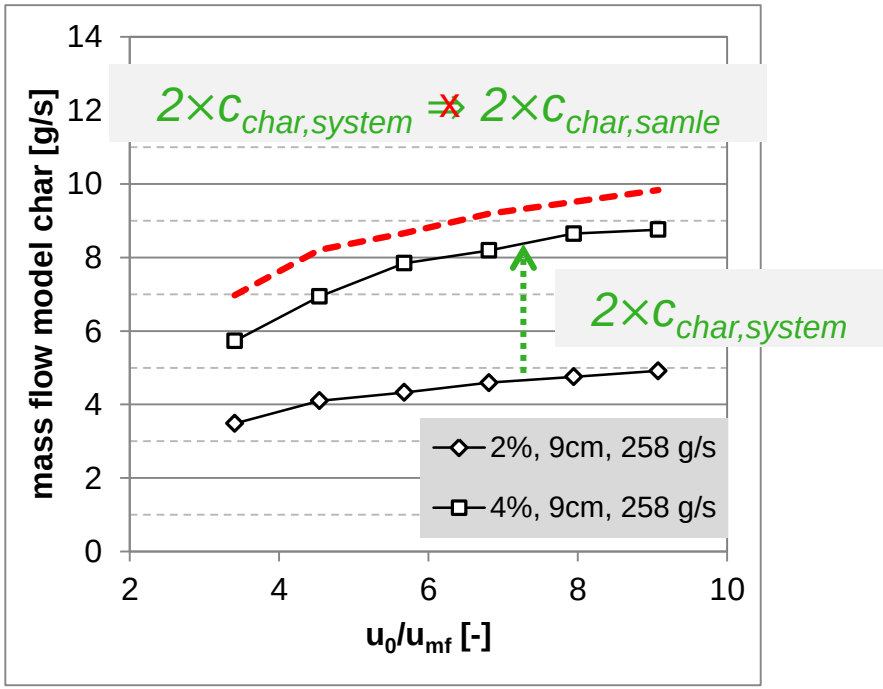


Influence of char concentration

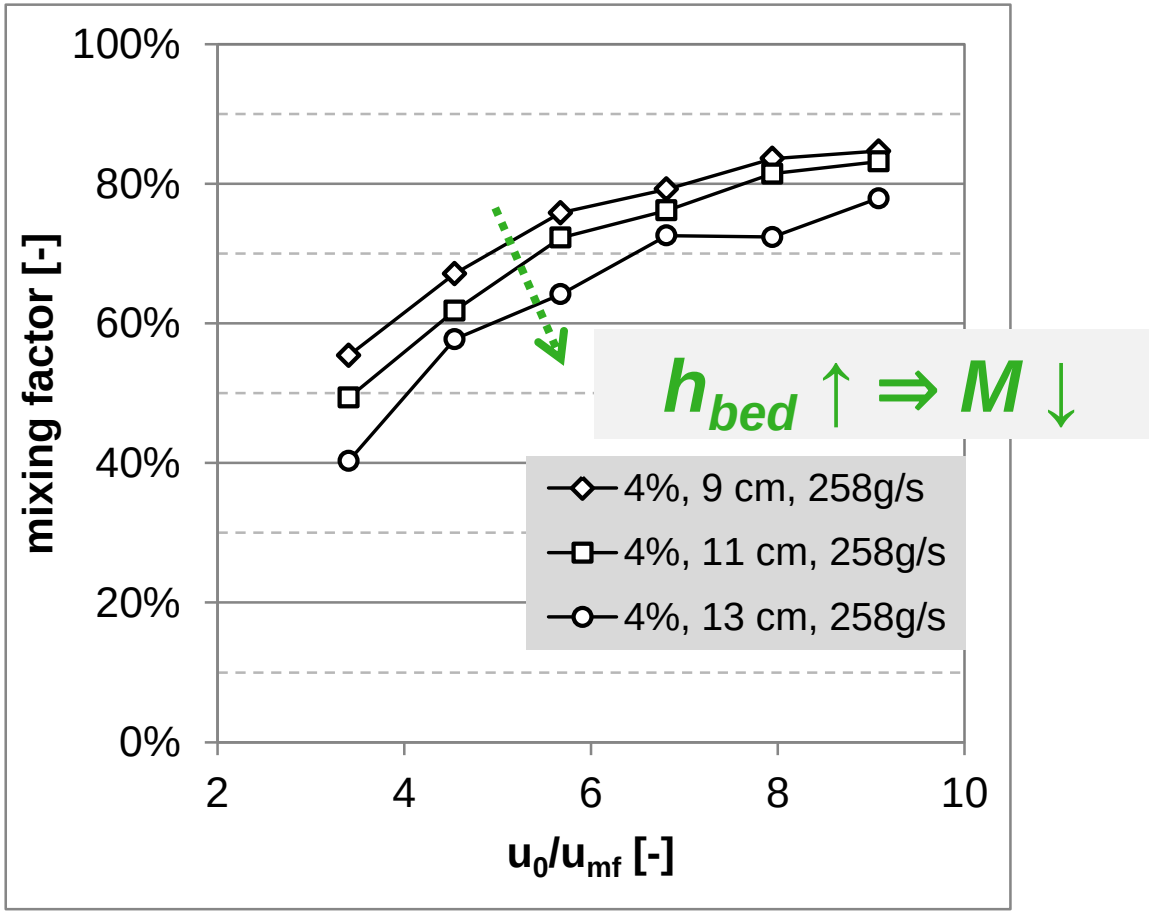


Influence of char concentration





Influence of bed height



Summary and conclusion

- fluidization rate ↑ ⇒ M ↑
- bed material recirculation rate ↑ ⇒ M ↑
- overall char concentration in the system ↑ ⇒ M ↓
- doubling the char concentration in the system does not lead to a doubling of the char concentration in the recirculation stream
- bed height ↑ ⇒ M ↓

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Thank you
for your attention!

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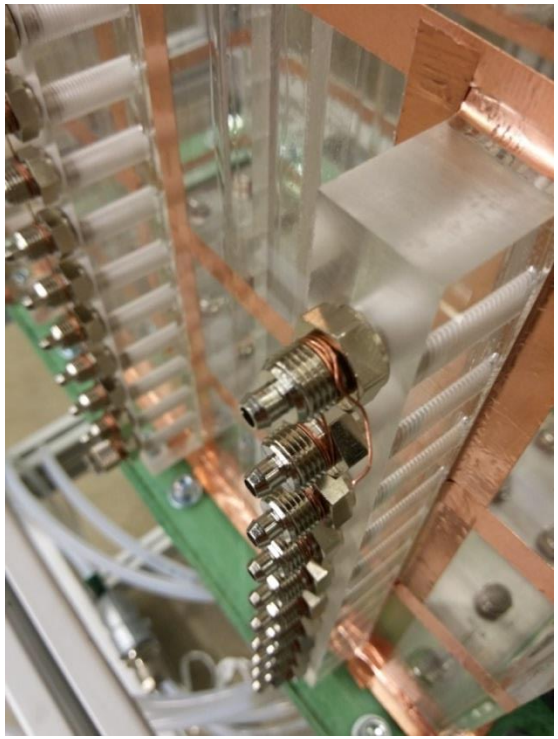

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