Double Pipe Heat Exchanger

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Objectives

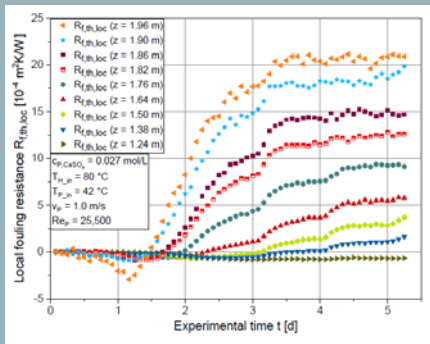
- Experimental investigation of scale formation in heat exchanger tubes

Detection possibilities

- Integral thermal fouling resistances over time through thermocouples in inlet and outlet of product and shell side.
- Local thermal fouling resistances over time through local thermocouples and high resolution glass fibre cable along the wall
- Determination of pressure loss over time on product side
- Deposit volume through displaced liquid volume
- Semi-local fouling mass by cutting pipes and weighing
- Local constriction via digital image evaluation

Capabilities and Possibilities

- Crystallization fouling possible with $CaSO_4$, $Ca(NO_3)_2$, $CaCO_3$
- Investigation of pipe fouling (20 x 1…5 x 804 and 2000 mm, outer diameter x thickness x length)
  - Coatings and welding
- Flow velocity 0….3 m/s; Heat duty: 3….12 kW
- $T_{\text{Shell side, inlet}}$: 30….100 °C, $T_{\text{Product side, inlet}}$: 35°C … 50°C
- Duration: From one day to several weeks



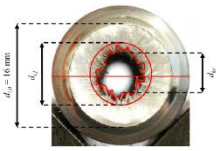


Fig.3: Cross-sectional constriction of $CaSO_4$

Fig. 4: Local thermal fouling resistance selected position

Flow diagram

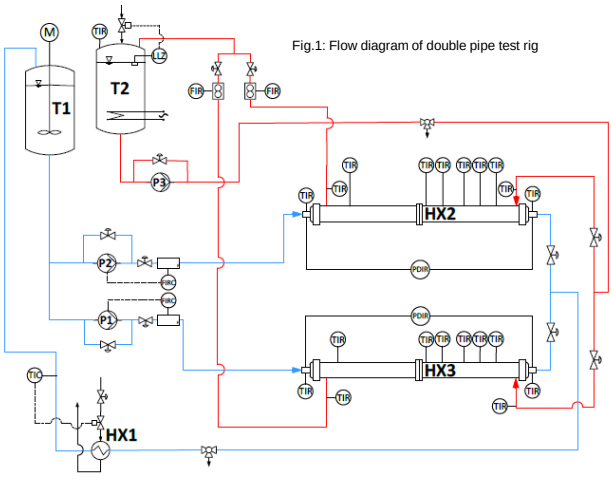


Fig.1: Flow diagram of double pipe test rig

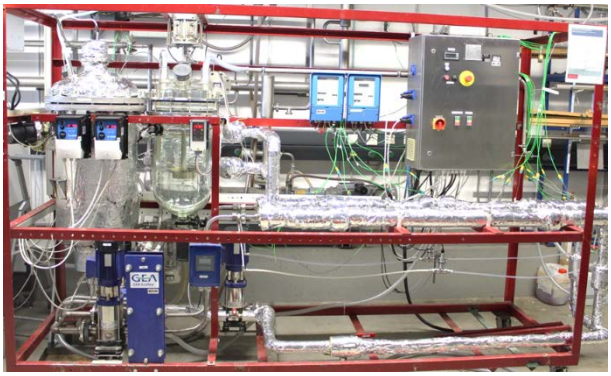


Fig.2: Image of double pipe test rig

Literature

- Albert, F., Augustin, W., Scholl, S., 2011. Roughness and constriction effects on heat transfering crystallization fouling. Chem. Eng. Sci. 66 (3), 499–509.
- Schlüter, F., Schnöing, L., Zettler, H., Augustin, W., Scholl, S., 2020 Measuring Local Crystallization Fouling in a Double-Pipe Heat Exchanger, Heat Transfer Eng. 41 (2), 149-159.

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