Technical discussion 3: Adsorption materials and generators

Starting point:

FRIENDS SORPTION

September 14-16, 2015
Milazzo, Sicily, Italy

	Session 1: Ab- and Adsorption, Basics Working Pairs	**Belal DAWOUD**	**Regensburg University**
11:00 - 13:00	• An alternative approach towards absorption heat pump working pair screening	Paris CHATZITAKIS	Viessmann
	• The adsorption contest of methanol and ethanol versus water in zeolites for thermal adsorption storage and heat transformation	Jochen JAENCHEN	FH Wildau
	• Possible strategies for a renewed use of traditional zeolites in adsorption heat pumps	Lucio BONACCORSI	University Messina
	• Metal-Organic Frameworks: Tailor-made adsorbents for heat transformation	Stefan HENNINGER	Fraunhofer ISE
	• NH_2-MIL-125 as a promising material for adsorptive heat transformation and storage	Larisa GORDEEVA	Boreskov Institute of Catalysis

Outcome of the session at SF I

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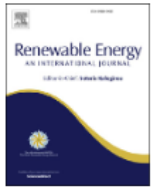

New materials for adsorption heat transformation and storage

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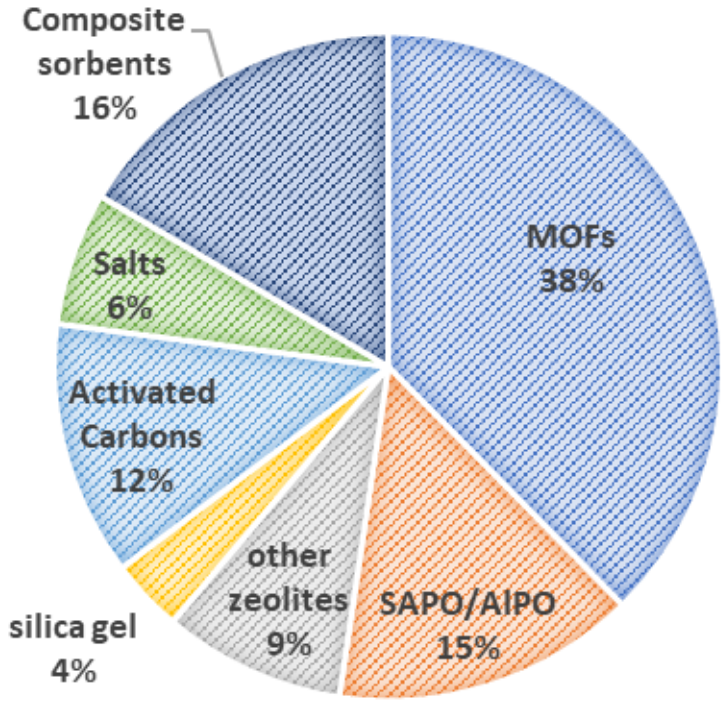
ABSTRACT

Great current progress in the materials science offers an enormous choice of novel adsorbents which may be promising for transformation and storage of low temperature heat, e.g. from renewable heat sources. This paper gives an overview of recent trends and achievements in this field. We consider possible optimization of zeolites by dealumination, further development on aluminophosphates, composites "salt in porous host matrice" and metal-organic frameworks which are currently receiving the largest share of scientific attention. The particular attention is focused on the chemical nano-tailoring and tunable adsorption behavior of these materials to satisfy the demands of appropriate heat transformation cycles. We hope that this review will give new impact on target-oriented research on the novel adsorbents for heat transformation and storage.

- ✓ Modification of classical zeolites (e.g. dealuminated)
- ✓ AlPO/SAPO
- ✓ MOFs as new opportunity
- ✓ Composite sorbents
- ✓ Importance of shaping the materials (Coating, direct crystallization, …)

Research on adsorbent materials in the period 2016 - 2023

- ✓ About 200 papers found in literature
- ✓ MOFs are the most investigated
- ✓ Many new composites (also based on MOFs)
- ✓ Modified zeolites rather than novel materials
- ✓ In >80% papers water as adsorbate



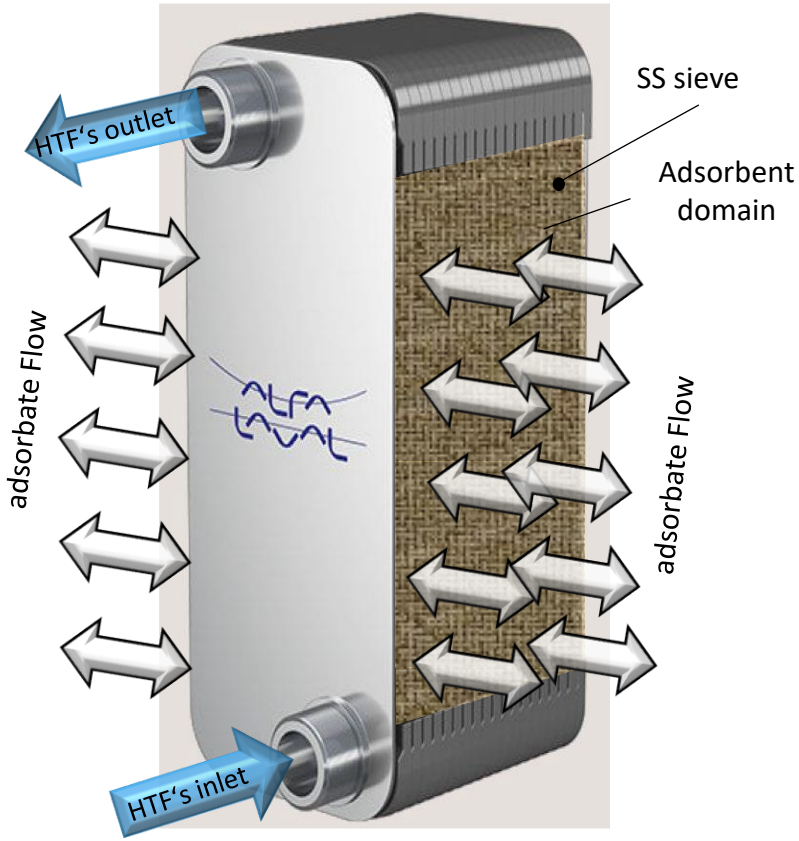
Some discussion points:

- ✓ Silica gel is still the standard sorbent (AQSOA n.a.)
- ✓ Cheap or expensive material?
- ✓ Scale-up at industrial level
- ✓ Optimization of composites (e.g. stability, high adsorption capacity or optimal adsorption rate?)
- ✓ Research on adsorbates? (e.g. mixtures)
- ✓ A good adsorbent or a good integration of a cheap adsorbent into HEX?

Tested Commercial Plate Heat Exchangers

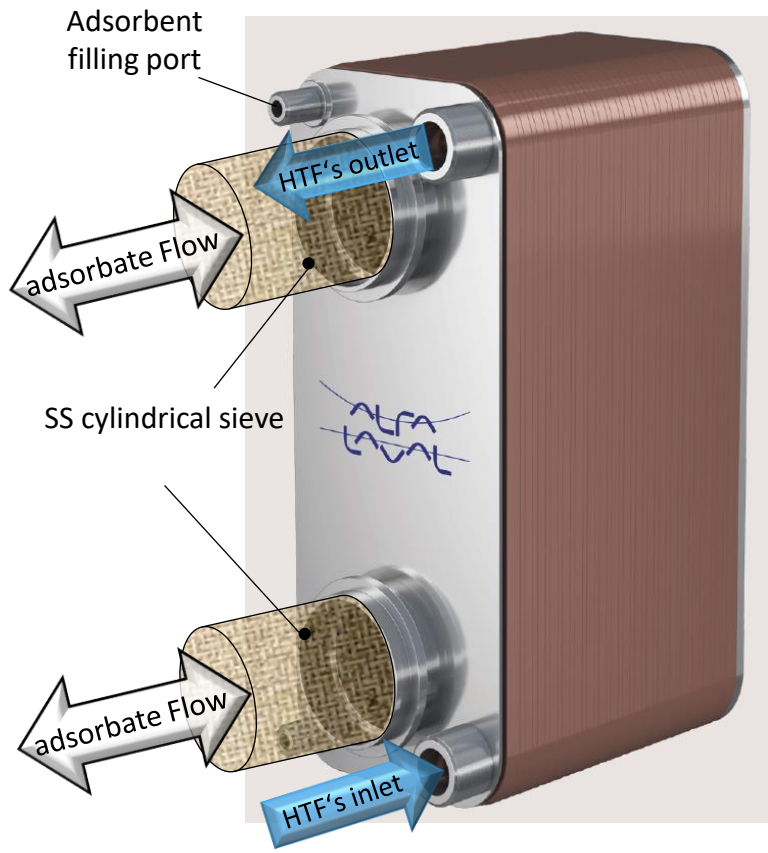
- **G**as / **L**iquid plate heat exchangers
- Each Consists of stainless steel plates brazed together with nickel.
- Designed to handle asymmetric volume flows with exceptionally high performance.

Open-Structured Asymmetric plate Heat Exchanger



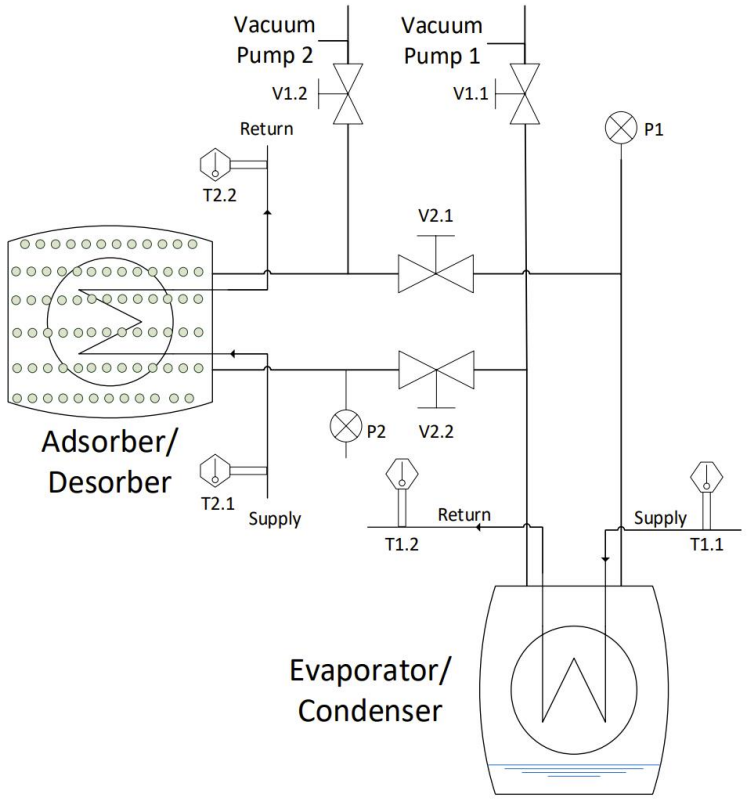
GLX30 PHE, AlfaLaval, Sweden

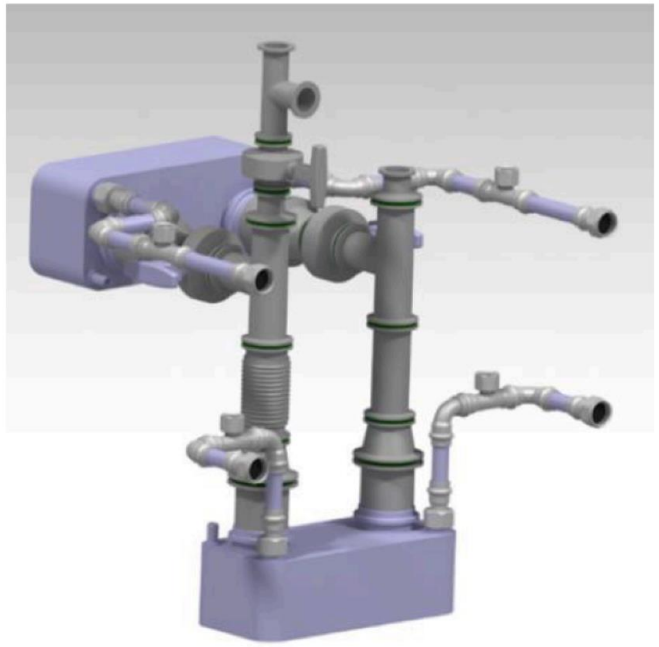
Closed-Structured Asymmetric plate Heat Exchanger

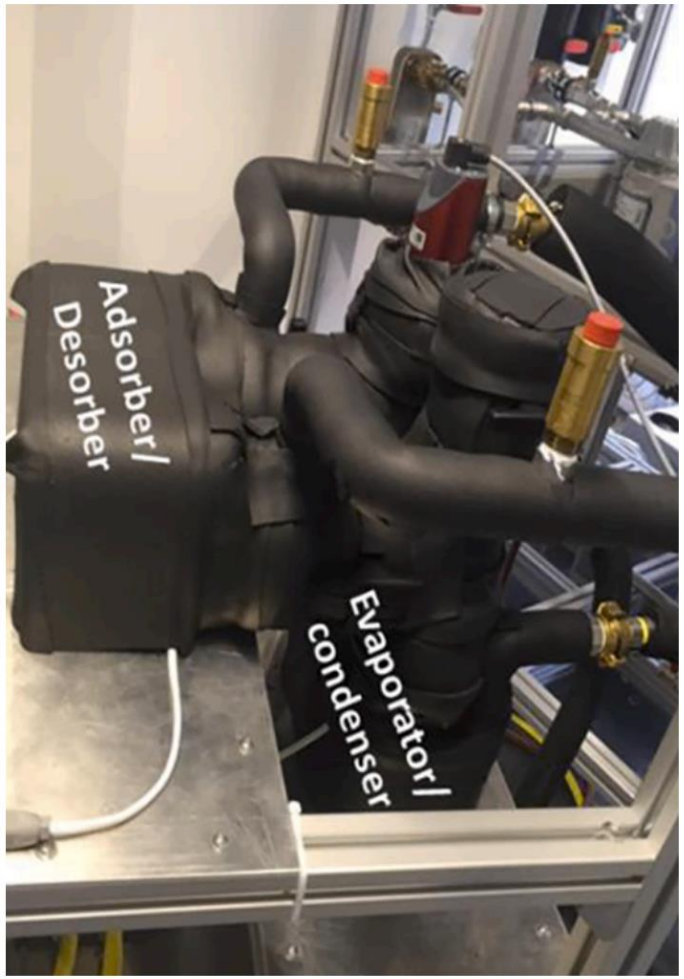


GL50 PHE, AlfaLaval, Sweden

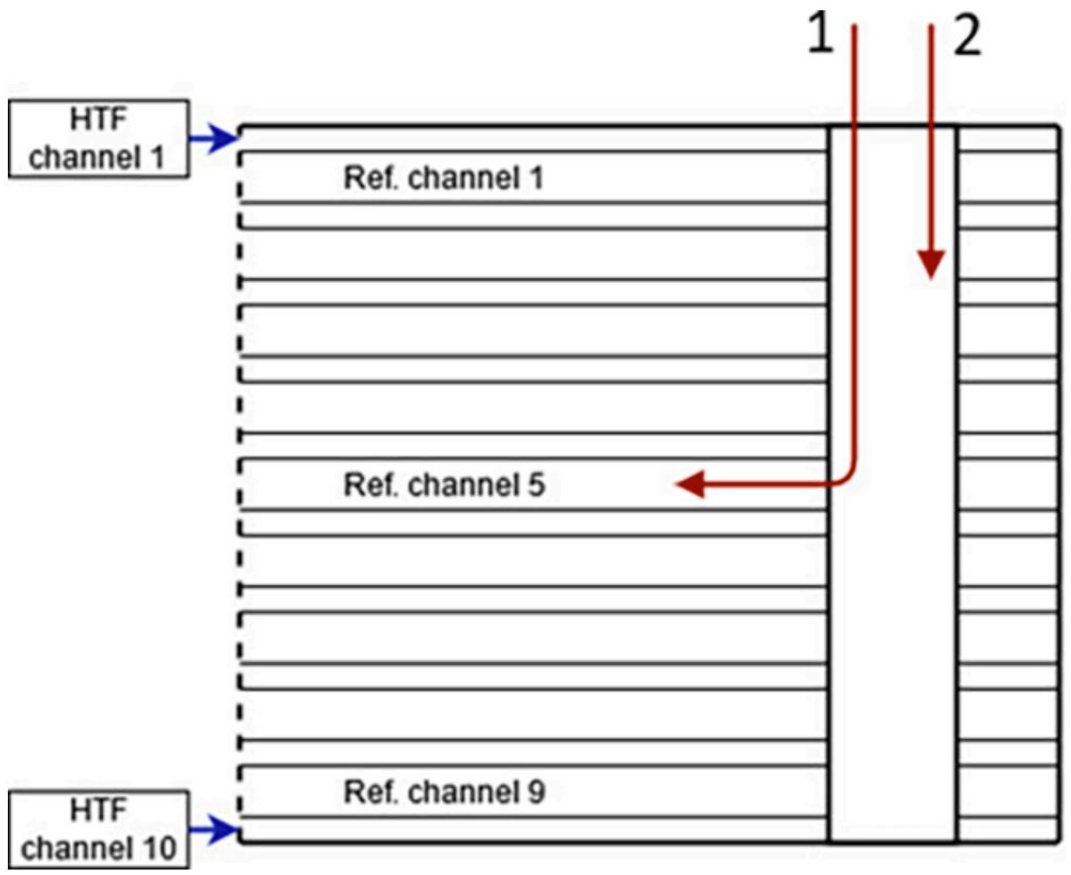
Same closed PHE as evaporator-condenser







Endoscope positions inside the closed PHE-evaporator



Correlating the evapaporator-U-value with the adsorption potential and the time derivative of water uptake