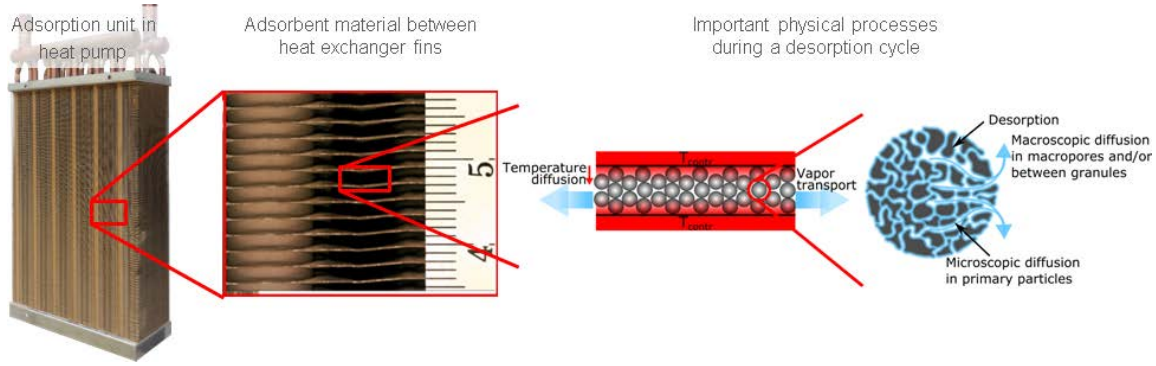
Improved prediction of adsorber material behaviour in sustainable heat pumps for smarter materials selection.

PhD Student position with the Building Energy Materials and Components laboratory

Description

With global cooling demand rising much faster than heating demand, suitable strategies are needed to cover it from renewable resources. Large amounts of waste heat are available at low temperature levels <100°C, where carnotization is inefficient and which are often discarded unused. Sorption heat pumps and sorption cooling are promising technologies which allow the direct conversion of waste heat or solar heat into precious cooling energy.

The performance and optimal operating temperatures of an adsorption heat pump depends critically on the adsorbent material used. This means that ideally the material is chosen to be consistent specifically for a final application. However, the estimation of the performance of an adsorbent is non-trivial due to the coupled processes of heat and vapor transfer and adsorption, which all have an influence on the effective COPs. Therefore the choice of adsorbent material is currently a rather haphazard process and a lot of potential for increased utilization of the technology lies within a better materials characterization and performance prediction methodology allowing the targeted choice of an adsorbent material for a specific heat pump application. Consequently, to facilitate and promote future targeted design of adsorption chillers as well as to reduce the lab to market time of new state of the art adsorption materials a new model for the prediction of the performance of an adsorbent material is the aim of the project.



Goals

The goals of this project are:

- Identification of the critical material properties influencing the water adsorption behavior and kinetics for different materials (silica, zeolites, carbon) and different adsorbent morphologies (granular, packed bed, film, monolith).
- Model capable of estimating the performance of a given adsorption chiller set-up and a given adsorbent material for a given application scenario.
- Validation of the developed model for lab-scale experiments and 50 kWh test facility and demonstration sites of a European project.

Group and Profile

The “Building Energy Materials and Components” laboratory at Empa spans subjects from fundamental research of wet chemical / sol-gel methods to the development of building components with the overarching goal to improve energy efficiency and reduce fossil fuel consumption. In this multidisciplinary environment, communication and interaction to create synergies and develop new ideas is highly valued. For this project, we are looking for a PhD student with a degree in materials science, chemistry, physics or computational science and engineering, capable of working autonomously but as a part of the team. The candidate should have some a sound basis in numerical modelling and programming.

Contact

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Applications only via this link: https://apply.refline.ch/673276/1014/pub/1/index.html