MOFs for water sorption for cycling heat transformation processes

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Metal-organic frameworks (MOFs) with water stability and high water uptake capacity are gaining attention for reversible cycling water sorption in order to achieve low temperature heat transformation applications in thermally driven adsorption chillers (TDCs) or adsorption heat pumps (AHPs) (Fig. 1). Sorption chillers or heat pumps are an alternative to conventional compression systems operating with high input of electricity, largley generated from fossil fuels. By using low grade heat as the driving energy, TDCs or AHPs can significantly help to minimize primary energy consumption and greenhouse gas emissions generated by industrial or domestic heating and cooling processes. TDCs and AHPs are based on the evaporation and consecutive adsorption of coolant liquids, preferably water. The process is driven and controlled by the microporosity and hydrophilicity of the employed sorption material. We present current basic research developments and critically discuss the potential of MOFs in adsorption chilling or adsorption heat pump processes (Fig. 1).[1,2]

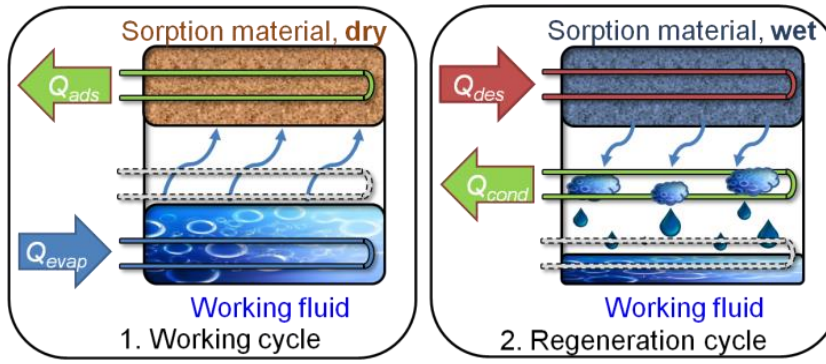

Fig. 1 Principle of adsorption chilling or adsorption heat pump.

Working cycle: A working fluid (typically H_2O) is evaporated at low pressure by application of evaporation heat Q_{evap}, and adsorbed at a microporous material, releasing adsorption heat Q_{ads}. **2. Regeneration cycle:** When the adsorbent is saturated, driving heat Q_{des} is applied for desorption of the working fluid. The vapour then condenses in a cooler, and condensation heat Q_{des} is released.

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