DYMAN: DYnamically MANaged self-cooling HPC Data Centers

Description

DYMAN targets the development of a completely new design of adsorption chillers based on the following innovation:

- New low temperature adsorbents achieving high capacities at very low driving temperatures below 50 °C.
- New type of adsorption heat exchangers made of 3D printed structures integrating the adsorption material into a porous structure, which reduces the internal thermal resistances and improvement of heat transfer by two-phase flow, enhancing the heat transfer rate and reducing the internal electricity consumption of the unit. Additionally the project aims to develop at second core concept to further develop an existing two-phase cooling system, for high-performance computing servers to handle thermal loads more efficiently from next-generation processors. Goals include increasing cooling capacities for processors generating high heat fluxes like the Nvidia H100 chip which produces 70 W/cm2. An additional objective is to recover 50% of waste heat from processors to generate additional cooling power through a sorption heat pump. Combining two-phase cooling directly with heat-powered cooling could significantly improve efficiency over conventional air or water-based cooling methods alone. The objective here is to 1)further develop the present twophasecooling system to work in an efficient way in combination with the sorption heat pump (concept 1) 2) Development of newevaporator with new advanced surfaces for high heat transfer coefficients
- Development of new condenser integrated with theheat adsorber of sorption heat pump. This is a crucial component that can improve the efficiency of the whole integrated system torecovery up to 50% of rejected heat. Furthermore, the cooling data center management is a complex engineering system withinteractions with different components of the data centers. So, DYMAN proposes a new way of active management of the data centerintegrating the cooling system as part of the optimization of processor management.