Docket #: S19-412

Continuously-Cycled Water Harvesting for Dry Cooling Tower Operated Power Plants

Stanford University researchers have developed a system that achieves atmospheric water harvesting with high specific productivity, defined as the rate of water collected per mass of absorbent material. Metal-organic-frameworks (MOFs) are promising materials for cooling applications due to their high water vapor absorption capacity, but have been cost-prohibitive due to the lower water recovery rates associated with low adsorption/desorption cycle frequencies. The invention enables high productivity by rapid mass transfer of vapor by fluidization of MOFs. Fluidization is a proven and scale-able process wherein powders are suspended in a column of air. This fluidization dramatically increases the surface area of absorbent exposed to an airstream and also decreases diffusion length scales. The improvement in vapor absorption and desorption rates enables cycle operation of up to 50 cycles per day, compared to 8 cycles or less from conventional methods. Fluidized bed systems are currently used in a wide range of industries, demonstrating the feasibility of the idea.

Stage of Development
Proof of concept for MOF fluidization as a rapidly cycled water vapor sorption unit

Applications

- Improve power cycle efficiency of power plants
- Refrigeration and air conditioning

Advantages

- The invention improves the specific throughtput achievable with porous MOFs, materials that effectively absorb water vapor, which decreases operating costs
- Yields water vapor harvesting rates an order of magnitude higher rate (per weight of absorbent) than existing technology
- Fluidization of MOFs is a scalable technology already in use in a wide range of industries

Publications

- Terzis A.,Ramachandran A., Wang K., Asheghi M., Goodson K.E., Santiago J.G. High-Frequency Water Vapor Sorption Cycling Using Fluidization of Metal-Organic Frameworks. Cell Reports Physical Science 1 (5), 100057.

Patents

- Published Application: WO2021067454
- Published Application: 20220370951
- Issued: 12,274,974 (USA)

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