Separate Sensible and Latent A/C System

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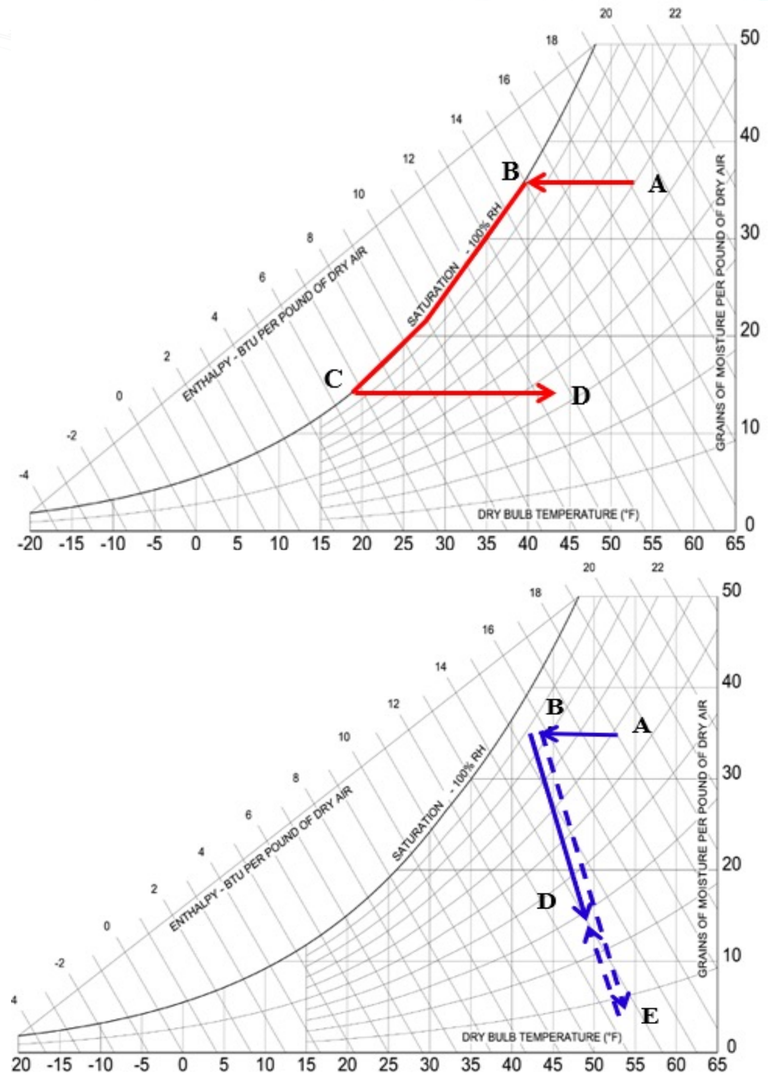
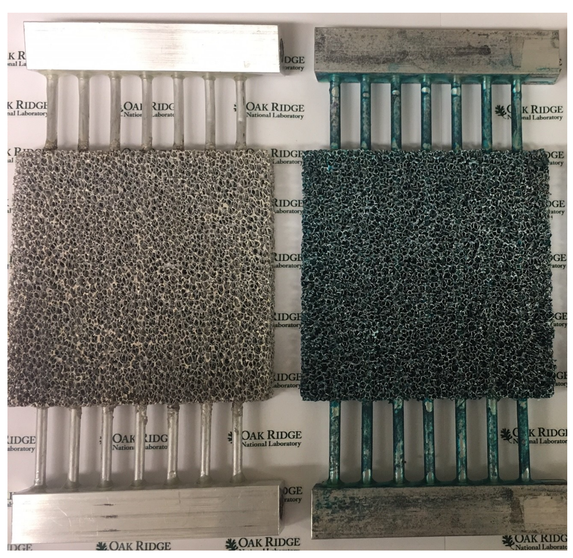
Research Challenge/Need/Problem Addressed

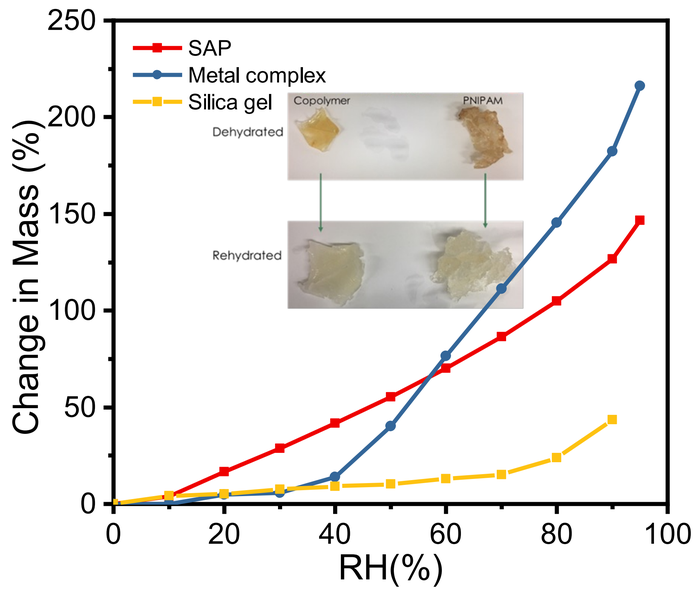
- On average, about 33% of energy consumption is attributed to the dehumidification processes.
- Conventional dehumidification technology relies on a single vapor compression system to handle both sensible and latent loads.
- Key to the energy efficiency of such systems is the performance of the heat and mass exchangers, which provide sensible cooling and dehumidification.
- Cooling/dehumidification systems with separate sensible and latent cooling (SSLC) offer significantly improved overall performance compared with conventional vapor compression air-conditioning systems.

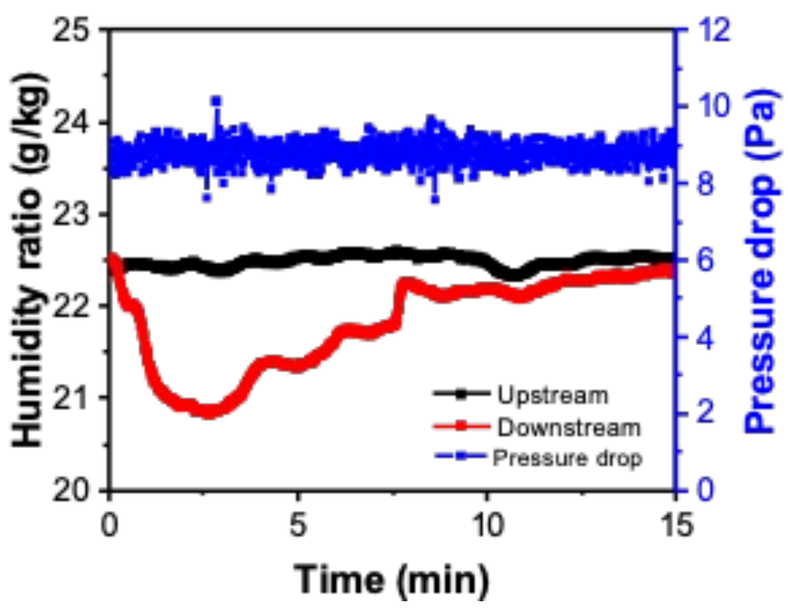


Current Research

- Novel technology was developed to handle sensible and latent loads for buildings: a heat and mass exchanger that deploys a metal foam coated with appropriate desiccant materials as the substrate.
- New desiccant materials have a high–moisture absorption capacity and low regeneration temperature.
- New desiccant-coated metal foam showed good dehumidification performance and stable desorption and absorption behavior during 50 cyclic regeneration and dehumidification cycles.
- Coating was durable during the cyclic desorption and absorption experiments.







Project Impact

- The improved dehumidification system deploying SSLC will have the following benefits:
  - Ultracompact infrastructure (>30% reduction in size) to control the moisture content of supply air
  - An expected improvement in coefficient of performance of at least 20% compared with existing systems (single vapor compression)
  - At least a 25% reduction in CO_2 emissions (>80 MMT) due to improved performance
- Enabling the development of small-scale residential systems for deployment will have the following benefits:
  - Reduced cost of the working fluid
  - Reduced required maintenance due to compact design
- At least 800 TBtu in energy savings in air-conditioning technologies