Percolated Microstructures for Multi-modal Transport Enhancement in Porous Active Materials

Technology #16705

Applications

The technology increases transport in active materials concurrently for two different modes, such as vapor and heat transport for adsorption heat pumps or electron and ion transport in battery electrodes.

Problem Addressed

For many engineered systems transport must occur concurrently for two different modes. Current methods add a low-volume non-active material to increase one mode and hinder the other as little as possible. However, these methods cannot increase both modes and reduce the overall active material density due to the added fraction of non-active material. The proposed method increases both modes of transport with a low additive fraction binder.

Technology

Microporous fins of carbon paper, carbon cloth, and porous metal can be incorporated into compressed zeolite 13x adsorbent material, improving both the bulk vapor transport and heat transport. The fins can be inserted and pressed vertically or horizontally into a fin-tube stack, and separate fins can extend both through and around the fin tube stack. The fins can be filled with a semi-rigid resin that helps maintain pore structure during densification. The resin is then removed with a solvent, leaving open channels for vapor or ion transport. This percolated graphene network increases maximum packing density of porous active material and heat and mass transport. This technique can be applied to other multi-modal transport systems to and from active materials.

Advantages

- Decoupling of modes of transport (e.g., heat and vapor, electron and ion)
- Increases maximum packing density

Categories For This Invention:

Energy
Electromechanical Systems
Energy Efficiency
Energy Storage
Batteries
Heat Exchangers
Other (Heat Exchangers)
Thermoelectricity

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Materials
Micro & Nanotech

Intellectual Property:

Percolated microstructures for multi-modal transport enhancement in porous active materials
Issued US Patent
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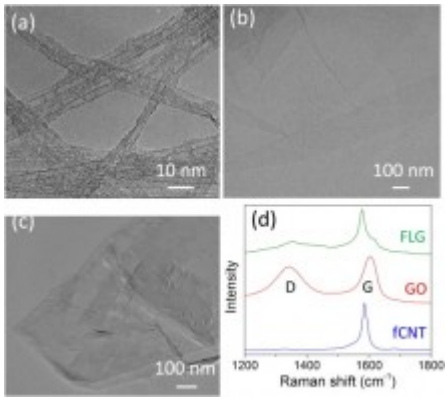
Publications:

Dimensionality Effects of Carbon-based Thermal Additives for Microporous Adsorbents
Materials and Design
2015

External Links:

Device Research Laboratory
http://drl.mit.edu/

Image Gallery:



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