"Membrane-less" Flow Battery
Technology #16441

Applications

Flow batteries (also known as flow cells) are a type of large-scale energy storage that relies on the exchange of electrons in different electrolytes. The current technology provides a means of lowering the cost of flow batteries, as well as increasing their durability, by removing the need for an expensive membrane in their design. The technology described here can be applied to various flow battery chemistries, such as hydrogen-bromine, zinc-borine, lithium-oxygen and lithium-ion.

Problem Addressed

To enable the electrical reaction in a flow battery, the electrolytes must be separated, while still allowing for ions to transfer between them. This is typically done using an ion-perm-selective membrane, which only allows certain types of ions to pass through the membrane in specific directions. This membrane is costly and requires frequent replacement, driving the overall cost of the flow battery beyond commercial viability for large-scale energy storage.

Technology

The current technology separates electrolytes by leveraging laminar flow, rather than using a typical ion-perm-selective membrane. This design makes it a "membrane-less" flow battery, and allows the current technology to be far more durable than existing solutions.

Different electrolytes are separated using a porous dispersion blocker. The blocker permits the flow of ions, but reduces convective mixing — thus ensuring separated, laminar flow of the different electrolytes. The structure of the porous channels through which the electrolytes flow can also be varied, helping to control their degree of dispersion. This has the added benefit of allowing electrolytes to be pumped through at different pressures and even different directions, which can optimize power output and utilization of the different reactants.

Advantages

- Eliminates requirement for a costly ion-perm-selective membrane in a flow battery
- Able to maintain a constant charging and discharging current of 0.2 A/cm2, thus retaining high voltage efficiency

Categories For This Invention:
Energy
Energy Storage
Batteries
Flow Batteries
Intellectual Property:
Battery with heterogeneous flow-through porous electrodes
Issued US Patent

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Publications:
A Cyclable Laminar Flow Battery for Large Scale Energy Storage
ECS Meeting Abstracts
2014

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