MARKET SHEET

Solid-State Ceramic Disc Membrane for Longer-Lasting Flow Batteries

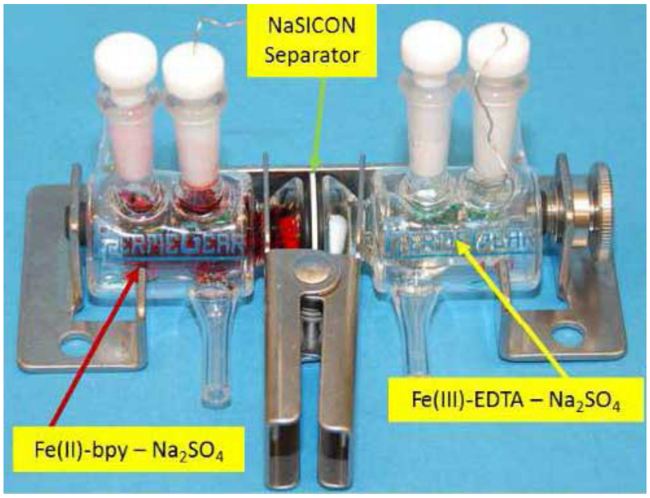
A solid-state ceramic disc membrane that increases the lifespan of aqueous-based system batteries by eliminating cross-over species and increasing conductivity

US Patent 10,586,997

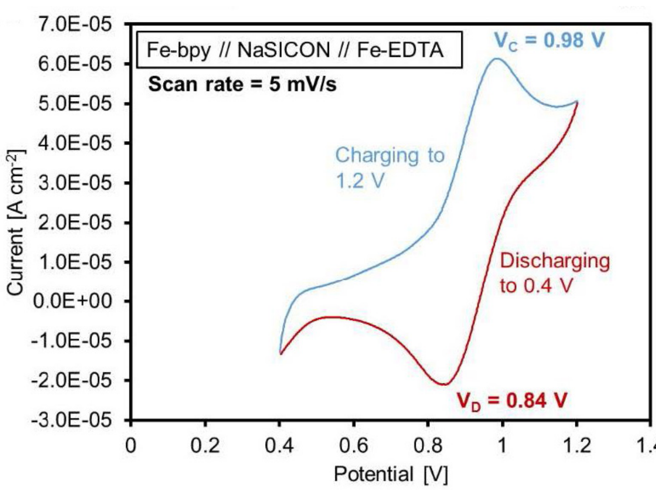
Technology Readiness Level 2

Redox flow batteries (RFB) are an increasingly promising solution for large-scale energy storage applications. The unique architecture of RFBs stores the analyte and catholyte within individual containers, which allows for individual control of power and energy. The most common RFBs are vanadium redox flow batteries (VRFB) which are gaining traction for grid-level storage needs. Typically RFBs use oil-based porous polymer membranes which face limitations such as low selective permeability. The resulting ion mixing causes battery inefficiencies and shorter lifespans and reduced performance.

Sandia researchers have implemented a solid-state ceramic disc membrane that shows no evidence of allowing crossover species through the membrane. The disc membrane also provides simultaneous charge compensation control that can be accomplished within dissimilar electrolyte solutions. The technology eliminates corrosion and uses abundant materials such as iron rather than scarce metals such as vanadium and lithium. The aqueous-based solvent eliminates cost while increasing safety and health for people and the environment, compared to traditional lithium-ion batteries. This advancement is relevant for storing station energy or electrical grids that require easy, flexible and long-term scalable electrochemical energy storage devices with reduced ion crossing.



Above: Photograph of assembled full cell of 4mM Fe-bpy catholyte vs. 4mM Fe-EDTA anolyte with a NaSICON IEM.



Above: Cyclic voltammetry of NaSICON full cell from 0.4 – 1.2 V at a rate of 5 mV s-1.

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Sandia National Laboratories

Next Steps

Sandia is seeking partners to develop and commercialize this invention. To learn more, contact Sandia National Laboratories' Licensing and Technology Transfer office.

Contact Us SD# 14061

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Technical Benefits

- Reduced cost
- Long-term aging stability
- Allows dissimilar electrolyte compositions
- High room temperature conductivity

Industries & Applications

- Redox chemistry
- Grid-level storage
- Energy storage and batteries
- Renewable energy
- Solar and wind farms

U.S. DEPARTMENT OF ENERGY NNSA National Nuclear Security Administration

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