Enclosed Distributed Flow Battery For Transport Systems

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PROBLEM STATEMENT

Vanadium redox flow batteries (VRFBs) are well suited for stationary energy storage, but their conventional cell architecture presents limitations for transport applications such as electric vehicles, rail, marine, and aviation. A standard VRFB cell consists of a stack of bipolar plates, end plates, gaskets, insulators, and current collectors that must all be precisely compressed together. This design is inherently bulky and heavy. Metal bipolar plates require corrosion-resistant coatings to survive acidic vanadium electrolyte. Composite plates are often porous, brittle, and expensive to manufacture. The result is a mechanically complex cell that is prone to leakage and poorly suited for any application where weight and volume matter.

SOLUTION

Researchers at Missouri University of Science and Technology have developed a new VRFB cell architecture that eliminates end plates, gaskets, and insulators entirely. This is achieved by embedding the electrodes and flow channels within a recess machined into a rigid, non-porous thermoplastic housing such as PVC. The two housing halves clamp around the membrane and are joined with simple mechanical fasteners. Unlike traditional designs that rely on multiple separate components, the housing itself provides the compression force, electrolyte containment, and electrical isolation all in one.

In head-to-head lab testing against a traditional VRFB design built to the same external dimensions, the new cell demonstrated clear advantages across the board. It weighed roughly 30 percent less and cost about 17 percent less to build on non-shared components. It also exhibited lower internal resistance and delivered higher peak power, all while showing no electrolyte leakage.

VALUE PROPOSITION

The new cell architecture cuts parts count, weight, cost, and assembly time while improving electrical performance and reliability. Fewer components mean fewer failure points, faster manufacturing, and a form factor compact enough to bring flow battery economics into transport systems. The design is compatible with standard thermoplastics and existing vanadium electrolyte chemistry, so partners can adopt it without retooling upstream supply chains.

Opportunity

Seeking a licensing and development partner to scale the new cell architecture into manufacturing for transport and mobile energy storage markets.

Development Stage

Validated at lab scale with single-cell prototypes benchmarked against a traditional VRFB control cell.

Intellectual Property

Issued Patents 11,032,619 and 11,611,098

Publication

[DOI: 10.1016/j.apenergy.2018.04.025]

IDF#

17-MST-032