

Standardization Requirements for Redox Flow Batteries



DOE OE Energy Storage Peer Review

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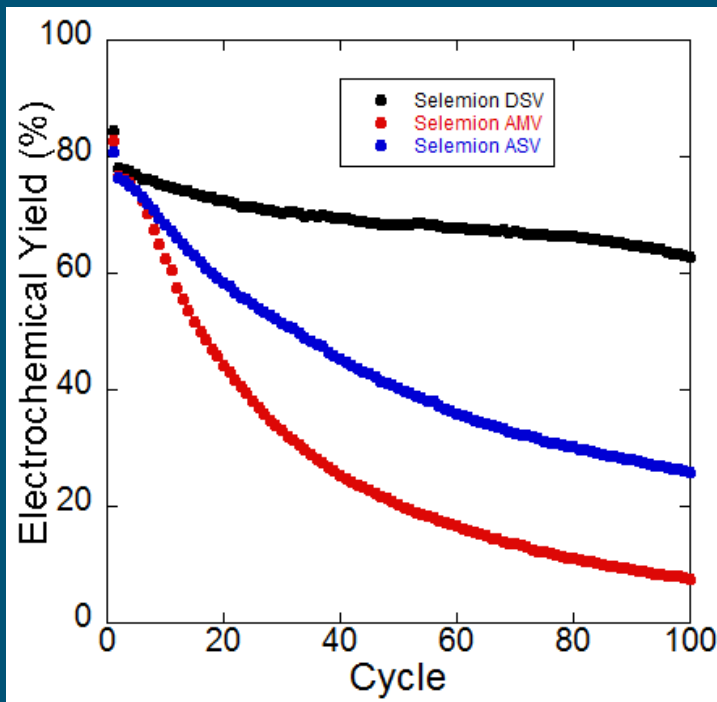
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- Redox flow batteries are complex systems with many components and testing parameters.
- Performance comparisons between labs can be difficult.

Example: Changing ion-exchange membranes in an aqueous-organic RFB.



↑
>50% capacity difference
after 100 cycles due
only to membrane



Standardization offers:

- Researchers the ability to meaningfully compare RFB data across the literature
- Consumers of flow battery technology meaningful comparison of cost and performance metrics
- Identification of best practices

Recommendation for a **standard** vs. **reporting requirement**

Flow Battery Physical Attributes



Electrolyte

- concentration
- viscosity

Membrane

- microporous vs. ion exchange

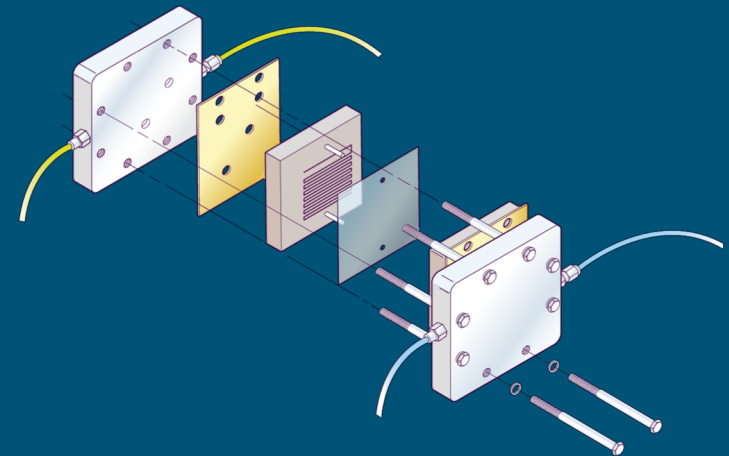
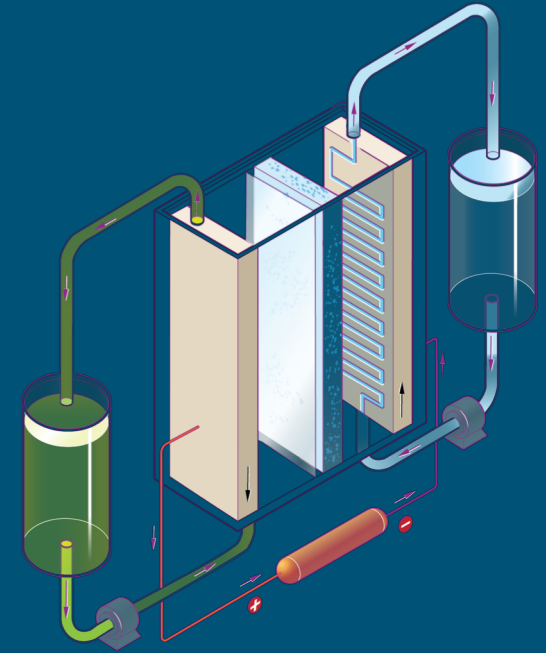
Electrode materials

- electrochemical surface area vs. membrane area

Electrolyte volume + flow rate

Flow field geometry

Back Pressure





Charge/discharge rate

- Minimum required?

Depth of discharge

Cell resistance (IR correction)

- Differentiate between cell design and kinetics

Efficiencies – Coulombic/Voltage/Energy

Minimum run time

Capacity fade after X hours or cycles



Energy + Power Densities: *as tested vs. theoretical*

- Maximum rate for given depth of discharge

Materials costs

- Acceptable sources (Alibaba?)

Unusual hazards that might incur extra costs

- e.g. highly flammable liquids, toxic gases



“Santa Fe Protocol”

Cell

- 10 cm² membrane area
- 10 mL anolyte, 10 mL catholyte
- 10 mL/min flow rate
- carbon felt electrode

Testing

- 25 mA cm⁻²
- 75% depth of discharge
- 100 cycles (100 h?)