

allegro

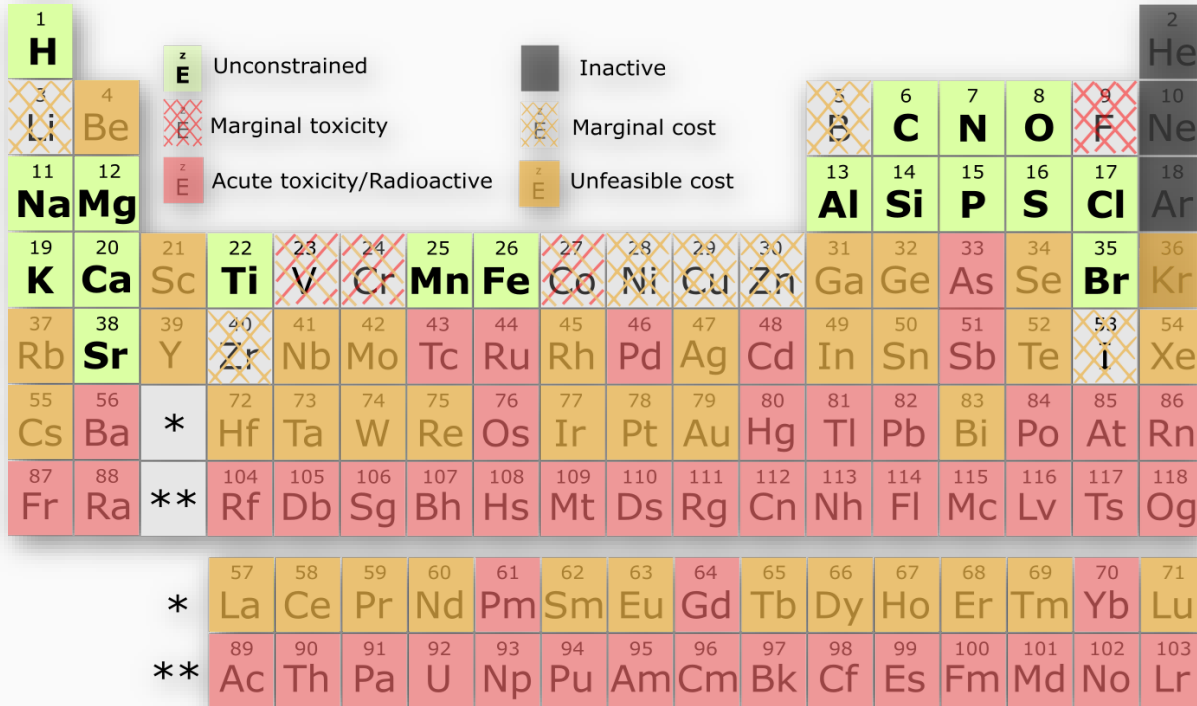
Microemulsion Flow Batteries

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ALLEGRO.ENERGY

Origin Story - Looking for Energy Storage that Scales



Refresher: Why and When 8+ Hours Batteries?



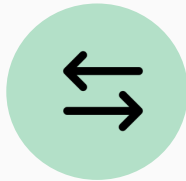
No wind and no sun (AND no batteries) for extended periods of time

What is the Issue?

To prevent catastrophic climate change, we must build a reliable energy grid powered by renewables. As renewables grow and coal and gas decline, we are facing three key challenges:



Balancing
electricity supply
and demand



Change in
transmission
flow patterns



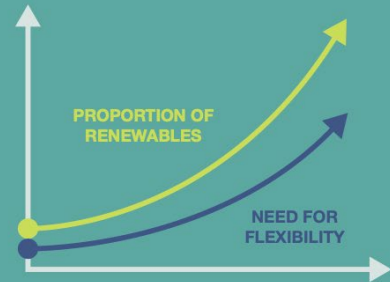
A decrease
in system
stability

What is the issue?

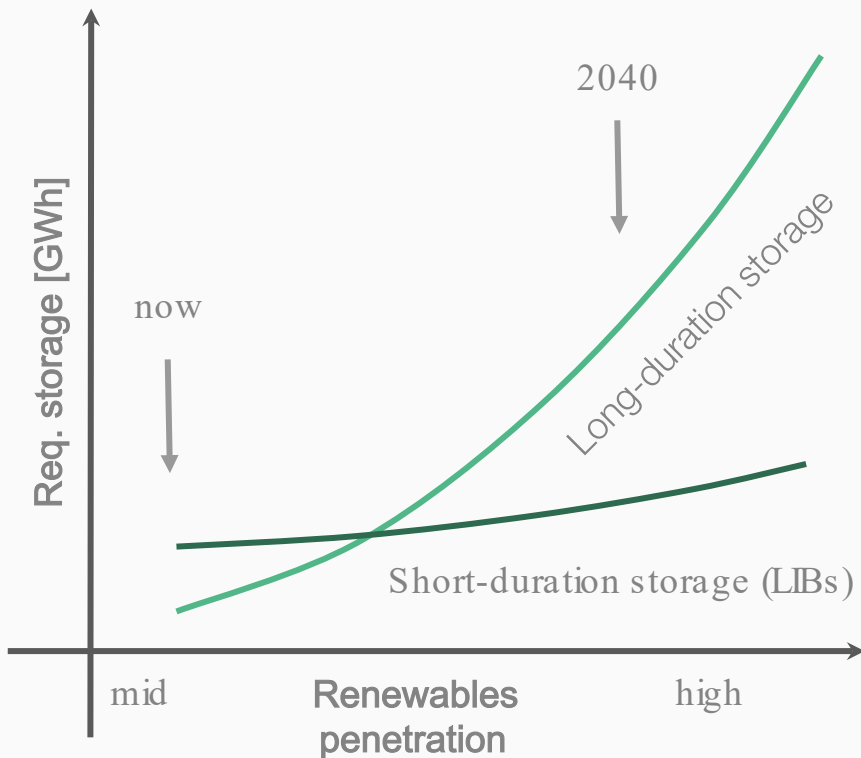
To avoid catastrophic climate change, we need to rapidly build a net-zero power sector predominantly powered by renewable energy.

As the proportion of renewables grows, we are presented with 3 challenges; balancing electricity supply and demand; a change in transmission flow patterns; and a decrease in system stability.

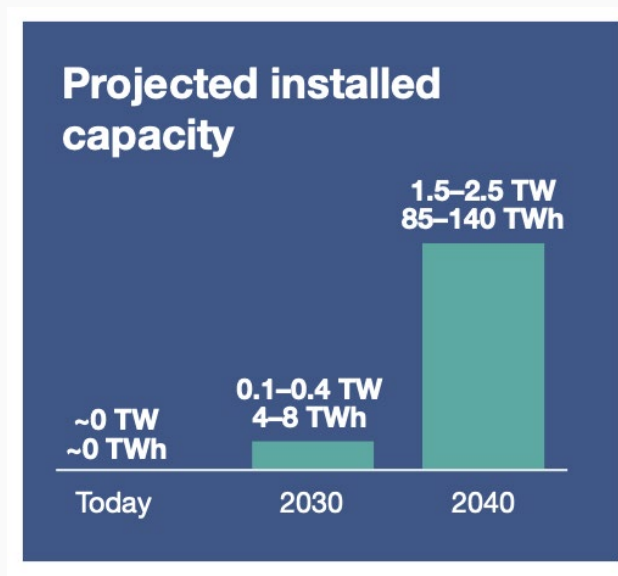
LDES can help address these issues by increasing the flexibility of the power system.



Long-Duration Energy Storage (LDES) in the Mix

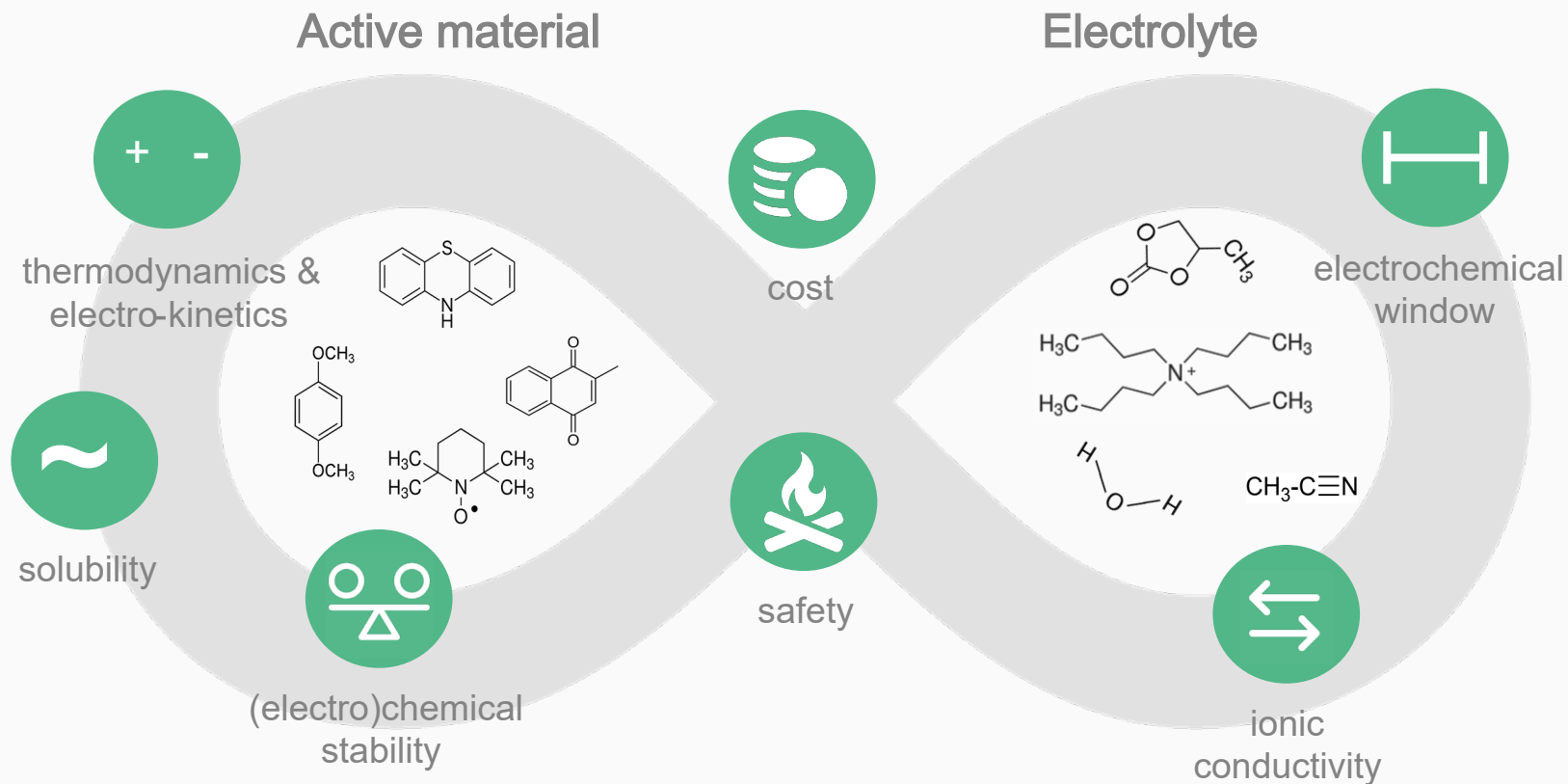


140 TWh by 2040

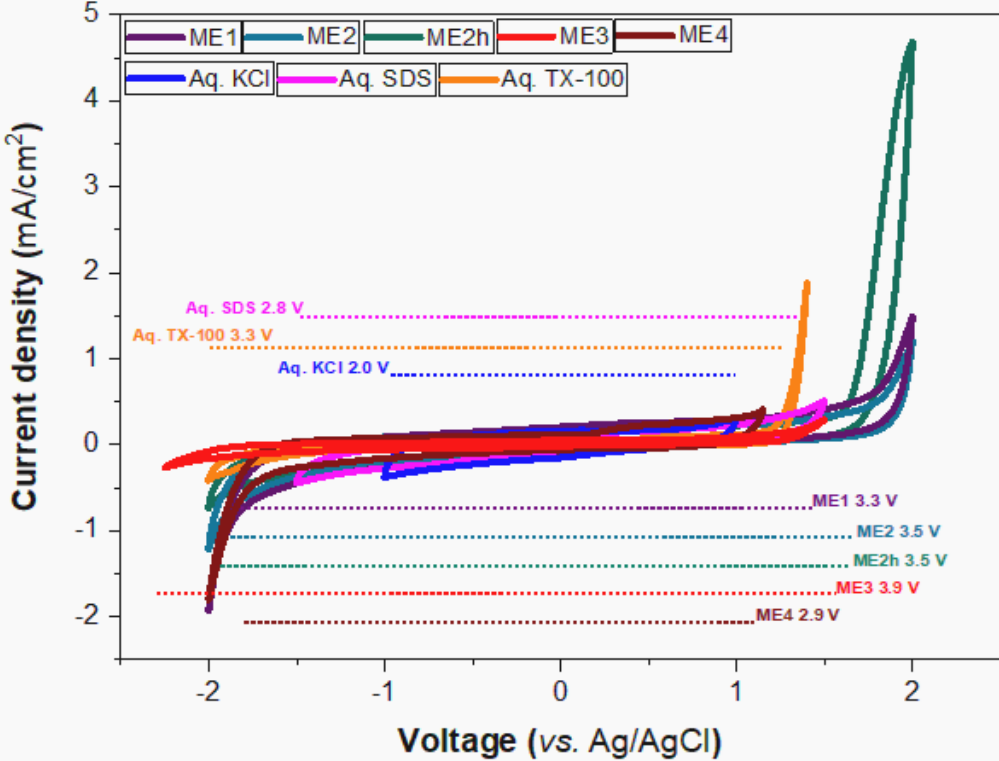


Source: Net-zero power, Long duration energy storage for a renewable grid, McKinsey & Company, 2021.

What Makes a Good RFB electrolyte ?



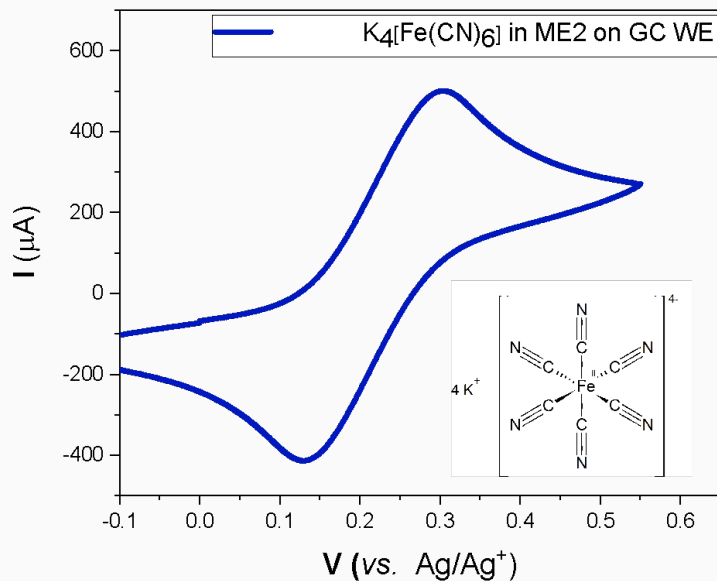
Microemulsion Discovery



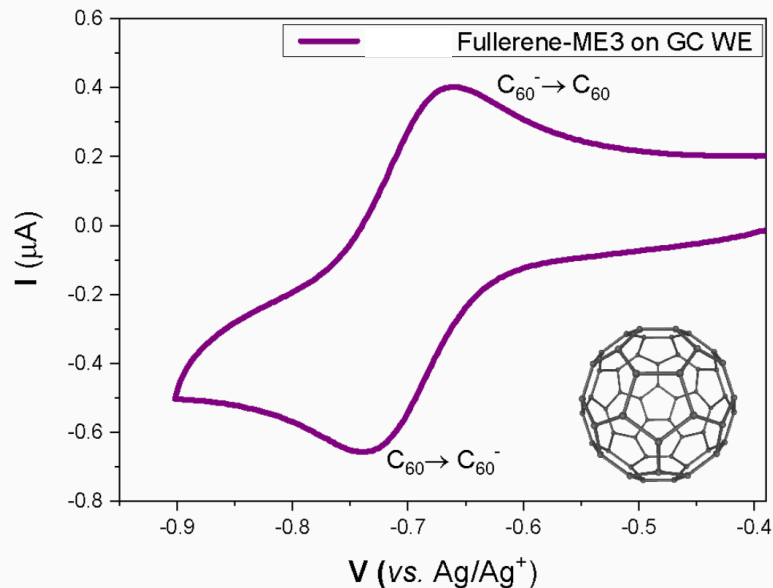
Electrochemical window

Microemulsion Discovery - Polarity Extremes

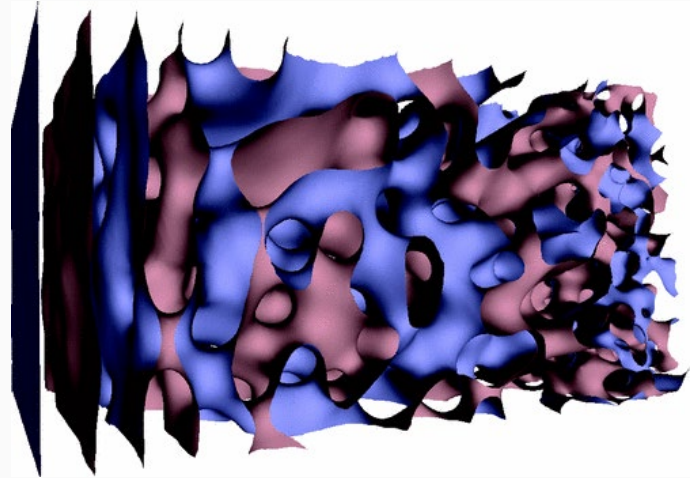
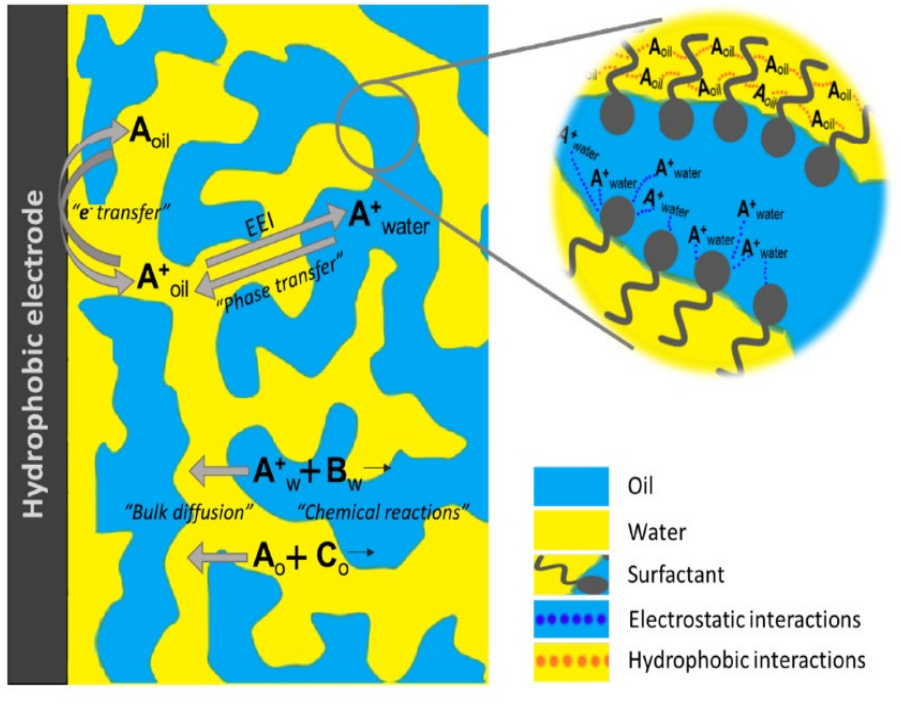
Hydrophilic



Hydrophobic



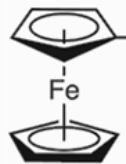
Electrode -Electrolyte Interface



Source: M. Kerscher, P. Busch, S. Mattauch, H. Frießinghaus, D. Richter, M. Belushkin, and G. Gompper, Near-surface structure of a bicontinuous microemulsion with a transition region, *Phys. Rev. E* 83, 030401(R),

Ferrocene in Microemulsions

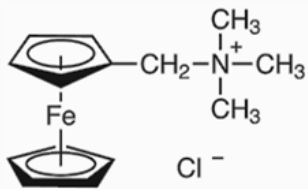
Organic synthesis



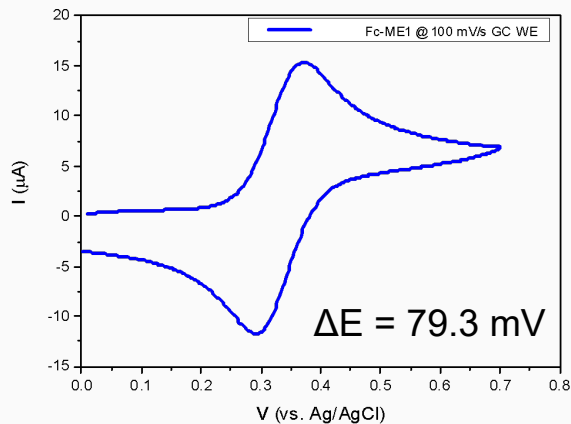
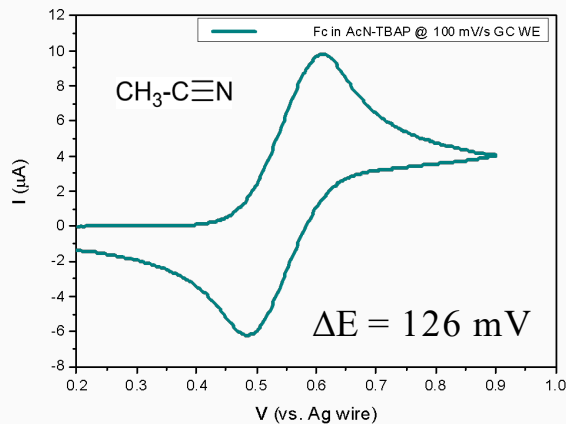
Microemulsion

- Organic salt costs/purity
- Conductivity losses
- Flammability/toxicity issues

Organic electrolytes

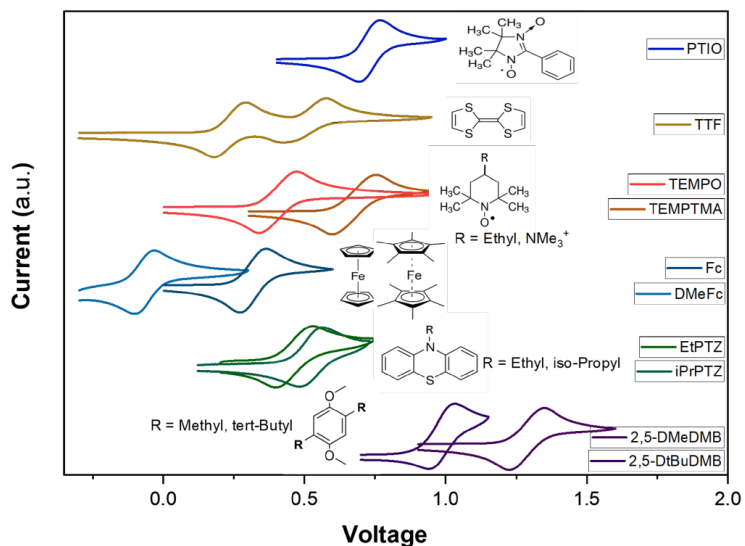


- Multi step synthesis
- Yield losses
- Scale-up production

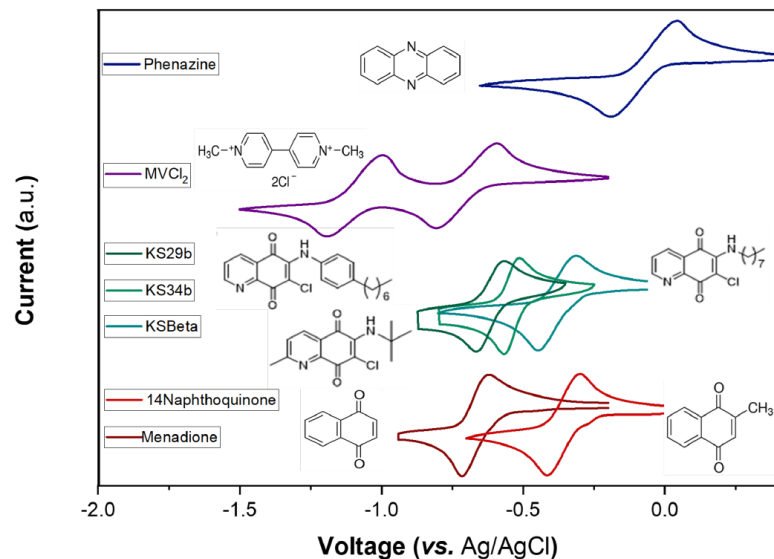


Redox-Active Molecules in Microemulsions

Catholytes



Anolytes



Allegro's new Microemulsion Technology

Features of Allegro's microemulsion batteries:

- low cost
- non flammable
- highly modular and expandable
- no rare or scarce materials
- patented platform technology



Oil & water

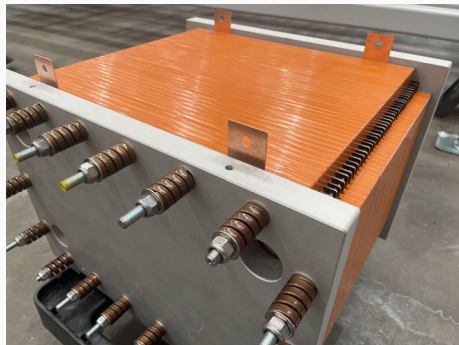
Emulsion

Microemulsion

Case study - Origin 100 kW BESS



Case study - Origin 100 kW BESS



Conclusions & Acknowledgements

- Microemulsion electrolytes offer a wealth of **new electrochemical options**
- Microemulsion electrolytes in flow batteries **suppress water-splitting** completely
- Microemulsion electrolytes in flow batteries enable the use of numerous **polar and non-polar active species** to be used in flow batteries



The Founders



Dr Fraser Hughson

Founder & CTO

- PhD Graduate in Chemistry from Victoria University of Wellington
- Co-inventor of Allegro innovative electrolyte platform patent
- Awarded a *KiwiNet "Emerging Innovator" grant* in 2020 to pursue the commercialisation of supercapacitors



Prof Thomas Nann

Founder & CEO

- 30 years' energy storage and nanotechnology research
- Helped spin-out 7 deep-tech startups
- Led NZ's MacDiarmid Institute (over 200 researchers)
- Raised many millions in funding for research and research institutions
- Co-inventor of Allegro's core IP



Dr Rohan Borah

Founder & CSO

- PhD at the University of Newcastle, 10 years in battery research
- Co-inventor of Allegro innovative electrolyte platform patent
- Awarded *Global Connections Fund, Bridging Grant 2020* for development of RFB technology



Next steps



Partner with us in pilot/lighthouse projects (RFB and supercaps)



Partner with us in research



Interested in being a future investor? [Contact me](#)

