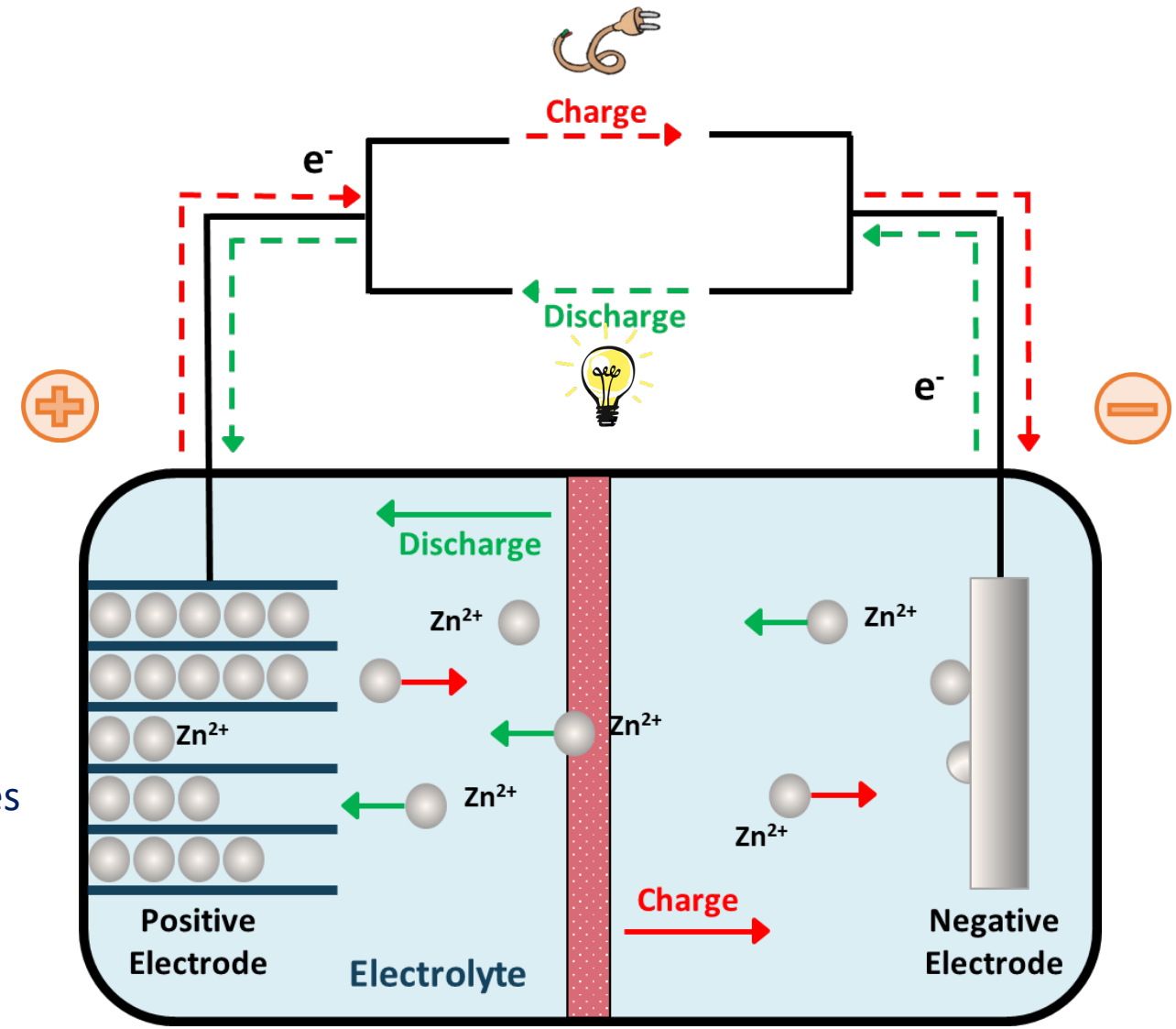
Aqueous Zn-Ion Batteries



Positive Electrode

- Manganese Oxide
- Vanadium-based compounds
- Prussian Blue Analogues

Zn (de-)insertion

Negative Electrode

- Metallic Zinc

Zn electrodeposition/ dissolution

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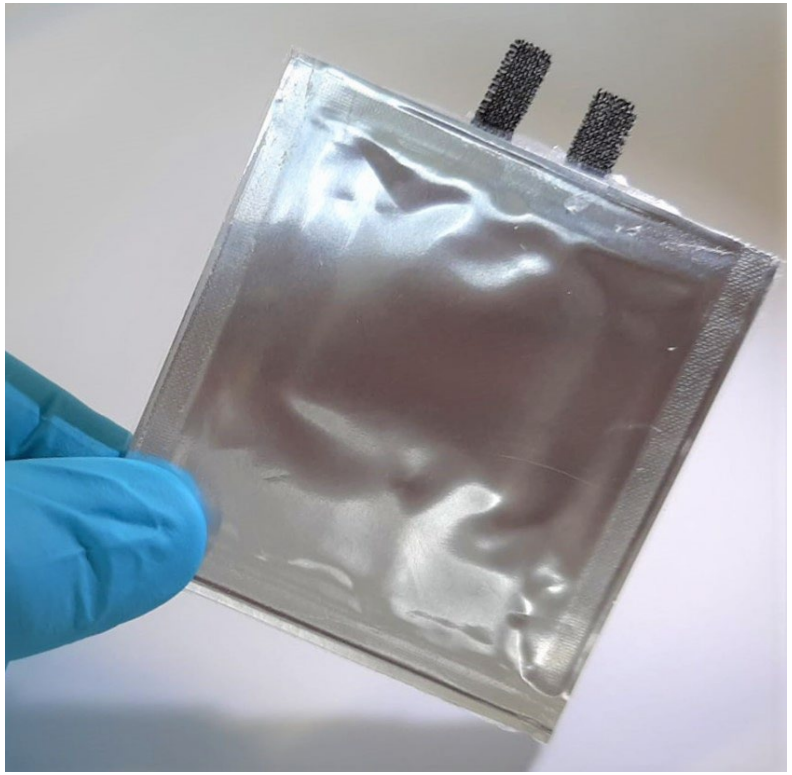
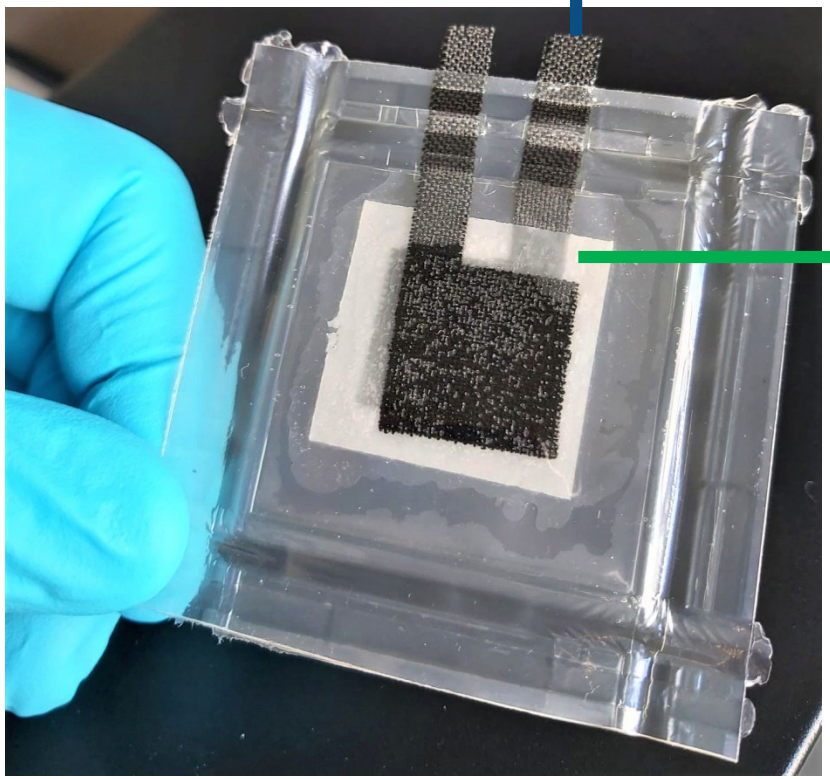
Aqueous Zn-Ion Batteries: Full Cell



MnO_2-based positive electrode (cathode)

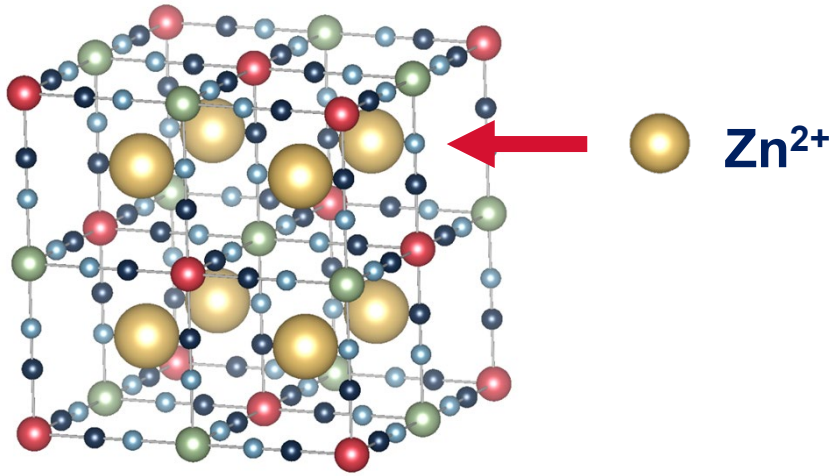
Zn-based negative electrode (anode)



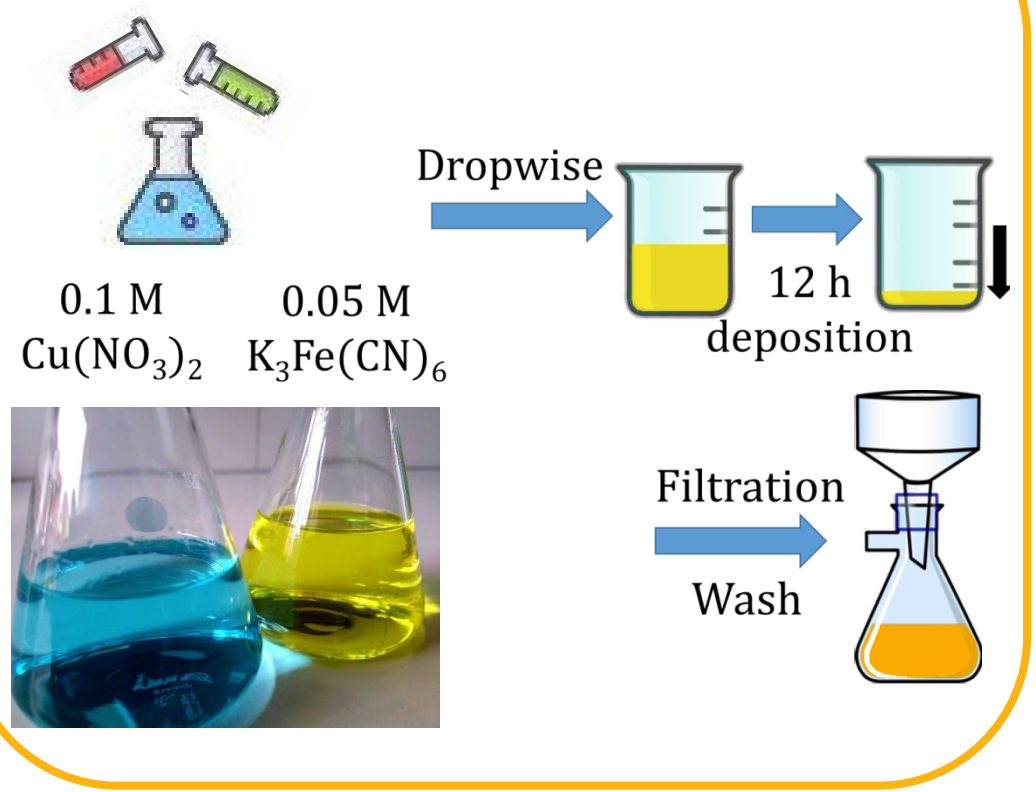
Separator with aqueous Zn^{2+}-containing electrolyte

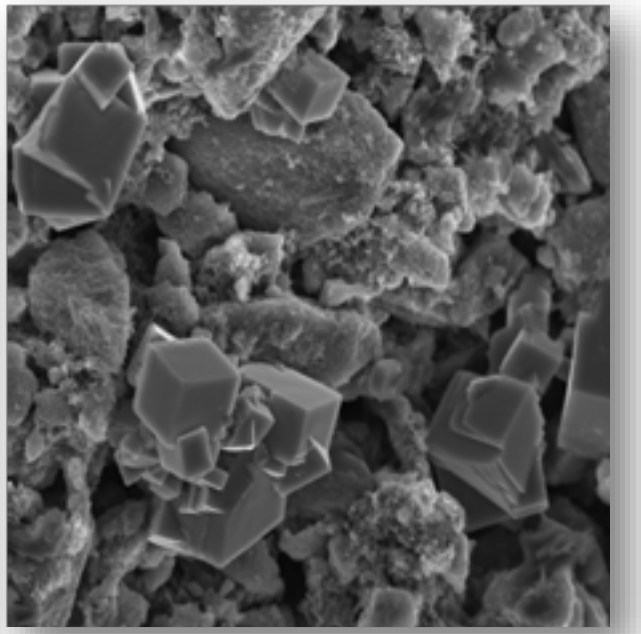
Copper Hexacyanoferrate - CuHCF

Copper Hexacyanoferrate $KCu[Fe(CN)_6]$



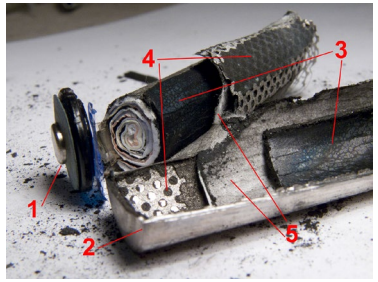
CuHCF synthesis





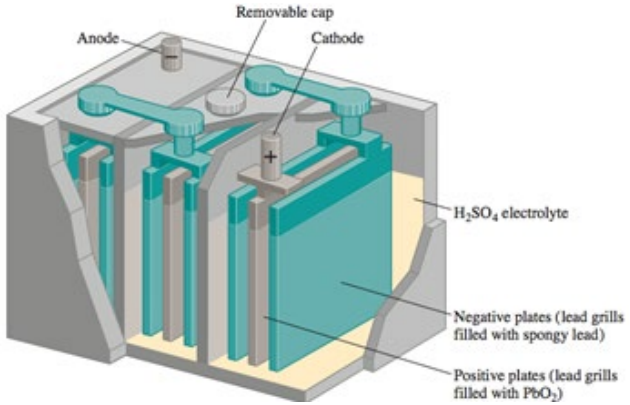
Commercially Available Aqueous Batteries

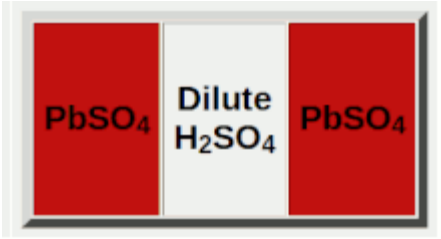
Nickel–metal hydride battery (NiMH)



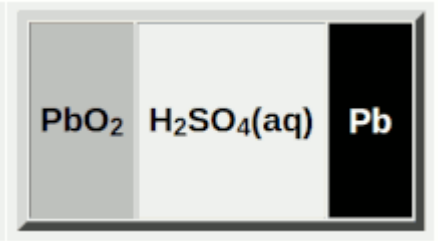
Nickel-Zinc battery (NiZn)

Lead-acid battery



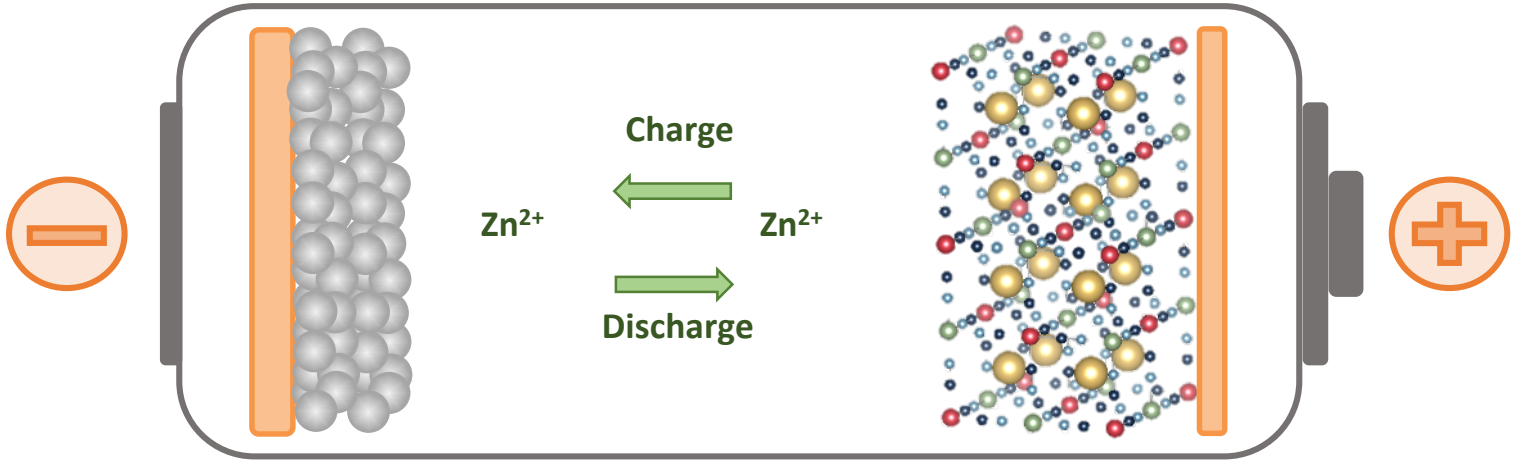


Discharged



Charged

Zinc Challenges



- High energy density
- Non-toxic
- Cheap

- Non-homogeneous Zn deposition (dendrite formation) → Alkaline pH
- Parasitic H_2 evolution reaction (reduced efficiency) → Neutral / Mild acidic pH

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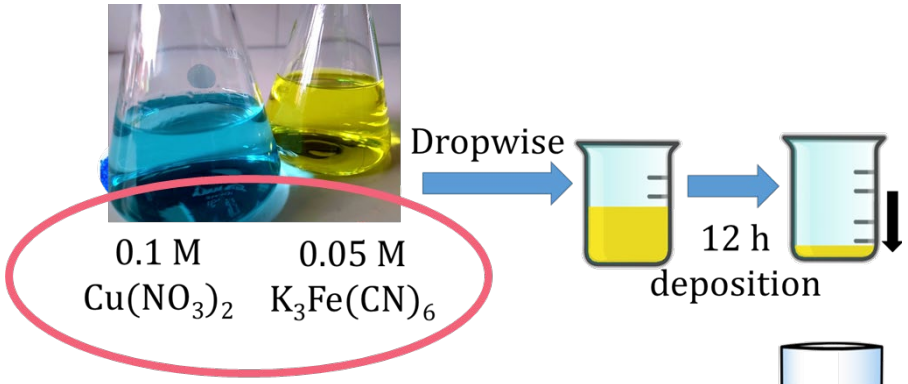

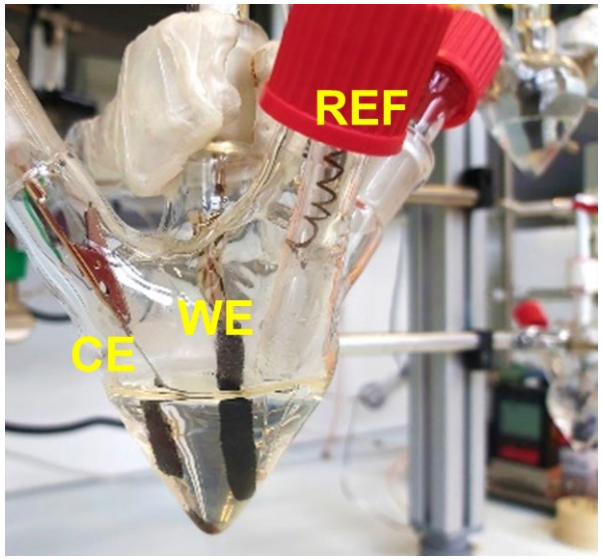

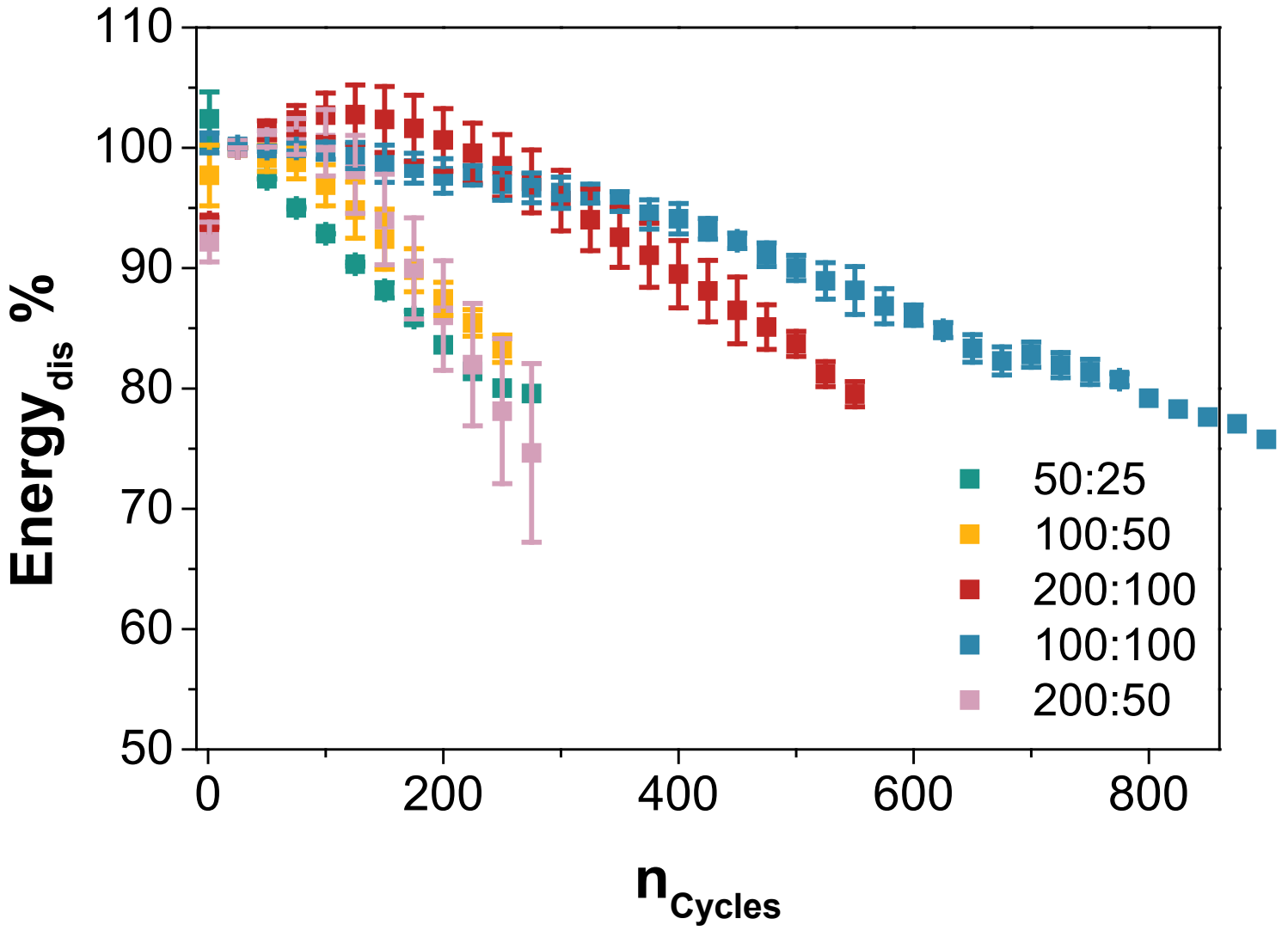

Zampardi, Warnecke, Tribbia, Glenneberg, La Mantia (2021) *Electrochem Commun*

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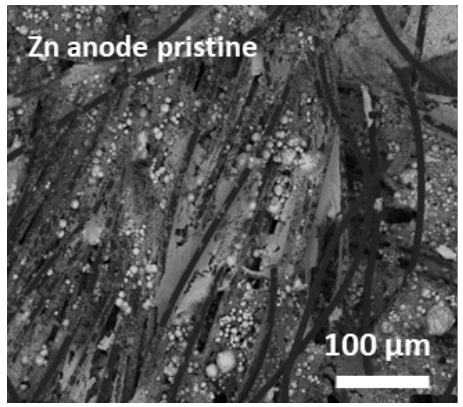
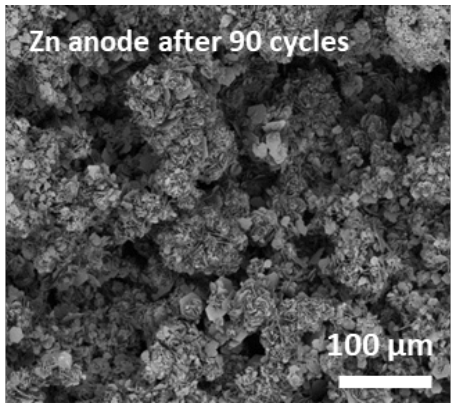
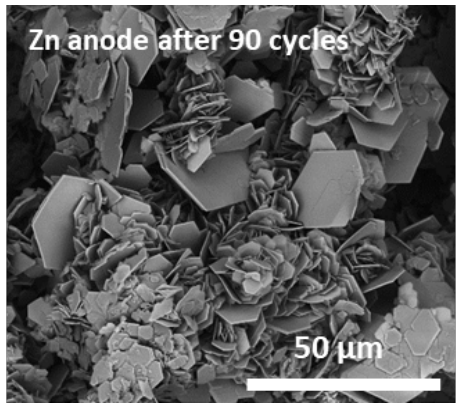
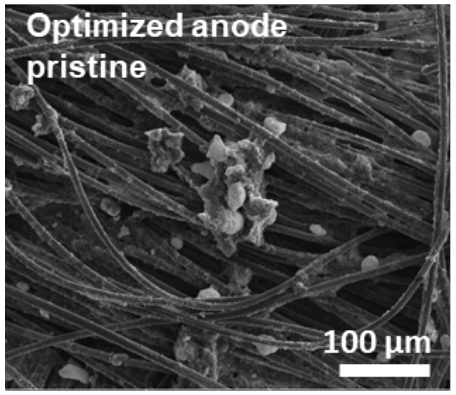
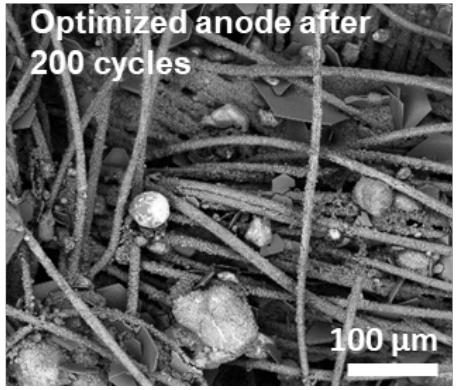
Our Research

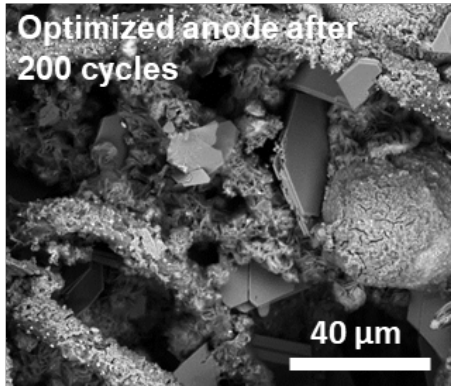


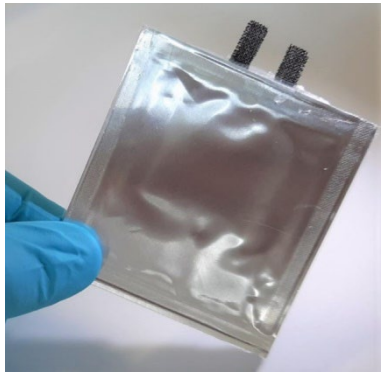




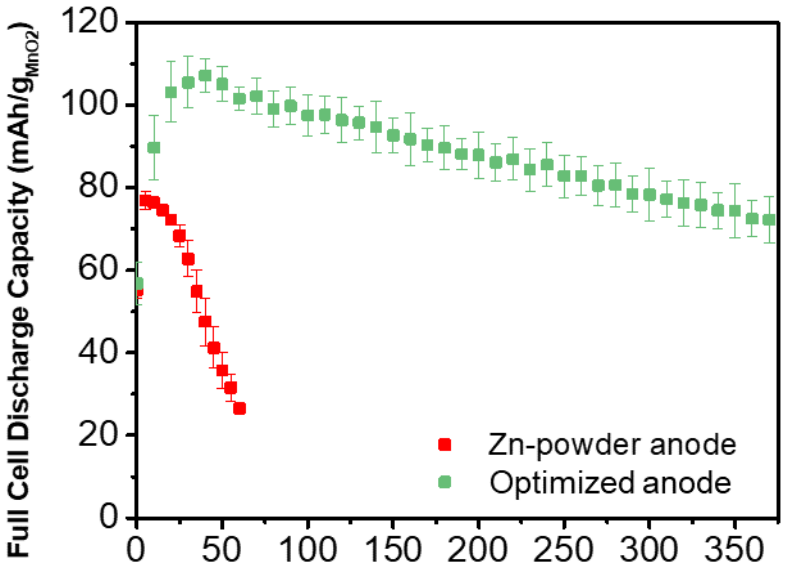


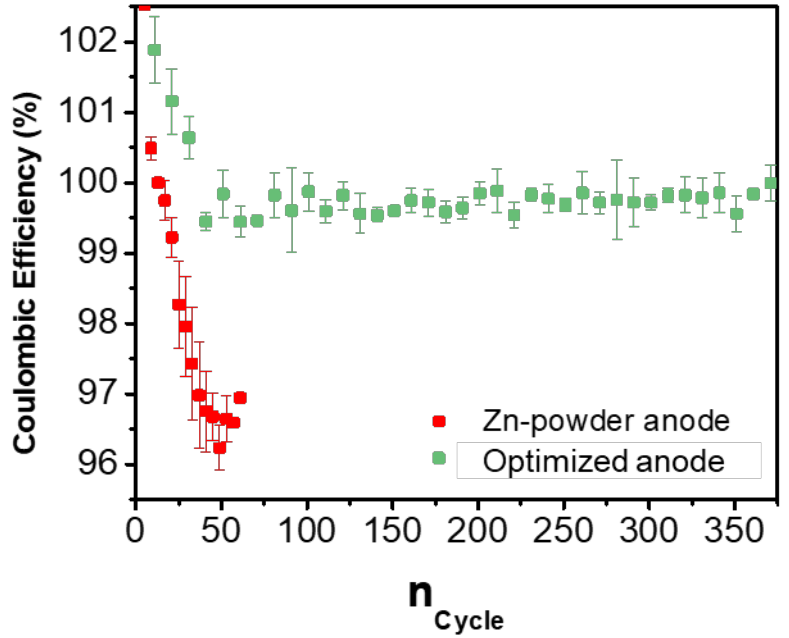






Optimized substrates for highly efficient Zn electrodeposition/dissolution





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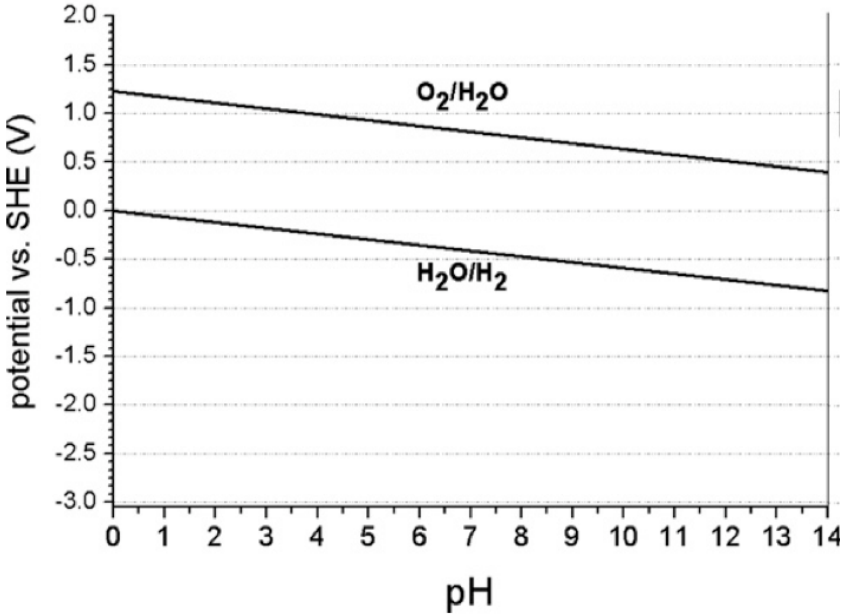
Aqueous Zn-ion Batteries

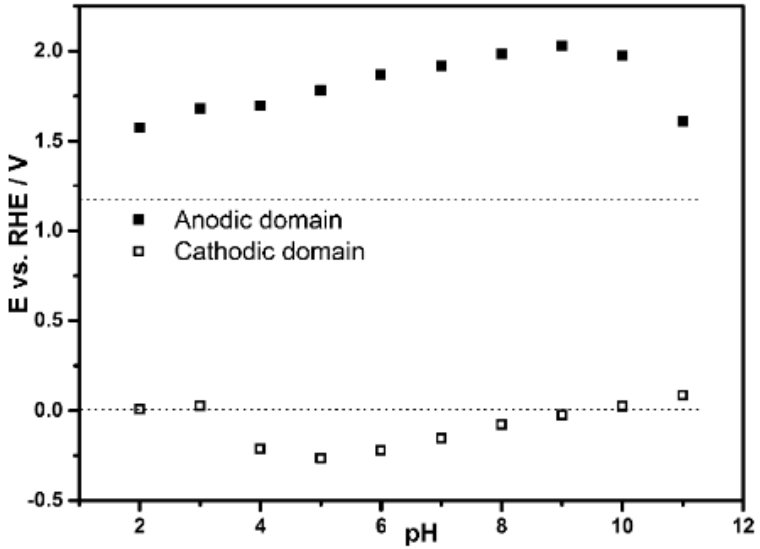
Advantages

- High power densities
- Cheap
- Non-toxic
- Environmentally friendly
- Sustainable
- Safe

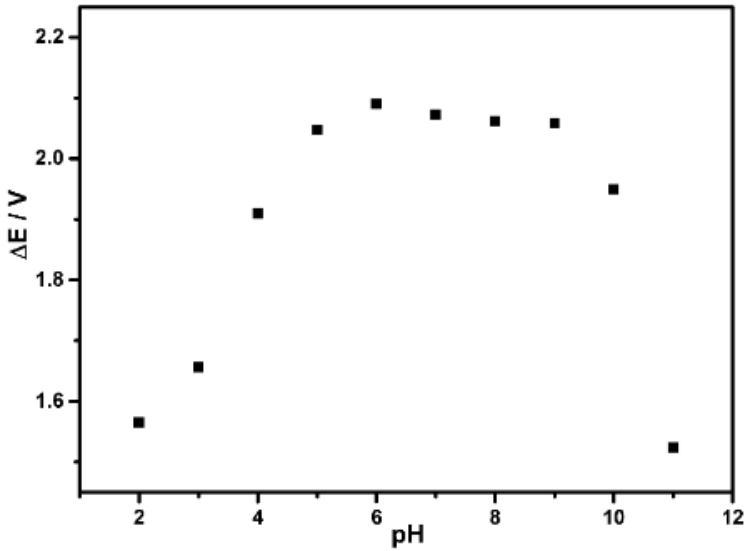
Water Splitting and Stability Window



Thermodynamic stability window of water



pH effect on the oxidation and reduction potential of water with 2 M Li_2SO_4

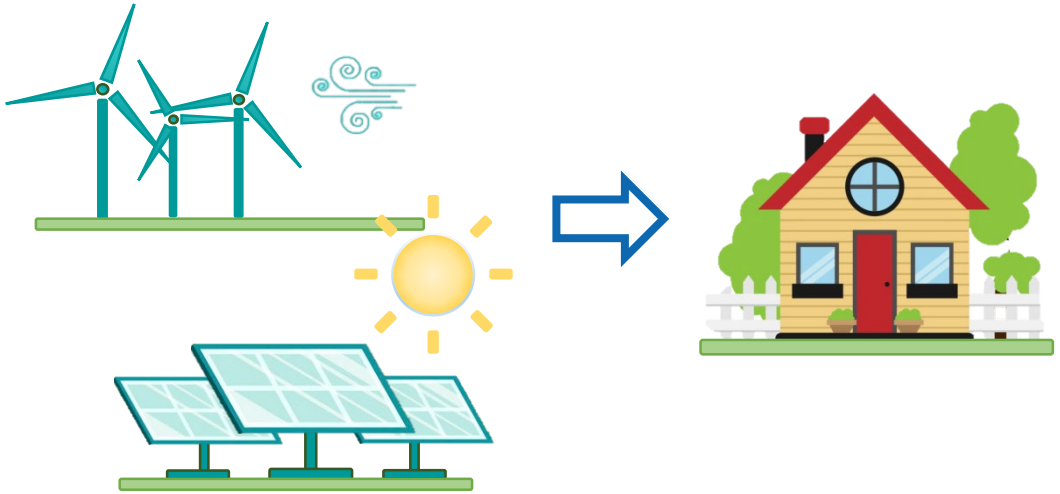


pH effect on the stability window of water with 2 M Li_2SO_4

Dushina, Stojadinovic, La Mantia (2015) *Electrochm. Acta*

Potential Applications of the Aqueous Zn-Ion Technology

Stationary energy storage from renewable sources



Medical devices