

Water Based Sodium Ion Batteries



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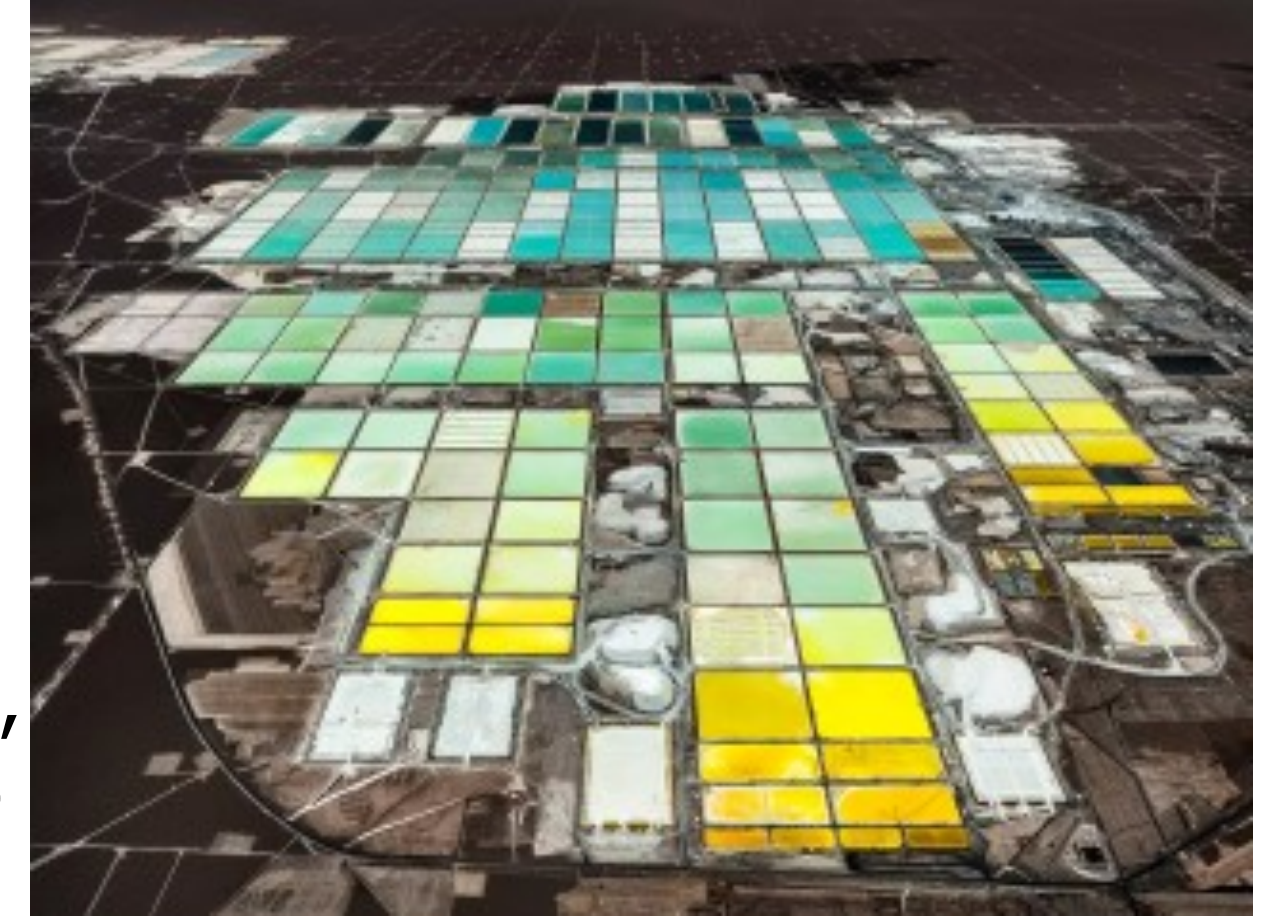
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How Sustainable are Lithium ion Batteries?



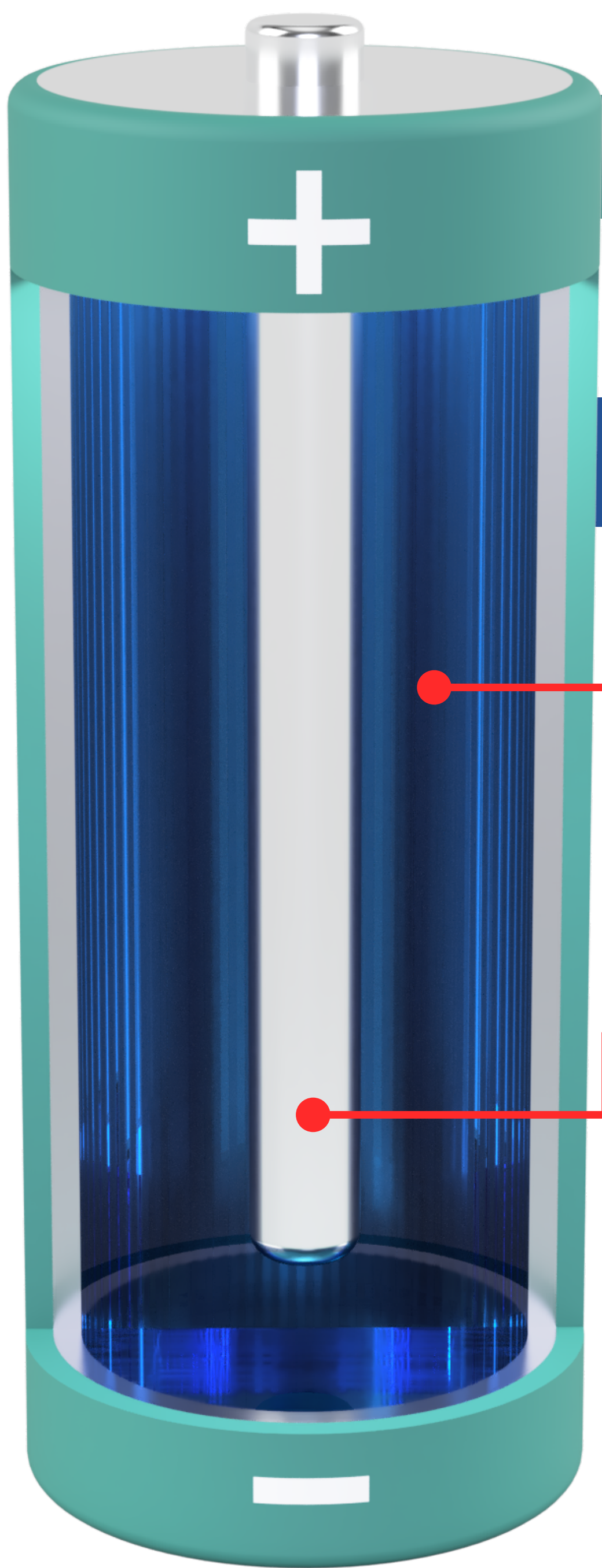
Rechargeable lithium ion batteries are responsible for the portable device and electric vehicle revolution, due to their high energy density. However, sources of lithium are relatively rare, requiring **2,000 tonnes of water** to be evaporated for each tonne of lithium carbonate, using environmentally destructive extraction methods. Furthermore, the use of flammable electrolyte gives rise to safety concerns.^{1,2}



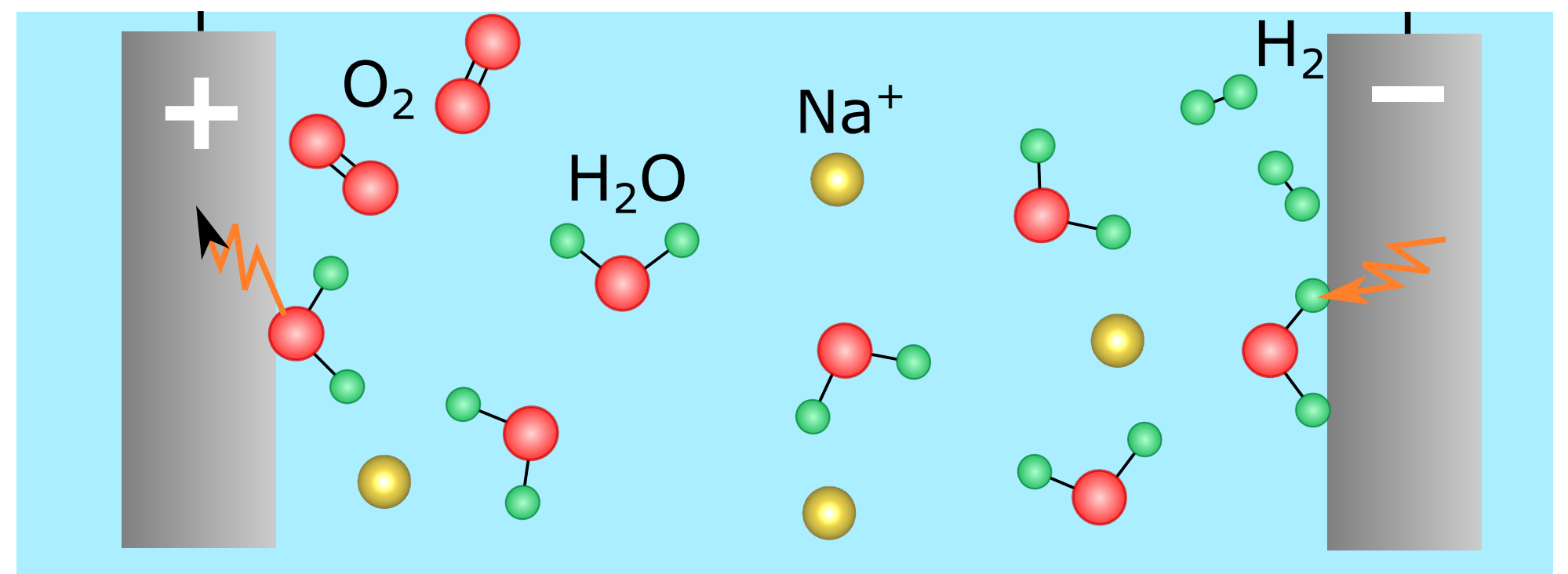
Sustainable and Safe Batteries

Sodium ion (Na^+) batteries can use ions from **sea water**, which is abundant and far less destructive to extract. Water based electrolytes prevent the risk of fire, improving battery safety.

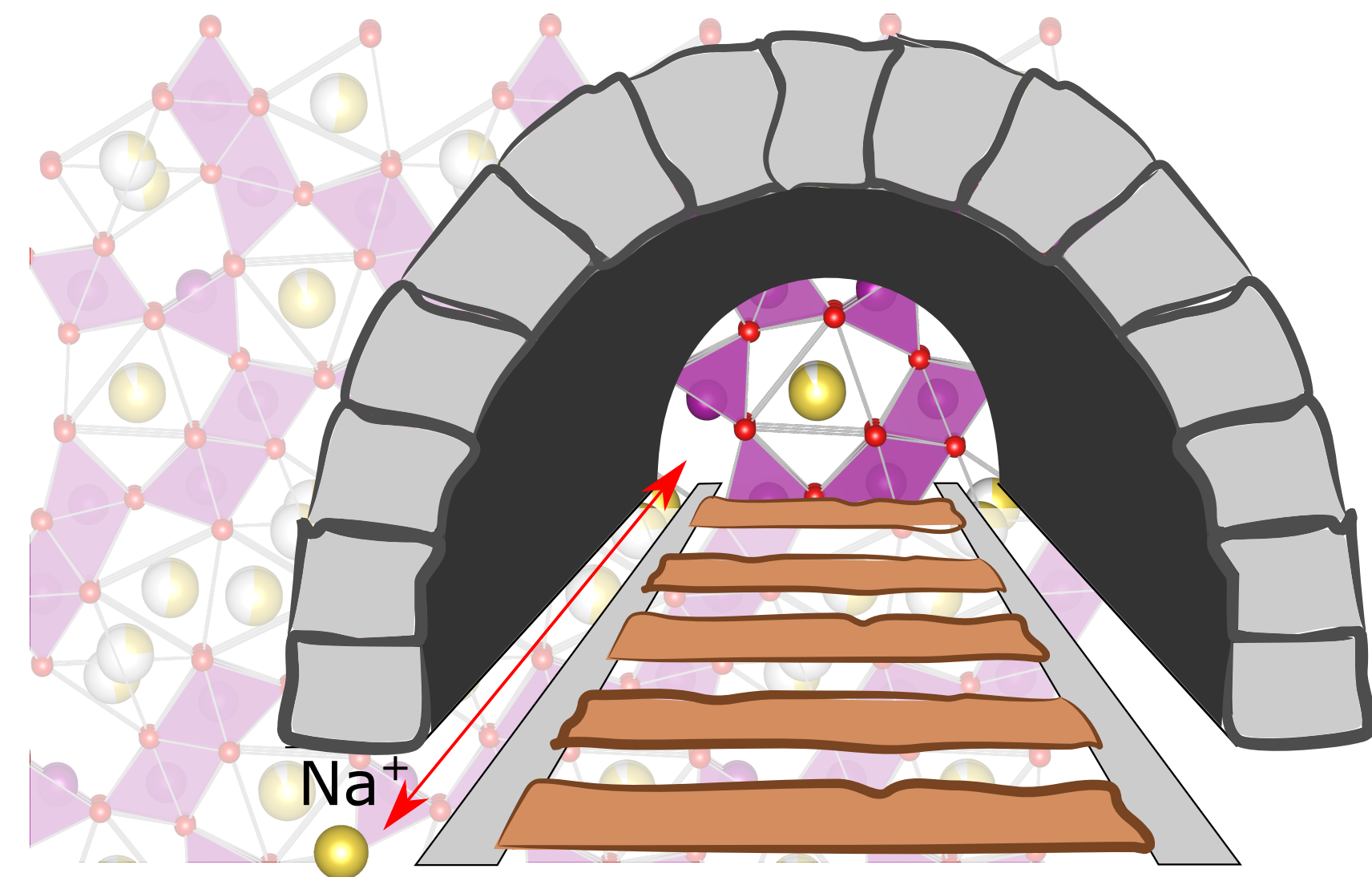
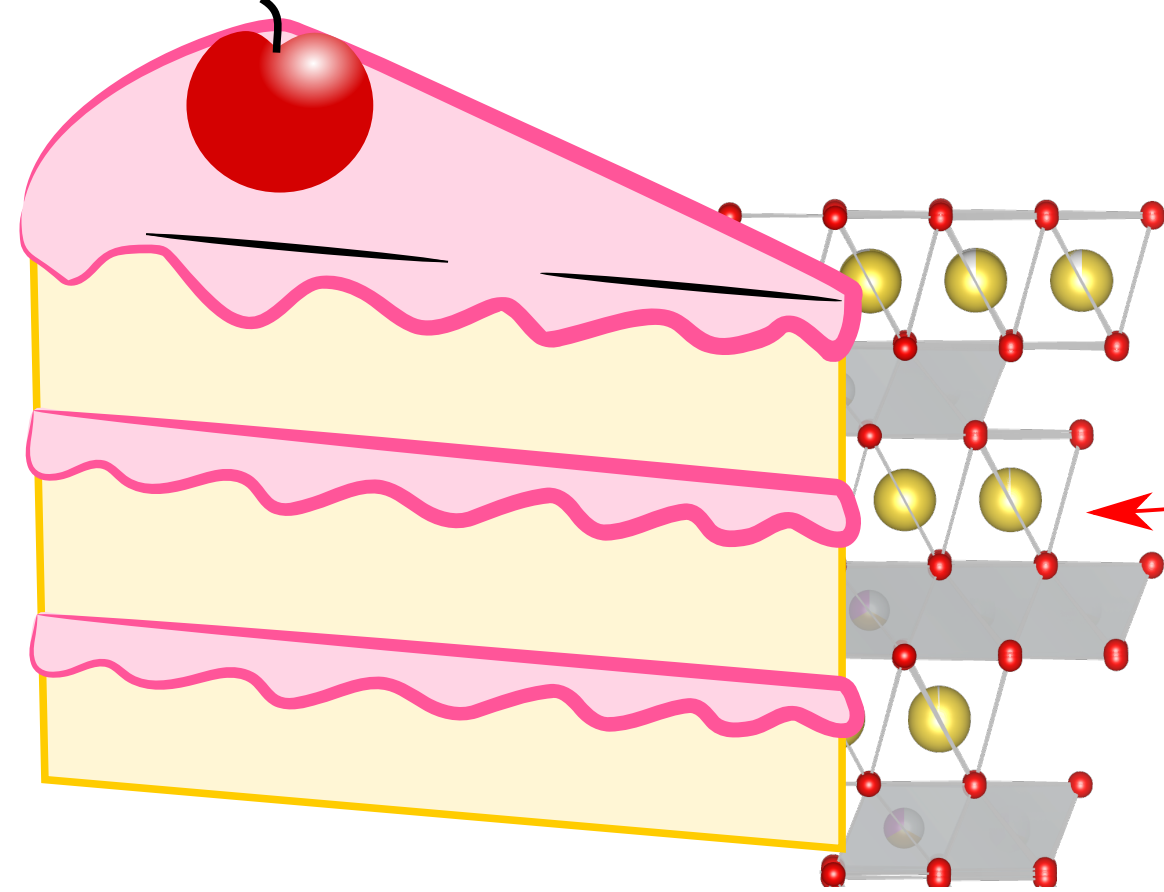
Our Approach



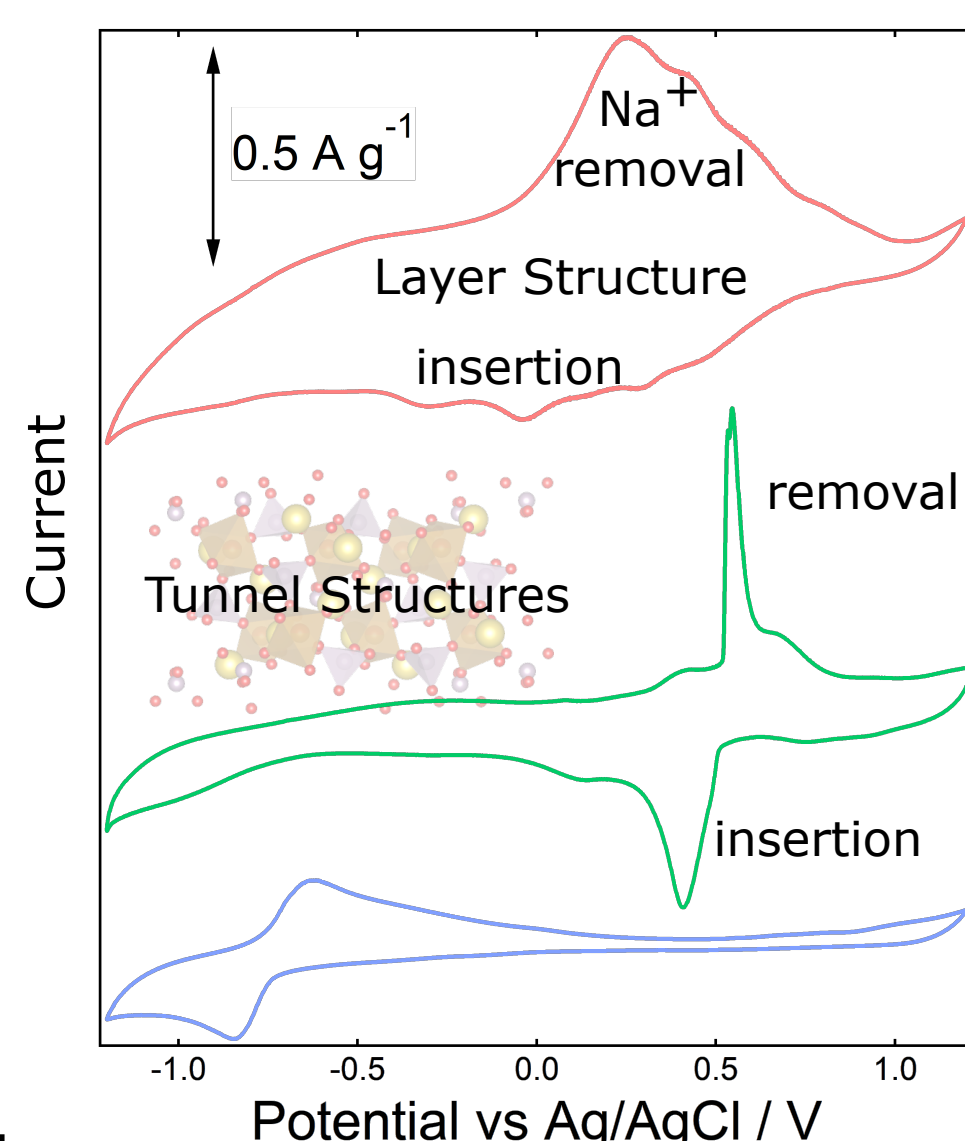
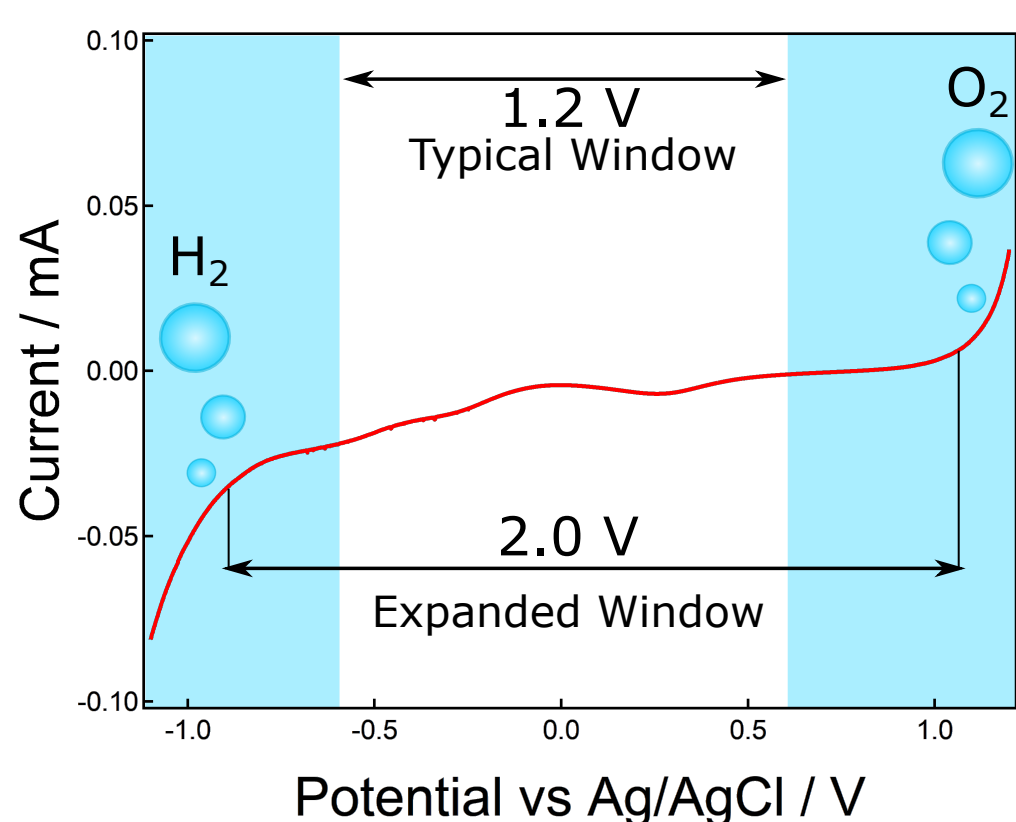
Expanded Voltage Window: neutral electrolyte is used to expand the voltage window of water to increase energy stored (without splitting water into H_2 and O_2).



New Electrode Materials: These reversibly store and release Na^+ , the materials were synthesised so that atoms are arranged in **layer** or **tunnel** structures.






Results



The voltage window of water was expanded, several new electrode materials were identified as active in the window, which makes them suitable for battery development.

The Future

-  Pouch cells will be made using water-stable current collectors and benchmark electrodes.
-  High throughput testing is underway to identify more new electrode materials.
-  New electrolytes such as WISE will be tested for a wider voltage window



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1. Rennie B Kuanda Potential environmental impacts of lithium mining, *Journal of Energy & Natural Resources Law*, 237-244, 2020.

2. Photo credit left: Edgar Su / Reuters Photo credit right: Tom Hegen