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STUDY OF MAGNESIUM REDOX FLOW BATTERIES

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Batteries and energy storage are becoming increasingly more important as our energy and transportation infrastructure continues towards clean and renewable resources. From intermittent renewable energy generation to electric vehicles, energy storage is a necessary component to facilitate a stable and reliable foothold towards improving our infrastructure. State-of-the-art lithium-ion (Li-ion) batteries have been the solution for many industries that require a high energy storage system due to its high specific capacity and rechargeability. Li-ion batteries, however, have a strong tendency to form electrochemical deposits—called dendrites—that once built up within the battery can compromise its cycle performance and safety. This problem has been extensively researched but with limited results. A promising alternative to the Li-ion batteries are redox flow batteries (RFBs). With the RFBs, a modular design electrochemical reactor is connected to variable size external tanks so that aqueous redox-active solutions (anolyte and catholyte) can be charged and discharged to store variable amounts of power. Due to this unique design, RFBs are a great solution for large-scale power grid and intermittent renewable energy storage. Currently, there are numerous related studies attempting to find low-cost, efficient and reliable electrolytes; highly permselective and durable membranes; low-cost, compatible redox-active solutions; and optimal flow patterns [1]. However, there has been little to no publication surrounding magnesium-based RFBs, even though there is a lot of promise with Mg capabilities and abundance in the Earth's crust—2% vs 0.002–0.006 wt% [2,3].

For these reasons, this research will test non-aqueous Mg RFBs using an organic electrolyte and tailoring the reactor's design and the cathode materials to combat limitations such as Mg dendrite formation and the solubility and cross-over of compatible catholytes. With this study, we will gain a better understanding of high-performance Mg RFBs potential development as well as how tailoring the structure of the cathode materials can improve RFBs in general.

References

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