DirectPlate™ $LiCoO_2$ as a redox membrane for direct electrochemical LiOH extraction from geothermal brine

Innovation tagline: Batteries from batteries

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To combat climate change, an ambitious net-zero carbon emission goal has been set by the U.S. government by 2050. Lithium-ion batteries (LIBs) are poised to play a critical role in this green revolution, from large-scale, grid energy storage to the electrification of the transportation sector. However, the massive adaptation of LIBs in the country's infrastructure will involve addressing major supply chain constraints of raw material, with the limited supply of domestic lithium being particularly critical. The Salton Sea region contains large amounts of lithium in geothermal brine and could be a secure source of lithium for the US. To date, no lithium extraction method is commercially available because of the chemically complex and aggressive nature of the brine.

For this prize competition, we propose to use Xerion's patented DirectPlate™ $LiCoO_2$ (DPLCO) as a lithium-ion selective redox membrane to extract LiOH directly from geothermal brine. DPLCO is a corrosion-resistant, mechanically robust LIB battery material that cycles lithium ion in and out upon electrochemical stimuli.

For phase 2, we have proposed a detailed extraction mechanism and conducted proof-of-concept experiments which will build off our phase 1 demonstration of the reversible uptake and release of lithium using DPLCO in a LiCl solution. In phase 1, via life-cycle cost analysis, we also showed a significant cost advantage using the proposed technology, made possible by the low-cost and energy-efficient DPLCO-based membrane technology. In phase 3, we plan to demonstrate continuous LiOH extraction. We will also design an industrial model and process flow, and carry out detailed analysis on extraction rate, energy consumption, life-cycle cost and environmental impact. We believe the DPLCO is one of the few membrane materials that can survive the harsh environment of geothermal brine. Our overarching goal is to turn this technology into an industrial process and in doing so contribute to the green revolution.

Video demonstration: https://www.ellipsis.tv/spl