Team TELEPORT:

Targeted Extraction of Lithium with Electroactive Particles fOr Recovery Technology

Geoffrey M. Geise, Gary M. Koenig, and Gaurav (Gino) Giri
University of Virginia, Charlottesville, VA
James Landon and Alan Rassoolkhani
PowerTech Water, Lexington, KY

The primary objective of this Phase 2 submission is to describe the rigorous design steps taken by Team TELEPORT to advance the concept proposed in Phase 1. Our activities include additional work in the laboratory to establish proof-of-concept for our intercalation-based lithium capture and release process and design calculations for an overall integrated system. Our Phase 2 efforts have positioned Team TELEPORT to build a prototype to demonstrate production of lithium hydroxide monohydrate from Salton Sea geothermal brine using our technology.

Our technology provides significant advantages over existing direct lithium extraction (DLE) technologies. Use of inorganic crystalline intercalation material facilitates highly selective capture of lithium from the brine. Exclusion of divalent ions and nearly all monovalent ions (other than lithium) coupled with the packed bed design enables processing of very high brine flow rates available during geothermal brine-based power production. Our intercalation material concentrates lithium in the solid by more than a factor of 750 relative to the concentration of lithium in the brine. Release of captured lithium can then be performed into a more concentrated lithium solution for downstream processing. This approach reduces the scale and cost of downstream processing, protects downstream processing steps from problematic brine components, and permits lower temperature operation of downstream processing equipment. Once released, lithium hydroxide will be produced in an electrolysis cell, which will also regenerate the oxidizing agent used to drive lithium release from the bed. In this manner, the downstream processing will largely be conducted using a closed loop system that will reduce water and chemical additive needs and costs. Once isolated, the lithium hydroxide will be crystallized to form the $LiOH{\bullet}H_2O$ product.

The Team TELEPORT approach will realize benefits over competing DLE approaches and technologies. First, the packed bed lithium capture step uses a low-cost and abundant intercalation material. This design choice means that scaling or other problems due to failure of the upstream silica removal step or other pretreatment steps can be mitigated by cleaning out and/or replacing the packed bed material as opposed to needing to replace costly membranes or complicated stack devices. In addition to protecting downstream equipment, the concentrating of lithium in the intercalation material means that downstream processing can be smaller and less expensive. Additionally, a closed loop system, facilitated by our approach, reduces chemical additive and water costs. These factors all lead to economic (i.e., below $4,000/mt lithium carbonate equivalent) and environmental benefits of the Team TELEPORT technology.