Docket #: S20-114

Lithium Extraction through Pulsed Electrochemical Intercalation Method

Stanford researchers have developed a new electrochemical method for extracting lithium from low concentration sources such as seawater. Despite containing 5000x more lithium than land and brine-based resources, the presence of sodium (4x that of lithium) in seawater has made clean extraction of lithium difficult. By using a TiO_2 -coated $FePO_4$ to intercalate lithium into the electrode, researchers were able to achieve high selectivity for lithium. In cases where the Li/Na molar ratio is greater than 10^{-3}, the diffusion barrier and thermodynamic intercalation potentials yield ~100% Li selectivity over Na. However, for seawater or water with lower Li/Na ratios, the pulse sequence developed here yields Li selectivity ~1.8×10^4 over Na. The pulse sequence additionally helps to stabilize the crystal structure, prolonging the electrode lifetime. This improved lithium extraction method is critical as the demand for lithium-ion batteries increases in the coming decades.

Stage of Research

- Proof of concept

Applications

- **Lithium-ion battery materials**
- Lithium extraction

Advantages

- **Lithium extraction from low concentration sources: seawater, lake water**
- Does not require pre-concentration of water into brine

Publications

- Liu et al. Joule (2020) "Lithium Extraction from Seawater through Pulsed Electrochemical Intercalation"

Patents

- Published Application: WO2021188570
- Published Application: 20230075724

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