Energy-Dense and High-Power Li-Cl₂/I₂ Batteries by Reversible Chemical Bonds

Authors: Pei Li, Chunyi Zhi

Abstract : Conversion-type lithium-ion batteries show great potential as high-energy-density, low-cost and sustainable alternatives to current transition-metal-based intercalation cells. Li-Cl₂/Li-I₂ conversion batteries, based on anionic redox reactions of Cl⁻/Cl⁰ or I⁻/I⁰, are highly attractive due to their superior voltage and capacity. However, a redox-active and reversible chlorine cathode has not been developed in organic electrolytes. And thermodynamic instability and shuttling issues of iodine cathodes have plagued the active iodine loading, capacity retention and cyclability. By reversible chemical bonds, we develop reversible chlorine redox reactions in organic electrolytes with interhalogen bonds between I and Cl for Li-I₂ batteries and develop a highly thermally stable I/I₃--bonded organic salts with iodine content up to 80% as cathode materials for the rechargeable Li-I₂ batteries. The demonstration of reversible chemical bonds enabled rechargeable Li-halogen batteries opens a new avenue to develop halogen compound cathodes.

Keywords: conversion-type, chlorine, halogen cathode, high energy density, iodine, interhalogen bond, lithium-ion batteries

Conference Title: ICAIE 2023: International Conference on Applied and Industrial Electrochemistry

Conference Location: Tokyo, Japan Conference Dates: October 09-10, 2023