

Electrochemical Lithium Harvesting from Waste Li-ion Batteries

Byron M. Wolfe III¹, Wen Chao Lee¹

¹Department of Mechanical Engineering, Purdue School of Engineering and Technology, IUPUI

This study demonstrates the feasibility of using water and the contents of waste Li-ion batteries for the electrodes in a Li-liquid battery system. Li metal was collected electrochemically from a waste Li-ion battery containing Li-ion source materials from the battery's anode, cathode, and electrolyte, thereby recycling the Li contained in the waste battery at the room temperature. The harvested Li metal in the battery system was discharged to produce the electricity by using water as the cathode. The discharge voltage of the water showed 2.7 V at 0.1 mA/cm² versus Li metal harvested from waste Li-ion batteries, compared to 2.8 V versus fresh Li metal at the same current rate. Since the electrodes for this proposed battery system are water and the contents of waste Li-ion batteries, the cost of the battery decreases, which is an attractive strategy for a large size energy storage application. The new design of a battery cell is accompanied in this research. The cell design has two anodes and one cathode which allow it to charge and discharge simultaneously. Thus far, the designs for the cell have been finalized, and will soon be machined so that testing may follow. This drives toward the hopes that an actual battery will be made which can directly harvest the Li metal from a waste Li-ion battery and gain energy immediately. This research will hopefully introduce a new, higher-energy-potential battery while using waste Li-ion batteries which will drastically reduce the cost of Li-ion batteries.

Mentors: Youngsik Kim and Joseph Huerkamp, Richard G. Lugar Center for Renewable Energy, Department of Mechanical Engineering, Purdue School of Engineering and Technology, IUPUI