CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38518

Project Title

Analyzing Electrochemical Effects of Ni Substitutions on Iron Silicate Compounds

Abstract

Objectives/Goals

The objective of this study is to determine the effect of substituting Ni in iron silicate compounds used in cathodes on the battery performance.

Methods/Materials

A Li ion cathode compound was synthesized using weighed masses of lithium carbonate, silicon oxide, nickel(II) chloride, and iron(III) chloride. A Li ion battery was assembled inside an Argon glove box. The Li ion battery was cycled for two weeks and the current and voltage of the battery were recorded.

Results

The Li ion battery after Ni substitutions had a capacity of approximately 105 milliamp hours per gram and was shown to reversibly cycle against Li with voltage plateaus at roughly 3.8 V. This work presents the enhancements that come from substituting Ni into pristine iron silicate cathodes, which have capacities of around 75 milliamp hours per gram and voltage plateaus of 2 V. This shows that the Ni substitutions improved the battery performance.

Conclusions/Discussion

The gained battery efficiency from the nickel substitution demonstrates the feasibility of a promising new group of earth-abundant cathode materials implementing nickel, significantly contributing to the sustainability of depleting natural resources.

Summary Statement

This project studies whether introducing nickel to an iron silicate compound used as a cathode in Li-ion batteries would improve battery performance.

Help Received

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