Developing Screening Methods for Dispersant and Conductive Carbon Additive Affinity for Lithium Ion Batteries

A Major Qualifying Project Report

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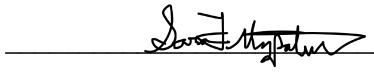
by



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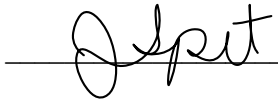

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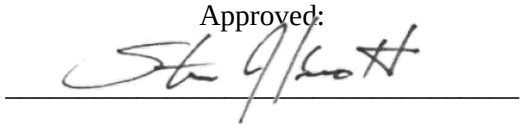

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Abstract

Battery technology and its improvement is a promising field for meeting global renewable energy goals. Cabot Corporation is currently working to develop materials, such as carbon conductive additives (CCAs), that could improve the capacity, energy density, and stability of lithium ion batteries. One problem with using CCA's, specifically carbon black (CB), is that they tend to agglomerate in battery systems. In a joint project with Cabot Corporation, we conducted research to develop a method for identifying polymers which could better disperse CB. We investigated several methods for determining affinity between CB and dispersants such as the use of adsorption isotherms, quartz crystal microbalance (QCM), and particle size analysis (PSA). Our largest problem with assessing affinity was finding a method to separate the carbon black from the samples. To overcome this challenge, we investigated filtration and ultracentrifugation. We concluded that the use of filtration to prepare the samples for the adsorption isotherms is the most promising method to assess CB-dispersant affinity and we provide recommendations for refining this method in this report. We also outline recommendations for further trials of QCM with the hope that more conclusive results can be obtained.

Note that the experimentation and data collection for this MQP ceased on March 6, 2020 due to disruptions from the rapid spread of pandemic caused by the COVID-19 virus. WPI and the Commonwealth of Massachusetts mandated a stop to all nonessential activities. This paper includes data obtained up to that date.

This MQP contains information deemed confidential to the business interest of the industrial sponsor. Due to this, the remainder of the report has been redacted. Please contact Stephen Kmiotek at sjkmiotek@wpi.edu for additional information.