Title of dissertation- Stabilization of Si and Graphite based anodes for LIB Using BIAN Type Conjugated polymer/Poly (lithium acrylate) Binder

Abstract

Energy storage systems have become integral for sustainable living, moving away from crude oils and fossil fuels. This thesis delves into the hierarchy of primary energy sources, their harvesting methods, associated disadvantages, and environmental impacts, while exploring sustainable alternatives. Focusing on lithium-ion battery (LIB) technology, it examines the evolution of crucial components defining LIB performance, such as the solid electrolyte interphase (SEI), its composition, integrity, and thickness affecting Li ion diffusion and battery efficiency. Emphasis is placed on binders and electrolyte additives influencing SEI development, particularly highlighting BIAN-based polymers and LiPAA for their mechanical and electrochemical characteristics in enhancing fast charging and SEI stabilization. The thesis aims to investigate the structural and chemical qualities of bis(imino)acenaphthene (BIAN) compounds, leveraging them to develop innovative BIAN-based functional polymers as binders for high-performance LIB anodes. Chapter 1 provides an introductory overview, while Chapter 2 details the utilization of a BIAN-LiPAA composite polymer in graphite-based anodes, facilitating extremely Fast Charging (XFC) via strategic modifications. Building upon these successes, Chapter 3 explores the synthesis of another BIAN-based composite polymer to stabilize silicon-based anodes. Chapter 4 consolidates and summarizes the research outcomes, presenting findings from the investigation into BIAN-based polymers and their impact on LIB anode performance. This thesis culminates in a conclusive reflection on the potential and significance of BIAN-based functional polymers as crucial components in advancing the efficiency and stability of high-performance LIBs.

Keywords-

BIAN-paraphenylene copolymer, lithium polyacrylate, extreme fast charging, high capacity, SEI.