ABSTRACT

Considering the governing issues like greenhouse effect and global warming, green energy is one of its importance. Efficient energy sources are very essential to develop owing to the continuous decline in fuel reservoirs and day by day increase in energy demand. In various energy storage technologies, lithium-ion batteries still stand tall to meet the future energy needs especially for the on-going huge demand for plug-in hybrid and electric vehicles. The main problem regarding lithium-ion battery is the choice of cathode material. Currently, $LiCoO_2$ is considered as the most exploited and extensively used cathode material in the present market. It is very effective but has some limitations in term of life span, cost, power density and safety. The focus of this thesis is to synthesize a cathode material that is cost effective, better cyclability and have high power density for its application in various industries. Former battery chemistries till developed have yet achieved practical capacity of 140 mAh/g that is half of its theoretical capacity (273 mAh/g). Based on the literature survey, aluminium and zirconium are selected as a dopant in Li-rich $LiCoO_2$ because of their numerous advantages and natural abundance. Five different compositions have been developed by using hydrothermal technique and sintered at a relatively lower temperature (800°C). XRD, FESEM, EDX, FTIR and CV are used for structural analyses and electrochemical study of all the samples. XRD results confirm the formation of α-$NaFeO_2$ crystal structure with R3m space group while maintaining better crystallinity. FESEM reveals the reduction in particle size from microns to the nano level. Cyclic voltammetry (CV) depicts the better electrochemical performance with the working potential of 4.18 V, higher anodic & cathodic current and reversibility of 91.13% is achieved by doping 1.5% Zr & 8.5% Al among all the samples.