Abstract

Li-ion batteries offer great promise for future plug-in hybrid electric vehicles (PHEVs) and pure electric vehicles (EVs). One of the challenges is to improve the cycle life of Li-ion batteries which requires detailed understanding of the aging phenomenon. In situ techniques are especially valuable to understand aging since it allows monitoring the physical and chemical changes in real time. In this study, in situ atomic force microscopy (AFM) is utilized to study the changes in morphology and particle size of $LiFePO_4$ cathode during discharge. The guidelines for in situ AFM cell design for accurate and reliable measurements based on different designs are presented. The effect of working electrode to counter electrode surface area ratio on cycling data of an in situ cell is also discussed. Analysis of the surface area change in $LiFePO_4$ particles when the cell was cycled between 100% and 70% state of charge is presented. Among four particles analyzed, surface area increase of particles during Li intercalation of $LiFePO_4$ spanned from 1.8% to 14.3% indicating the inhomogeneous nature of the cathode surface.

Citation

DE Demirocak & B Bhushan. In-situ atomic force microscopy analysis of morphology and particle size changes in LiFePO4 cathode. Journal of Colloid and Interface Science, 2014, 423, 151-7.