

NOVEL ACOUSTIC EMISSION AND XRD IN-SITU CELL FOR CHARACTERIZATION OF LITHIUM ION BATTERIES

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The deployment of an electrical vehicle fleet requires the development of a safe, reliable, and affordable portable energy source. Lithium ion batteries (LIB) are a prime candidate for this role and their potential has already been amply demonstrated by their success in portable electronic devices. However, some issues must be addressed before LIB's can be scaled up to transportation applications. As lithium intercalates and de-intercalates active electrode materials, stress and strain develop in many active electrode materials which can lead to fracture and degradation. This manifests as a drop in cell capacity and a shortening of a LIB's operating lifetime.

Acoustic emission (AE) is nondestructive technique capable of recording ultrasonic sounds that may arise from events such as cracking or bubbling. AE has been applied to the in situ study of battery materials as they are cycled. This technique provides a time resolved picture of when and to what extent different events occur. In order to correlate lattice parameters and phase composition with the onset of fracture detection a novel in situ method that combines AE and X-ray diffraction (XRD) has been developed. Mylar disks sputtered with a thin layer of copper were laminated with a silicon composite electrode and assembled in a coin cell versus lithium foil. The coin cell hardware was modified to include a window through which X-rays could penetrate the thin Mylar disk to the active material.

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