ELECTRONICS

Stability of cathode slurry for lithium-ion battery

Introduction

Lithium ion batteries have applications in laptops, mobile phones, cars and even airplanes as they offer a high energy density and low self-discharge. However, aqueous cathode slurries are subject to strong particles agglomeration leading to an alteration of the mechanical properties of the electrode and a shorter shelf life. Polymers such as Poly(acrylic acid) (PAA) are classically used to improve the particles stability by adsorption. In this application note, stability of cathode slurry was investigated for dispersions of $LiFePO_4$ (LFP) and Carbon Black (CB) particles supplemented with PAA in function of the pH to understand polymer adsorption effect on stability

KEY **BENEFITS**

FAST

OBJECTIVE

SENSITIVE

Reference

Effect of pH on the dispersion stability of water based cathode slurry with poly(acrylic acid) as a binder, Kim Do Hoon, Master report from Seoul National university, South Korea.

Battery electrode slurry stability challenges

Electrode coating slurries are complex systems, which contain a large percent of solid particles of different chemicals, sizes and shapes, dispersed in a highly viscous media. Cathode slurry contains active material, conductive agent, binder and solvent. However these components can present various challenges:

- Preparation of the electrodes for the rechargeable batteries requires the use of organic solvents such as NMP which are toxic and high cost.
- Carbon black (CB) is widely used as conductive agent but causes agglomeration problems.
- Cathode slurries have serious agglomeration problems leading to mechanical properties weakness and shorten shelf life.
- PAA binder is proposed for aqueous processing as it plays a role of dispersant in water-based slurries. But LFP and CB dispersibility in PAA depends on slurries' pH, or polymer structure: linear PAA polymer can adsorb on the particles.

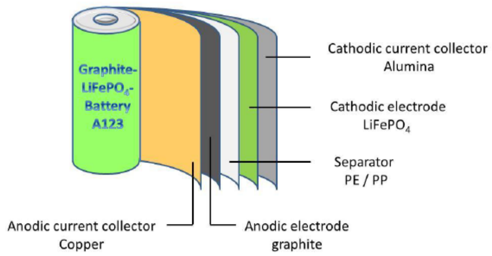

Figure 1. LFP battery composition

Materials & Methods

In this study, two dispersions were studied at various pH conditions (3.0, 6.0, 7.7 and 12).

Dispersed particle	Concentration	PAA supplement
$LiFePO_4$	10^{-1} vol%	10^{-2} wt%
CB	10^{-3} vol%	$0.5.10^{-3}$ wt%

These preparations were dispersed in water and analyzed for 12 hours using the Turbiscan Lab equipment.

Reminder on SMLS technique

Turbiscan® technology, based on static multiple light scattering, consists on illuminating a sample with an infrared light source and acquiring backscattered (BS) and transmitted (T) signals over the whole height of the sample. By repeating this measurement over time, the instrument enables to monitor physical stability.

$$\boldsymbol{BS\ and\ T} = \boldsymbol{f}(\varphi, \boldsymbol{d}, \boldsymbol{n_p}, \boldsymbol{n_f})$$

The signal is directly linked to the particle's concentration (φ) and size (d) according to the Mie theory,with refractive index of continuous (n_f) and dispersed phase (n_p) being known parameters.