Efficient Li-ion battery production with XRF

Online analysis of metals in cathode active material (CAM)

The Li-ion battery (LIB) manufacturing industry is experiencing substantial growth, driven by the escalating demand for enhanced energy solutions. This increase is primarily driven by advances in cathode active materials (CAM), which are the core for energy storage and release within batteries.

Additionally, an increasing number of countries are mandating the use of electric vehicles (EVs), while automotive manufacturers are committing to decrease internal combustion engines.

The cathode foil of LIB batteries consists of a thin layer of lithium-metal-oxide salts often referred to as the cathode slurry or CAM. The efficiency of the battery is influenced by the impurities present; as well as the consistency in size, shape, and dispersion of the CAM particles and its precursor product, the pCAM.

To ensure consistent CAM quality, Metrohm has developed the 2060 XRF Process Analyzer. This analyzer can quantify a wide range of elements within the CAM slurry simultaneously, using the fast and non-destructive XRF technique.

Metrohm
Process Analytics

CAM SLURRY MONITORING WITH XRF ANALYSIS

Cathode active materials typically consist of either layered metal oxides, such as lithium cobalt oxide (LCO), or ternary metal oxides, like lithium nickel manganese cobalt oxide (NMC). During the precursor precipitation process, the concentrations of transition metals of both the sulfate solutions and the resulting cathode material after calcination with lithium is critical for optimizing production costs and cycle life in lithium ion batteries.

Traditionally, CAM slurries, or electrode coating solutions, have been monitored using techniques such as wet chemical analysis (e.g., titration) or inductively coupled plasma (ICP) spectrometry. While these methods offer valuable insights, they have limitations of their own. These methods are time-consuming, labor-intensive, and destructive, limiting sample availability and potentially overlooking critical elements or contaminants in the CAM slurry's composition.

WHY ONLINE MONITORING

- **Improved battery performance** – By ensuring consistent CAM quality and energy density and stability.
- **Multi-elemental analysis** – a wide range of elements within the CAM slurry can be monitored simultaneously.
- **Direct analysis** – No need for any sample dilution or acid digestion.
- **Early detection of outliers** – avoid reprocessing or under/overdosing of chemicals.
- **Fast, non-destructive analysis** – quick response to process variations without destroying the sample.

Metrohm Process Analytics offers a turnkey solution for the monitoring of cathode material during LIB production. The **2060 XRF Process Analyzer** stands out as a versatile solution to optimize CAM slurry monitoring and ensure the production of high-performance, sustainable batteries.

BENEFITS FOR 2060 XRF PROCESS ANALYZER

- **Multiple analysis techniques** in one platform (XRF with titration, photometry)
- Versatility to accommodate **multiple and diverse process streams** and conditions (20 sampling points)
- Multiple analysis of a **broad spectrum of chemical elements**, spanning from magnesium to uranium (z=12 to 92)
- Outstanding precision and accuracy even at **low detection limits** (from mg/L to weight percent (wt%) concentrations
- **Rapid response**, durability, minimal upkeep, non-destructive and reagent-less operation