

● Outline of analysis methods for Li-ion batteries

TNE0002

Overview

We provide a comprehensive contract analytical service for batteries, from disassembly through sampling of the materials to measurement and analysis. In analysis and evaluation, we use the method of analysis best suited to the purpose, whether it be analysis of the composition of the materials, purity analysis or qualitative analysis etc. The following table provides a summary of the methods used to analyze the individual structural components of batteries.

Table. Methods of analysis of Li-ion batteries

Information derived		Method of analysis	Positive	Negative	Electrolyte	Separator
Morphology	Morphology	SEM、TEM	○	○		○
	Elemental distribution	FE-EPMA	○	○		
	Elemental distribution	X-ray CT	○	○		○
Surface composition	Elemental information Variation in composition	XPS	○	○		
	Variation in composition	FT-IR	○	○		
	Membrane (polymer)	LC-MS、GPC、 FD-MS	○	○		
Active material	Inorganic material	ICP-AES, ICP-MS	○	○	○	
Inorganic material	Crystal size	XRD	○	○		
carbon	Lattice constant			○		
	Metallic lithium	Solid NMR				
Binder Organic composition Degraded components	Compositional ratio	TGA	○	○		
	Binder components	Extraction-FT-IR, PyGC-MS	○	○		
	Separator layer structure	Imaging IR				○
	Electrolyte composition	GC-MS			○	
	Polymer	LC-MS、GPC、 FD-MS			○	
Trapped gases		GC	Interior of sample			

SEM: Scanning electron microscopy
TEM: Transmission electron microscopy
EPMA: Electron probe microanalyzer
X-ray CT: X-ray computer tomography
XPS: X-ray photoelectron spectroscopy
LC-MS: Liquid chromatography-Mass spectrometry
GPC: Gel permeation chromatography
FD-MS: Field desorption-Mass spectrometry

ICP-AES: Inductively coupled plasma-Atomic emission spectroscopy
ICP-MS: Inductively coupled plasma-Mass spectroscopy
XRD: X-ray diffraction
NMR: Nuclear magnetic resonance
TGA: Thermogravimetric analysis
PyGC-MS: Pyrolysis gas chromatographic-Mass spectrometry

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