

Outline of Analysis Methods for Li-ion Batteries

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 1 Methods of analysis of Li-ion batteries

Information derived		Method of analyses	Positive	Negative	Electrolyte	Separator
Morphology	Morphology	SEM, TEM	✓	✓		✓
	Elemental distribution	FE-EPMA	✓	✓		
	Internal structure	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 Electrolyte	ICP-AES, ICP-MS	✓	✓	✓	
Inorganic material	Crystal size Lattice constant	XRD	✓	✓		
Carbon	Metallic lithium	Solid NMR		✓		
Binder	Compositional ratio	TGA	✓	✓		
	Binder components	Extraction-FT-IR, PyGC-MS	✓	✓		
	Separator layer structure	Imaging IR				✓
Organic composition	Electrolyte composition	GC-MS			✓	
	Polymer	LC-MS, GPC, FD-MS			✓	
Degraded components						
Trapped gases		GC	Interior portion 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 spectrometry
 XRD: X-ray diffraction
 NMR: Nuclear magnetic resonance
 TGA: Thermogravimetric analysis
 PyGC-MS: Pyrolysis gas chromatographic-Mass spectrometry

Created by SCAS: <http://www.scas.co.jp/analysis/pdf/tn291.pdf>

<p><i>Total solution partner for analyses, measurements, and evaluations.</i></p> <p>SCASS SCAS SINGAPORE PTE LTD</p>	<p>[Laboratory] 17 Sakra Road, Pulau Sakra, Singapore 627886 [Office] 2 Jurong East Street 21, #04-02 IMM Building, Singapore 609601 E-mail: scass@scass.com.sg WEB site: http://www.scass.com.sg/</p>
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