Application Note BATT0004

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Chemical Composition Analysis of NMC Cathode

Wavelength Dispersive X-ray Fluorescence Spectroscopy (WDXRF) enables non-destructive and precise elemental analysis from major components to trace impurities down to ppm levels. The use of Standardless Fundamental Parameters (FP) analysis enables simple and quick quantification without requiring sample-specific calibration curves. The results from WDXRF studies of Ni/Co/Al (NCA) and Ni/Co/Mn (NMC) molar ratios for the Lithium cathode materials NCA and NMC (shown below) are comparable with ICP-MS analysis. Trace amounts of Fe in NMC cathode can be clearly detected using WDXRF with Rigaku's ZSX Primus IV spectrometer.

WDXRF standardless FP analysis method enables simple and quick elemental quantification from major components to trace impurities down to 10 ppm.

Sample: NCA (0.80/0.15/0.05)

	Al	Co	Ni
XRF	0.042	0.156	0.803
ICP	0.05	0.15	0.80

Sample: NMC (0.85/0.10/0.05)

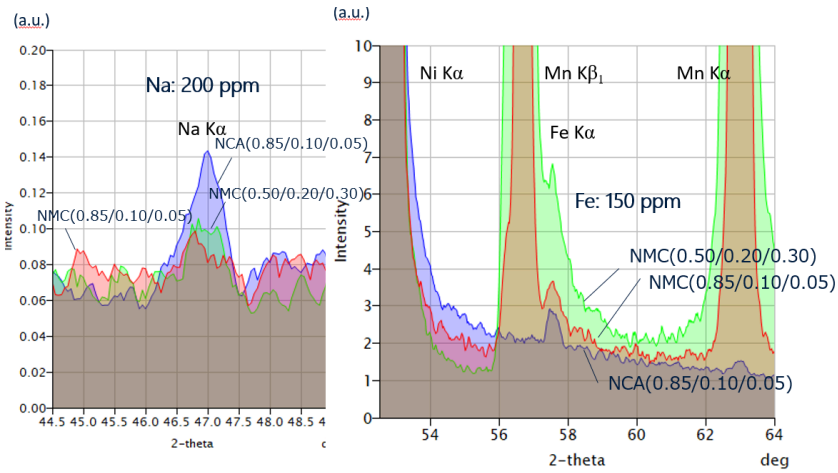
	Mn	Co	Ni
XRF	0.056	0.098	0.846
ICP	0.05	0.10	0.85

Sample: NMC (0.50/0.20/0.30)

	Mn	Co	Ni
XRF	0.309	0.201	0.490
ICP	0.30	0.20	0.50

Standardless FP analysis results for cathode material samples. The results are shown in molar ratios as x values in $LiMxO_2$. The ICP analysis values are also shown.

WDXRF spectra of NCA and NMC cathode materials



Fe impurities in NMC cathode samples, which are difficult to detect with energy dispersive XRF (EDXRF) due to peak overlapping with Mn Kβ line, can be analyzed using wavelength dispersive XRF (WDXRF).

Related products

ZSX Primus IVi

High-power, tube-below, sequential WDXRF spectrometer wi th new ZSX Guidance expert system software

ZSX Primus IV

High power, tube above, sequential WDXRF spectrometer wi th new ZSX Guidance expert system software

ZSX Primus III NEXT

Affordable, high-end, tube-above Industrial WDXRF for the a nalysis of solid samples