



Lithium-Ion Battery Fire Residues Analysis

EMSL Analytical, Inc. provides testing for lithium-ion battery fire residues in the Materials Science Laboratory. The major chemical components in lithium-ion batteries (LIB's) are:

- Lithium combined with a metal oxide (*for cathode*)
 - Lithium + Cobalt Oxide
 - Lithium + [Nickel + Cobalt+ Aluminum] Oxides
 - Lithium + [Nickel + Cobalt+ Manganese] Oxides
 - Lithium + [Nickel + Cobalt+ Manganese+ Aluminum] Oxides
- Lithium + [Aluminum + Titanium] Phosphate (*alternative for cathode*)
- Silicon-Carbon or Graphite (*for anode*)
- Lithium Hexafluorophosphate LiPF_6 (*electrolyte*)
- Fluoropolymers (*as binders*)
- Polymers (*as separator*)

Analyte	Method	Sampling Guide and Additional Information
Li	ICP-MS	<ul style="list-style-type: none"> • For air sample: 37 mm MCE cassette. 1-4 L/min, min 100 liters • Ghost Wipe or Invis-Wipe for surface sampling; 100 cm² suggested. • Min 2 grams bulk residue.
Ni, Co, Mn, Al, Ti, P	ICP-MS	<ul style="list-style-type: none"> • Ghost Wipe or Invis-Wipe for surface sampling; 100 cm² suggested. • Min 2 grams bulk residue. • <i>NIOSH 7300 for air (see current price book)</i>
Fluoride	IC	<ul style="list-style-type: none"> • Alcohol prep wipe for surface sampling; 100 cm² suggested. • Min 2 grams bulk residue.
<i>Hydrofluoric Acid/HF</i>	IC	<ul style="list-style-type: none"> • <i>NIOSH 7906; Area sampling only, not for personal monitoring</i>

Note: It is suggested to start the lithium-ion battery fire residue investigation with lithium as target analyte because it is not a common element in the environment. For a more comprehensive investigation, analysis for additional metals and fluoride/HF should be added.

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