



## GET COMPETITIVE INSIGHT ON BATTERIES IN CUTTING-EDGE CONSUMER ELECTRONICS

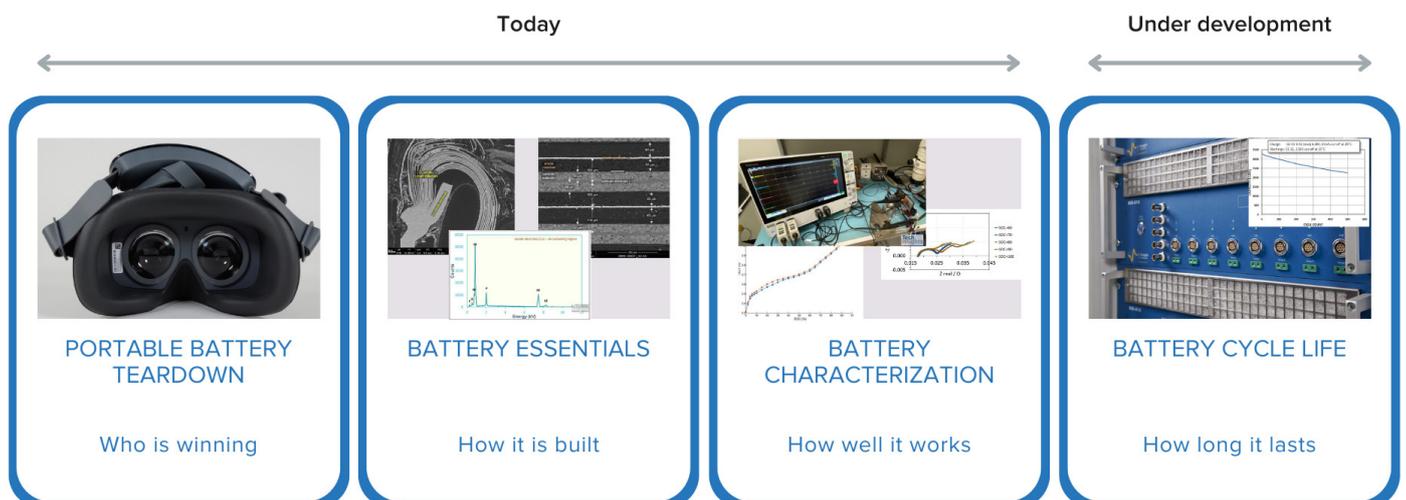
Given the critical role rechargeable batteries play in mobile phones, tablets, laptops, wearables, portable tools, and other consumer products, there continues to be significant investment in new battery technologies resulting in a constant stream of innovation news releases and claims.

Innovations are seen in the areas of battery life, energy density, cost reduction, charging speed, temperature performance, and battery management complexity.

With an abundance of rechargeable battery options and new battery innovation claims in the market, it is difficult for Product OEMs, Battery pack/cell OEMs and battery materials suppliers to understand which battery technologies are being used by industry leaders and how they are being used in real-world products.

To address these challenges, TechInsights offers a range of Battery Subscriptions, each focused on a different level of practical battery analysis.

The subscriptions work together to provide a complete picture for companies that need to make product development, pack and cell development, or other important business decisions related to rechargeable battery technology.



WHO	SUBSCRIPTION BENEFITS
Product OEMs	<ul style="list-style-type: none"> <li>• Make educated product level decisions on selecting and incorporating battery packs, cells, Battery Protection Control Modules (PCM), and battery ICs of innovation news releases and claims.</li> <li>• Understand the capacities/sizes/costs of the battery pack/cells and Battery ICs used in a broad range of consumer electronics</li> <li>• Identify innovative battery packs/cells and battery technologies used by other industry leaders</li> <li>• Discover how to optimize performance and charging time of the battery without compromising other factors (i.e., safety, charging time, temperature, cost, etc.)</li> <li>• Understand battery functional and thermal characteristics</li> </ul>
Battery pack/cell OEM	<ul style="list-style-type: none"> <li>• Make informed decisions in product development and better understand competitors</li> <li>• Gain visibility into design wins, capacities/sizes/costs of the battery pack/cells, battery performance, and thermal characteristics of competitors</li> <li>• Identify innovative materials, structures and manufacturing processes used in new battery cells</li> </ul>
Battery materials suppliers (anode, cathode, separator, electrolyte, foil and raw material providers)	<ul style="list-style-type: none"> <li>• Understand opportunities to grow market share</li> <li>• Identify target companies in the market to engage</li> <li>• Understand whose cells are seen most often and understand potential volumes</li> <li>• Identify materials, amounts used, and chemistry/foil requirements for leading battery cells and how they advance performance</li> </ul>

## Portable Battery Teardown

Provides information on the source device, rechargeable battery packs, battery cells and battery management ICs found in mobile phones, tablets, laptops, wearables, and other products.

Content includes:

- 1 year subscription covering over 200 devices in 2022 and over 470 devices from 2020 and 2021
- Source Product information including product type, product model, country of purchase
- Battery pack information including brand, part number, pack voltage, pack capacity rating, pack dimensions (L, W, H, Weight)
- Battery cell information including cell cost estimates, number of cells per pack
- Source product, battery pack, battery cell and battery protection control module images
- Identification of Protection Circuit Module (PCM) battery ICs
- Information delivered through the TechInsights Platform

## Battery Cell Essentials

The Battery Cell Essentials channel extends the depth of the Battery subscription by profiling the innovations impacting battery life extension, energy density, safety, cost reduction, charging speed, etc. The analysis includes materials and structural analysis (anode, cathode, electrolyte and separator) of innovative Li-ion Battery cells found in phones, wearables, laptops, tablets, pens and more. The analysis will also show details on the battery pack, its fit in the source device and the components found on the battery protection control module.

Content includes:

- 1 year subscription targeting approximately 8 reports
- Source Product Analysis Product Teardown Images
  - Product Teardown Images
  - Measurement of battery fit while “in-place” in the product. Double sided tape, etc.
  - Protection Control Module images and cross section with measurements
  - Battery management IC images
  - Flexible Printed Cable Images from pack to system

- Non-invasive Cell Analysis
  - Battery voltage and weight
  - Battery images and x-rays (cell, tabs, edges)
  - Measurement of unraveled folding tape
- Basic Cell Characterization
  - Differential Capacity Analysis (dQ/dV)
  - Electrochemical Impedance Spectroscopy
  - At different states of charge (0%, 25%, 50%, 75%, 100%)
- Cell Structural Analysis
  - Optical microscopy of features including electrode geometry and estimated total cell area (unfolded electrode images). SEM microscopy of features:
    - Anode current collector thickness and Anode active layers
    - Separator, including separator active layers, if present
    - Cathode current collector thickness and Cathode active layers
    - Casing layers thickness (in the case of pouch cell characterizations)
- Materials Characterization
  - High resolution SEM with SEM-EDS of Anode and Cathode
  - Current collector
  - Active materials
  - SEM-EDS of casing (for pouch cells)
  - SEM-EDS of separator (if separator contains ceramics)
  - FTIR of Separator
  - GCMS of electrolyte composition
  - XRD on anode and cathode (case-by-case)
  - XPS on anode and cathode in cases where detailed elemental composition is required (case-by-case)
  - ICPMS of the electrolyte to determine concentration of lithium salts dissolved in the electrolyte (case-by-case)
  - Raman of the electrodes to detect presence of graphene/r-GO (case-by-case)
  - Additional tests might be included if specific
- Information delivered through the TechInsights

## Battery Characterization

The Battery Characterization channel covers cells from a range of market applications, with a focus on Mobile and smaller (wearable, pens, etc.) formfactors from leading OEMs. The analysis provides insight into the devices' thermal characteristics during wireless and wired charging as well as lithium-ion battery performance during operation over a range of different conditions.

Content includes:

- 1 year subscription targeting approximately 8+ reports
  - PDF report and image folders
  - Excel summary aggregating essential data from delivered reports
- 2 briefings summarizing findings
- System level analysis
  - Charge characterization and thermal analysis
- Cell level analysis tests
  - Open Circuit Voltage (OCV) curve and hysteresis effect, dQ/dV analysis, and EIS measurement at different SOCs
  - Linear scanning voltammetry of the cell (done on cells with high impedance)
  - Charge characteristics (C/3 CCCV charge to Vmax, 0.05C current cutoff)
  - Direct current internal resistance (DCIR) following the IEC 61960 standard
  - Discharge Characteristics (-10 °C, 0°C, 10°C, 25 °C, 45°C X 0.2C, 0.5C, 1C and 2C)



**For over 30 years TechInsights has been a trusted patent and technology partner to the world's largest and most successful companies including 37 of the top 50 U.S. patent holders.**

By revealing the innovation others can't see inside the broadest range of advanced technology products, we prove patent value and enable business leaders to make the best, fact-based IP and technology investment decisions. Headquartered in Ottawa Canada, TechInsights delivers specialized products and services from global offices.

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