

Global Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries Market 2026 by Manufacturers, Regions, Type and Application, Forecast to 2032

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Abstracts

According to our (Global Info Research) latest study, the global Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries market size was valued at US\$ 34.57 million in 2025 and is forecast to a readjusted size of US\$ 1057 million by 2032 with a CAGR of 62.8% during review period.

Ultra-high-nickel NCM cathode active material for semi-solid-state batteries refers to a powdered layered oxide primarily based on $\text{LiNi}_{1-x-y}\text{Co}_x\text{Mn}_y\text{O}_2$ -type $\text{LiNi}_{1-x-y}\text{Co}_x\text{Mn}_y\text{O}_2$, in which nickel accounts for at least 90 mol% of the transition-metal layer. The material is specifically engineered for batteries using a solid–liquid hybrid electrolyte composed of a solid electrolyte together with a limited amount of liquid or gel electrolyte.

These materials employ single-crystal or structurally reinforced particles, bulk-element doping, concentration-gradient design, residual-lithium control and functional surface coatings—including oxides, phosphates, borates, niobates or solid-electrolyte-derived layers—to improve interfacial compatibility and lithium-ion transport. Such modifications suppress oxygen release, particle cracking, parasitic interfacial reactions, impedance growth and thermal instability under high states of charge, thereby enabling high specific capacity, high energy density, acceptable cycle life and improved safety.

The market scope covers cathode active material powders and integral functional coatings incorporated into the material, including merchant sales and equivalent-value captive transfers. It excludes NCM precursors, lithium salts, conductive additives, binders, separately supplied solid electrolytes, coated cathode sheets, battery cells and

battery packs.

Key Findings

Ni90–<95 materials remained the largest nickel-content segment due to stronger production maturity, safety balance and customer qualification

Electric vehicles led demand, while drones, eVTOL aircraft and robotics provided faster premium-product qualification channels

Competition remained concentrated among customer-qualified suppliers with proprietary particle design, interface coatings and scale-up capabilities

Market Trends

The market is shifting from simply increasing nickel content toward the coordinated design of particle morphology, bulk chemistry and cathode–electrolyte interfaces. Single-crystal and quasi-single-crystal products are gaining importance because their lower grain-boundary density can reduce intergranular cracking and gas generation, although optimized polycrystalline secondary particles remain commercially relevant because of their mature production processes and competitive capacity performance. Surface treatment is evolving from conventional protective oxide coatings toward multilayer composite coatings and fast-ion-conducting interphases that simultaneously suppress side reactions and maintain lithium-ion transport. Ni₉₀–<95 products are moving through pilot production and customer validation, while Ni₉₀–<95 products continue to underpin near-term commercial programmes. Material suppliers are also integrating residual-lithium management, low-cobalt formulation, gradient structures and more precise particle-size distribution control. Commercial transactions are increasingly based on jointly developed customer-specific specifications rather than standardized spot grades, so pricing reflects raw-material content, coating complexity, production yield, qualification status and committed supply volume. The exceptional transition of the BASF Shanshan and WELION project from development to mass production within approximately one year illustrates the accelerating but highly collaborative commercialization model.

Market Dynamics

Drivers

The principal demand driver is the requirement for higher cell-level energy density without relying exclusively on a fully solid electrolyte architecture that remains difficult to manufacture at scale. Semi-solid-state batteries provide a transitional route that retains part of the manufacturing base of conventional lithium-ion batteries while improving safety and enabling high-capacity cathodes, silicon-rich anodes or lithium-metal-related designs. Long-range premium electric vehicles represent the largest near-term demand source, while drones, eVTOL aircraft, humanoid robots and other weight-sensitive equipment create demand for high specific energy and high discharge power. Commercial adoption is also supported by the expansion of customer-qualified Ni90-series materials, new semi-solid vehicle programmes and cooperation between cathode producers and specialist solid-state battery developers.

Restraints

Market expansion is constrained by the limited number of semi-solid-state battery programmes that have reached stable mass production. Cathode materials are normally developed against a specific electrolyte, electrode formulation and cell process, resulting in long verification cycles and limited interchangeability between customers. Ultra-high nickel also raises the requirements for precursor consistency, calcination atmosphere, moisture control, residual lithium removal, coating uniformity and contamination management. Additional coating operations and relatively low early-stage production yields increase processing costs, while fluctuations in lithium hydroxide, nickel, cobalt and manganese prices affect customer purchasing decisions and supplier profitability. The economic advantage over mature liquid-electrolyte NCM batteries therefore depends on achieving higher energy density without excessive losses in cycle life, manufacturing throughput or pack-level safety.

Opportunities

The most attractive opportunity lies in material platforms that can serve both near-term semi-solid-state batteries and future all-solid-state batteries through adjustments to coatings, particle size and electrode formulation. Ni⁹⁵ single-crystal and mixed-morphology products provide a path toward premium electric mobility and aviation applications, while composite coatings based on solid-electrolyte-compatible or fast-ion-

conducting compounds can create additional product differentiation. Low-altitude aviation, unmanned systems and embodied-intelligence equipment offer earlier commercialization opportunities because customers are more willing to pay for weight reduction and high energy density. Suppliers can also expand through integrated packages combining cathode active material, solid electrolyte, silicon-based anode material and interface engineering support. Regionalized production in Europe, North America and East Asia will become increasingly relevant as battery manufacturers seek qualified local materials and more traceable nickel, lithium and cobalt supply chains.

Challenges

The central technical challenge is to maintain structural and interfacial stability when nickel content and upper cut-off voltage increase. Ultra-high-nickel layered oxides are more susceptible to oxygen release, surface reconstruction, lithium–nickel disorder, anisotropic lattice changes and microcracking, while residual lithium compounds can promote gas generation and processing instability. In semi-solid systems, these intrinsic issues interact with solid electrolytes and limited liquid electrolyte, creating complex interphases that may increase resistance or undergo continuous chemical decomposition. A coating that is highly protective may restrict lithium-ion transport, whereas a conductive but chemically unstable layer may fail during storage or high-voltage cycling. Manufacturers must therefore control coating thickness, elemental distribution, particle strength and batch consistency at industrial scale. Commercial risk also arises from rapid changes in downstream electrolyte systems, as a material optimized for oxide, sulfide, polymer or hybrid electrolytes may require substantial redesign for another customer platform.

Industry Chain Analysis

The upstream industry comprises nickel, cobalt and manganese raw materials, lithium hydroxide, NCM precursors, dopants, coating compounds and solid-electrolyte-derived interface materials. Precursor morphology, impurity control and metal-ratio consistency directly influence the final cathode structure, making integrated nickel and precursor supply an important competitive advantage. Midstream production generally covers precursor selection or co-development, lithium mixing, controlled-atmosphere calcination, crushing, classification, washing or non-washing treatment, surface coating, secondary heat treatment and electrochemical quality control. Value creation is concentrated in formulation design, interface modification, manufacturing yield and

customer-specific validation rather than in basic powder conversion alone. Downstream customers include semi-solid and solid-state cell manufacturers, conventional battery companies developing hybrid-electrolyte platforms and captive battery operations of vehicle manufacturers. The final demand chain extends to electric vehicles, low-altitude aircraft, unmanned systems, consumer devices, industrial robots and selected stationary storage projects. Closed-loop recycling and recovered nickel, cobalt and lithium are becoming additional elements of the supply chain as customers introduce carbon-footprint and traceability requirements.

Segment Insights

By nickel content, Ni₉₀–<95 products currently constitute the largest commercial segment. They offer a more established balance among discharge capacity, thermal stability, cycle performance, production yield and customer qualification than Ni₉₅ products. This segment includes materials already used in long-range vehicle batteries and emerging low-altitude applications. Ni₉₅ materials provide higher theoretical capacity and are expected to gain share, but most products remain in pilot production, qualification or initial supply because stricter controls are required for surface stability and production consistency. POSCO Future M, for example, has completed pilot development of a nickel-content-above-95% material, while other suppliers are expanding Ni₉₀-series products and next-generation solid-state-compatible grades.

By particle morphology, polycrystalline secondary-particle materials retain a meaningful position because of established capacity and processing economics. Single-crystal and quasi-single-crystal materials are gaining share in premium applications as suppliers seek to reduce particle cracking and gas generation. In practice, the market is also developing mixed-morphology and structurally reinforced products that combine the capacity advantages of optimized secondary particles with the mechanical stability of single-crystal materials. Interface modification represents an additional technology dimension: conventional oxide or phosphate coatings address basic surface protection, while composite and fast-ion-conducting coatings command greater strategic value in semi-solid-state systems.

Downstream Market Opportunities

Electric vehicles will remain the largest application because long-range premium models can absorb the higher material and validation costs while directly benefiting from improved energy density. Aircraft, drones and eVTOL platforms form the most attractive

emerging segment, as battery weight has a direct impact on payload, flight time and operating range. Humanoid robots, autonomous industrial equipment and specialized mobile machinery provide another high-value opportunity where compact size, runtime and peak-power capability are more important than minimum material cost. Consumer electronics may adopt selected ultra-thin or high-capacity cell designs, but the addressable volume is fragmented. Stationary energy storage is expected to remain a secondary application because the sector prioritizes low cost, long cycle life and thermal robustness; opportunities are concentrated in weight- or space-constrained systems rather than utility-scale projects.

Regional Insights

China represents the largest and most commercially advanced regional market, supported by operating semi-solid battery projects, specialist cell developers and a broad domestic cathode-material supply chain. Direct commercial evidence includes BASF Shanshan's delivery of ultra-high-nickel NCM material to WELION, Ronbay's stable cooperation for liquid and semi-solid Ni90-series materials and Easpring's cumulative thousand-tonne shipments of cathode products for solid-liquid battery systems. Demand is extending from premium electric vehicles to drones, eVTOL aircraft and embodied-intelligence equipment.

South Korea is the principal technology-development region outside China. EcoPro BM has commercial Ni-content-above-90% and single-crystal capabilities while developing materials optimized for solid-state applications, and POSCO Future M has completed pilot development of Ni₉₅ material and is conducting solid-state cathode customer testing. Europe is strategically important for localized supply, sustainability requirements and advanced material R&D, but current demand remains more qualification-driven than volume-driven. North America is expected to develop through battery and automotive customer programmes and localized supply-chain investment rather than through a large independent semi-solid cathode market in the immediate term.

Competitive Landscape Analysis

The competitive landscape is narrow at the commercial level but broader at the technology-development level. BASF should be represented by BASF Shanshan Battery Materials, the manufacturing entity that has achieved mass production and delivery of an ultra-high-nickel NCM product for WELION's semi-solid-state batteries.

Ronbay Technology is another core participant because its Ni90-series materials maintain stable semi-solid customer cooperation and have entered vehicle and low-altitude applications. Easpring Technology has developed solid-liquid battery cathode products across several chemistries and reported cumulative thousand-tonne shipments, giving it a significant customer-validation base. Xiamen Tungsten New Energy has achieved batch supply of solid-state-compatible cathode materials, while BTR has introduced an integrated semi-solid material solution containing high-nickel ternary cathodes.

Report Scope

This report is a detailed and comprehensive analysis for global Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries market. Both quantitative and qualitative analyses are presented by manufacturers, by region & country, by Type and by Application. As the market is constantly changing, this report explores the competition, supply and demand trends, as well as key factors that contribute to its changing demands across many markets. Company profiles and product examples of selected competitors, along with market share estimates of some of the selected leaders for the year 2025, are provided.

Key Features:

Global Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries market size and forecasts, in consumption value (\$ Million), sales quantity (Tons), and average selling prices (US\$/kg), 2021-2032

Global Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries market size and forecasts by region and country, in consumption value (\$ Million), sales quantity (Tons), and average selling prices (US\$/kg), 2021-2032

Global Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries market size and forecasts, by Type and by Application, in consumption value (\$ Million), sales quantity (Tons), and average selling prices (US\$/kg), 2021-2032

Global Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries market shares of main players, shipments in revenue (\$ Million), sales quantity (Tons), and ASP (US\$/kg), 2021-2026

The Primary Objectives in This Report Are:

To determine the size of the total market opportunity of global and key countries

To assess the growth potential for Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries

To forecast future growth in each product and end-use market

To assess competitive factors affecting the marketplace

This report profiles key players in the global Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries market based on the following parameters - company overview, sales quantity, revenue, price, gross margin, product portfolio, geographical presence, and key developments. Key companies covered as a part of this study include BASF, Huayou Cobalt, etc.

This report also provides key insights about market drivers, restraints, opportunities, new product launches or approvals.

Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries market is split by Type and by Application. For the period 2021-2032, the growth among segments provides accurate calculations and forecasts for consumption value by Type, and by Application in terms of volume and value. This analysis can help you expand your business by targeting qualified niche markets.

Market Segmentation

Market segment by Type

Polycrystalline Secondary-Particle

Single-Crystal and Quasi-Single-Crystal

Market segment by Nickel Content

Ni90—<95

Ni?95

Market segment by Application

Electric Vehicles

Aircraft and Unmanned Aerial Vehicles

Consumer Electronics

Industrial Equipment and Robotics

Stationary Energy Storage Systems

Others

Major players covered

BASF

Huayou Cobalt

Market segment by region, regional analysis covers

North America (United States, Canada, and Mexico)

Europe (Germany, France, United Kingdom, Russia, Italy, and Rest of Europe)

Asia-Pacific (China, Japan, Korea, India, Southeast Asia, and Australia)

South America (Brazil, Argentina, Colombia, and Rest of South America)

Middle East & Africa (Saudi Arabia, UAE, Egypt, South Africa, and Rest of Middle East & Africa)

Chapter Outline

Chapter 1, to describe Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries product scope, market overview, market estimation caveats and base year.

Chapter 2, to profile the top manufacturers of Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries, with price, sales quantity, revenue, and global market share of Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries from 2021 to 2026.

Chapter 3, the Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries competitive situation, sales quantity, revenue, and global market share of top manufacturers are analyzed emphatically by landscape contrast.

Chapter 4, the Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries breakdown data are shown at the regional level, to show the sales quantity, consumption value, and growth by regions, from 2021 to 2032.

Chapter 5 and 6, to segment the sales by Type and by Application, with sales market share and growth rate by Type, by Application, from 2021 to 2032.

Chapter 7, 8, 9, 10 and 11, to break the sales data at the country level, with sales quantity, consumption value, and market share for key countries in the world, from 2021 to 2026. and Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries market forecast, by regions, by Type, and by Application, with sales and revenue, from 2027 to 2032.

Chapter 12, market dynamics, drivers, restraints, trends, and Porters Five Forces analysis.

Chapter 13, the key raw materials and key suppliers, and industry chain of Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries.

Chapter 14 and 15, to describe Ultra-high-nickel NCM Cathode Active Material for Semi-Solid-State Batteries sales channel, distributors, customers, research findings and conclusion.

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