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Protective Coatings for Li-Ion Cathodes: Technology Landscape, Supply Chain & Market Forecast 2027–2037

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Abstracts

The market for protective coatings applied to lithium-ion cathode active material sits at an unusual intersection of technical necessity and commercial constraint. These coatings — nanometre-scale layers of alumina, phosphates, fluorides or lithium-conducting oxides applied to cathode particles — exist to interrupt the degradation mechanisms that make high-energy cathode chemistry viable in the first place: electrolyte oxidation at high voltage, transition metal dissolution and cathode-to-anode crosstalk, hydrofluoric acid attack, residual surface lithium, intergranular microcracking, surface reconstruction and lattice oxygen release.

Above roughly 75% nickel content, coating ceases to be a performance enhancement and becomes a precondition of automotive qualification. Exothermic onset falls from around 280 °C at 33% nickel to 195 °C at 90%, while total heat release rises approximately 2.7-fold across the same span. Every commercial nickel-rich grade shipping today carries surface treatment, whether disclosed or not, and penetration within that segment is effectively complete.

The commercial structure runs against that technical importance. Coating material is cheap and largely undifferentiated; what is expensive is the capability to apply it uniformly across tonnes of powder without agglomeration, yield loss or interference from residual surface lithium. That capability sits inside a small number of large cathode producers — the five largest high-nickel manufacturers held roughly 62% share in 2025 and all coat in-house — leaving merchant suppliers addressing a narrow and consolidating customer set.

Chemistry mix compounds the constraint. Lithium iron phosphate, which requires no

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discrete protective coating step, is the fastest-growing cathode chemistry, and the coated share of global cathode output peaked in 2025 at approximately 50.5%, declining toward 45% by 2037 even as coated tonnage more than doubles in absolute terms. Growth in this market is driven by battery volume rather than by adoption.

Two segments break that pattern. Solid-state cells using sulfide electrolytes require a lithium-conducting buffer layer — typically lithium niobate or a zirconate alternative — without which the cell does not function at all, commanding three to four times conventional coating value per kilogram. And dry-process coating aligns with solvent-free electrode manufacture, gaining commercial weight as lifecycle emissions disclosure requirements take effect in Europe from 2027.

Protective Coatings for Li-Ion Cathodes: Technology Landscape, Supply Chain & Market Forecast 2027–2037 provides a complete commercial and technical assessment of protective coatings applied to lithium-ion cathode active material, covering degradation mechanisms, coating chemistries, deposition processes, application by cathode chemistry, solid-state and dry-electrode systems, manufacturing equipment, the company landscape, supply chain structure, intellectual property, and a bottom-up market forecast to 2037.

Contents include:

Executive summary — key findings, market size and 2037 outlook, technology readiness by coating family, five strategic takeaways

Introduction — role of coatings in performance, safety and life; why coatings became mandatory with high nickel; coatings versus doping, single-crystal morphology and electrolyte additives; scope boundaries and methodology

Degradation mechanisms the coating must solve — electrolyte oxidation, transition metal dissolution and crosstalk, HF attack and residual lithium, intergranular microcracking, phase transition and oxygen release, gas generation and thermal runaway; failure mode to coating function matrix

Coating materials landscape — oxides, phosphates, fluorides, nitrides, conductive coatings, lithium-ion-conducting coatings, polymers and hybrids, bi-layer and gradient architectures; master materials matrix; precursor cost and supply

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Deposition and process technology — wet chemical, atomic layer deposition, molecular layer deposition, sol-gel, sputtering and CVD, solid-state reaction and dry coating, mechanofusion; process comparison; bottom-up cost model at three scales; in-line metrology

Application by cathode chemistry — nickel-rich NMC and NCA, LCO and high-voltage LCO, LFP and LMFP, high-voltage spinels, lithium-rich manganese, sodium-ion; coating selection guide

Coatings for solid-state and dry-electrode systems — cathode–sulfide interfacial instability, buffer layer specification, oxide and halide interfaces, dry-electrode compatibility, cell format and line design implications

Manufacturing equipment — particle coating equipment suppliers, selection criteria, line integration and insertion points, solid-state cell manufacturing equipment

Company landscape — segmentation, funding and partnership timeline, regional distribution, announced coated CAM capacity, master company matrix

Supply chain and value chain analysis — value chain map, precursor supply, toll coating versus integration, geographic chokepoints, cost and margin distribution, trade policy, supply risk register

IP and patent landscape — foundational patents and key holders, filing trends by family and geography, freedom-to-operate considerations, licensing models

Market analysis and forecast 2027–2037 — model structure and assumptions, base, bull and bear scenarios, growth phasing, segmentation by coating material, deposition process, cathode chemistry, end application and region, coated CAM penetration rate, pricing trends

Challenges and opportunities — uniformity at scale, cost versus performance, chemistry compatibility, validation, standardisation gaps, opportunity matrix

Strategic insights — coating as differentiator, build/buy/toll/co-develop decision path, line integration, capital flows, recommendations by stakeholder, watch list to 2037

Company profiles — 19 profiles across coating technology pure plays, equipment vendors, chemical suppliers and cell manufacturers. Companies Profiled include Anaphite, Forge Nano, LG Energy Solution, Mitsui Kinzoku, NEI Corporation, Panasonic Energy Co., Ltd., Samsung SDI Co., Ltd. and more...

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Contents

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List Of Tables

LIST OF TABLES

List Of Figures

LIST OF FIGURES

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