

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

<https://marketpublishers.com/r/PE065EAC33EFEN.html>

Date: August 2026

Pages: 166

Price: US\$ 1,400.00 (Single User License)

ID: PE065EAC33EFEN

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

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

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...

Contents

1 EXECUTIVE SUMMARY

- 1.1 Key Findings at a Glance
- 1.2 Market Size, Growth and 2037 Outlook
- 1.3 Technology Readiness by Coating Family
- 1.4 Strategic Overview

2 INTRODUCTION

- 2.1 Role of Cathode Coatings in Performance, Safety and Life
- 2.2 Why Coatings Became Mandatory: The Shift to High-Ni and High-Voltage
- 2.3 Coatings versus Doping, Single-Crystal and Electrolyte Additives
- 2.4 Report Scope and Boundaries
- 2.5 Research Methodology and Data Sources

3 DEGRADATION MECHANISMS THE COATING MUST SOLVE

- 3.1 Electrolyte Oxidation and Interfacial Film Growth at High Voltage
- 3.2 Transition Metal Dissolution and Cathode-to-Anode Crosstalk
- 3.3 HF Attack and Residual Lithium
- 3.4 Intergranular Microcracking in Polycrystalline Particles
- 3.5 Phase Transition and Lattice Oxygen Release
- 3.6 Gas Generation, Swelling and Thermal Runaway Pathways
- 3.7 Mapping Failure Mode to Coating Function

4 COATINGS MATERIALS LANDSCAPE

- 4.1 Oxides — Al_2O_3 , ZrO_2 , TiO_2 , MgO
 - 4.1.1 Commercial position
- 4.2 Phosphates — Li_3PO_4 , AlPO_4 , LiFePO_4 Shells
- 4.3 Fluorides — LiF , AlF_3 and Fluorinated Hybrids
 - 4.3.1 Why they lag oxides commercially
 - 4.3.2 Where they win
- 4.4 Nitrides — BN , Si_3N_4
 - 4.4.1 Why they have not scaled
- 4.5 Conductive Coatings — Carbon and Doped Oxides
- 4.6 Lithium-Ion-Conducting Coatings

- 4.7 Polymer and Organic-Inorganic Hybrid Coatings
- 4.8 Bi-Layer, Gradient and Multifunctional Architectures
 - 4.8.1 Why they have not displaced single layers
 - 4.8.2 Where the balance shifts
- 4.9 Comparative Assessment

5 DEPOSITION AND PROCESS TECHNOLOGY

- 5.1 Wet Chemical Coating and Co-Precipitation
 - 5.1.1 Process sequence and chemistry
 - 5.1.2 Why the route dominates
 - 5.1.3 Failure modes and limitations
 - 5.1.4 Scale-up behaviour
 - 5.1.5 Cost position
- 5.2 Atomic Layer Deposition
 - 5.2.1 Self-limiting surface chemistry
 - 5.2.2 Why geometric independence matters for powders
 - 5.2.3 Reactor configurations
 - 5.2.4 Scale-up discontinuity
 - 5.2.5 Cost structure and why scale does not close the gap
 - 5.2.6 Where the commercial case holds
- 5.3 Molecular Layer Deposition and Hybrid ALD/MLD
 - 5.3.1 Chemistry and film architecture
 - 5.3.2 Why compliance matters
 - 5.3.3 Constraints on adoption
 - 5.3.4 Commercial position
- 5.4 Sol-Gel Routes
 - 5.4.1 Process sequence
 - 5.4.2 Compositional access
 - 5.4.3 Limitations
 - 5.4.4 Commercial position
- 5.5 Sputtering, PVD and CVD
 - 5.5.1 Why the physics is unfavourable for powders
 - 5.5.2 Cost structure
 - 5.5.3 Where these routes remain relevant
- 5.6 Solid-State Reaction and Dry Powder Coating
 - 5.6.1 Process sequence
 - 5.6.2 Economic case
 - 5.6.3 Failure modes

- 5.6.4 Strategic position
- 5.7 Mechanofusion and Dry Particle Fusion
 - 5.7.1 Mechanism
 - 5.7.2 Disclosed operating parameters
 - 5.7.3 Particle attrition
 - 5.7.4 Effect of the single-crystal transition
- 5.8 Process Comparison
- 5.9 Cost Modelling
- 5.10 In-Line Metrology and Quality Control
 - 5.10.1 The structural problem
 - 5.10.2 Commercial opportunity

6 APPLICATION BY CATHODE CHEMISTRY

- 6.1 Nickel-Rich NMC and NCA
 - 6.1.1 What the coating must achieve
 - 6.1.2 Why wet phosphate treatment dominates here
 - 6.1.3 Where the segment is heading
 - 6.1.4 Commercial context
- 6.2 LCO and High-Voltage LCO
- 6.3 LFP and LMFP
- 6.4 High-Voltage Spinel — LNMO
- 6.5 Lithium-Rich and Manganese-Rich Compositions
- 6.6 Sodium-Ion Cathodes
- 6.7 Coating Selection Guide

7 COATINGS FOR SOLID-STATE AND DRY-ELECTRODE SYSTEMS

- 7.1 Cathode–Sulfide Electrolyte Interfacial Instability
- 7.2 Buffer Layer Requirements
- 7.3 Oxide and Halide Electrolyte Interfaces
- 7.4 Compatibility with Dry Electrode and Solvent-Free Processing
- 7.5 Implications for Cell Format and Line Design

8 MANUFACTURING EQUIPMENT

- 8.1 Equipment Selection Criteria and Line Integration
- 8.2 Solid-State Cell Manufacturing Equipment
 - 8.2.1 Where solid-state manufacture diverges

8.2.2 Equipment suppliers

8.2.3 Where the coating step sits in a solid-state line

9 COMPANY LANDSCAPE

9.1 Segmentation Framework

9.2 Capital and Partnership Activity

9.3 Regional Distribution

9.4 Announced and Estimated Coated CAM Capacity

9.5 What the Landscape Shows

10 SUPPLY CHAIN AND VALUE CHAIN ANALYSIS

10.1 Value Chain Structure

10.2 Precursor Supply

10.3 Toll Coating versus Integrated Production

10.4 Geographic Concentration and Chokepoints

10.5 Cost Structure and Margin Distribution

10.6 Trade Policy, Export Controls and Localisation

10.7 Supply Risk Assessment

11 IP AND PATENT LANDSCAPE

11.1 Foundational Patents and Key Holders

11.2 Filing Trends by Coating Family and Geography

11.3 Freedom-to-Operate Considerations

11.4 Licensing Models and Custom Coating Services

12 MARKET ANALYSIS AND FORECAST 2027–2037

12.1 Market Definition and Sizing Methodology

12.2 Base Year, Forecast Period and Currency Basis

12.3 Forecast Model Structure and Assumptions

12.4 Historic Market and 2026E Baseline

12.5 Forecast 2027–2037: Base, Bull and Bear

12.6 Growth Phasing

12.7 Segmentation by Coating Material

12.8 Segmentation by Deposition Process

12.9 Segmentation by Cathode Chemistry

- 12.10 Segmentation by End Application
- 12.11 Regional Forecast
- 12.12 Coated CAM Penetration Rate
- 12.13 Pricing Trends and Cost Pressure

13 CHALLENGES AND OPPORTUNITIES

- 13.1 Coating Uniformity and Thickness Control at Scale
- 13.2 Cost versus Performance Trade-offs
- 13.3 Chemistry Compatibility and Side Reactions
- 13.4 Long-Term Thermal and Electrochemical Stability Validation
- 13.5 Standardisation and Testing Gaps
- 13.6 Low-Cost Scalable Wet and Spray-Drying Routes
- 13.7 Dual-Function and Multifunctional Coatings
- 13.8 Solid-State and Dry-Electrode Specific Coatings
- 13.9 IP Licensing and Toll Coating Services

14 STRATEGIC INSIGHTS

- 14.1 Coating as Competitive Differentiator
- 14.2 Build, Buy, Toll or Co-Develop
- 14.3 Integration into Existing Production Lines
- 14.4 Where Capital Is Flowing and Why
- 14.5 Watch List to 2037
- 14.6 Outlook to 2037

15 COMPANY PROFILES (19 COMPANY PROFILES)

16 REFERENCES

List Of Tables

LIST OF TABLES

Table 1. Key findings summary: technology, market and competitive position
Table 2. Surface and structural stabilisation strategies compared
Table 3. Data sources and confidence assessment by content area
Table 4. Failure mode to coating function matrix
Table 5. Lithium-ion-conducting coating benchmark
Table 6. Master materials matrix
Table 7. Precursor cost and supply characteristics by coating family
Table 8. Wet chemical coating: precursor chemistry and operating windows
Table 9. Particle ALD reactor configurations compared
Table 10. ALD/MLD hybrid architectures and their properties
Table 11. Coating compositions by accessible deposition route
Table 12. Vacuum deposition routes compared for powder coating
Table 13. Disclosed mechanofusion process parameters
Table 14. Process comparison matrix
Table 15. Modelled cost of coating, USD per kilogram of coated CAM
Table 16. Cost decomposition at 10,000 tpa, USD per kilogram
Table 17. Metrology and quality control methods
Table 18. Reported performance gains from coating, by cathode chemistry
Table 19. Coating and process selection guide by chemistry and application
Table 20. Buffer layer specification for sulfide solid-state cells
Table 21. Electrolyte class and coating compatibility
Table 22. Equipment supplier comparison
Table 23. Equipment selection criteria scorecard
Table 24. Process divergence between conventional and solid-state cell manufacture
Table 25. Coated cathode active material capacity, announced and estimated
Table 26. Precursor supply characteristics by coating chemistry
Table 27. Supply risk register
Table 28. Key patent families in cathode protective coatings
Table 29. Commercial models for monetising coating technology
Table 30. Model input variables, values and sources
Table 31. Scenario assumptions and sensitivities
Table 32. Forecast by coating material, USD billion
Table 33. Coated tonnage and value by cathode chemistry
Table 34. Challenge severity and expected resolution timeline
Table 35. Watch list: technologies, companies and trigger events

List Of Figures

LIST OF FIGURES

- Figure 1. Global cathode protective coating market, 2020–2037, base case
- Figure 2. Technology readiness by coating family and deployment context
- Figure 3. Coated versus uncoated cathode particle through cycling
- Figure 4. Nickel content versus coating necessity across commercial cathode grades
- Figure 5. Degradation pathways in a nickel-rich cathode particle
- Figure 6. Transition metal dissolution and the cathode–anode crosstalk loop
- Figure 7. Microcracking after extended cycling: uncoated versus coated polycrystalline particle
- Figure 8. Thermal characteristics of charged cathode material versus nickel content
- Figure 9. Coating family positioning by ionic and electronic conductivity
- Figure 10. Coating thickness versus capacity retention and rate capability
- Figure 11. Single-layer, bi-layer and gradient coating architectures
- Figure 12. Process flow comparison across seven coating routes
- Figure 13. Particle ALD reactor configurations
- Figure 14. Capital intensity versus single-line throughput, scaled by cost per kilogram
- Figure 15. Scale-up readiness and cost position by process route
- Figure 16. Capacity retention with and without coating, by cathode chemistry
- Figure 17. Upper cut-off voltage enabled by coating type
- Figure 18. Cathode/sulfide electrolyte interface with and without a lithium-conducting buffer layer
- Figure 19. Interfacial resistance with and without a lithium-conducting buffer layer
- Figure 20. Position of the coating step in conventional wet and dry electrode manufacturing
- Figure 21. Coating step insertion points in an existing cathode active material production line
- Figure 22. Company positioning by business model and technology differentiation
- Figure 23. Funding and partnership events, 2021–2026
- Figure 24. Regional distribution of identified coating capability
- Figure 25. Cathode coating value chain, with participants and chokepoints
- Figure 26. Regional share of activity by value chain stage
- Figure 27. Coating cost build-up and margin distribution across the chain
- Figure 28. Relative patent filing activity by coating family, 2010–2026
- Figure 29. Filing jurisdiction and holder composition
- Figure 30. Forecast model structure
- Figure 31. Market value 2020–2037, three scenarios

- Figure 32. Compound annual growth rate by sub-period
- Figure 33. Share of market value by deposition process
- Figure 34. Market value by end application
- Figure 35. Market value by region
- Figure 36. Coated cathode material as a share of total CAM output
- Figure 37. Coating cost per kWh and share of cell cost
- Figure 38. Opportunity matrix: market attractiveness versus barrier to entry
- Figure 39. Coating capability decision path
- Figure 40. Technology and market roadmap, 2026–2037

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