INDEPENDENT RESEARCH SERIES · NANO ONE MATERIALS

THE DOPANT CHAIN

Boron, Aluminum, Niobium: From the One-Pot Paper to a Western High-Nickel Supply Chain

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MANAGEMENT SUMMARY

Executive Summary

A single experiment, published in June 2026, ties together four layers of the Nano One thesis: the paper by Chen, Moradi, Hadidi and Gates (Energy Advances, RSC) demonstrates the simultaneous doping and coating of NMC 811 with boron, aluminum and niobium in a single one-pot step — with express permission to use Nano One's patented M2CAM process. The choice of these three dopants is no accident: B and Al define the high-nickel patent portfolio (NCMA) that LG Chem acquired from Hanyang University in 2022 for a multi-billion-won sum; Nb is the subject of the co-development agreement running between Nano One and CBMM since 2021, and the standard protective layer ($LiNbO_3$) of Toyota's solid-state lines. At ~91 % capacity retention after 100 cycles, the paper hits exactly the benchmark the Sun group (Hanyang) established for B-doped NCM90 — there via multi-step co-precipitation routes, here in one step.

The raw-material side of the three dopants plus iron, lithium and phosphate is covered almost entirely by Nano One's documented partner and investor network: Rio Tinto (equity investor 2022; iron, lithium, and to date boron via U.S. Borax), CBMM (niobium), Sumitomo Metal Mining (equity investor 2023; collaboration agreement expressly covering LFP *and* NMC) and Worley/JESA/OCP (engineering, phosphate). On the demand side, GM/LG (NCMA in Ultium cells), Tesla (B and Al doping claims; blend patent LFP+nickel oxide) and Toyota (Nb/$LiNbO_3$, solid state) are today building or patenting precisely the chemistries whose building blocks the paper unites in one reactor. This report documents each of these links from primary sources, labels the epistemic quality of every statement, and names falsification criteria.

> THESIS · SPECULATION — Core thesis of this report
> The B-Al-Nb paper is the publicly published proof that One-Pot/M2CAM can reproduce the recipe toolbox of the leading Western high-nickel programs (LG/Hanyang, Tesla, Toyota) in a single process step — while the specific commercial recipes remain protected as trade secrets. The dopant supply chain for it already exists within Nano One's investor and partner circle. For licensees this implies substantial added value: whoever licenses One-Pot acquires not a single-purpose LFP solution but access to a platform whose demonstrated and patented chemistry space extends from LFP to high-nickel NMC 811 (Chapter 7).

CHAPTER 1

The Core: the One-Pot B-Al-Nb Paper

Rex Chen, Vahid Moradi, Lida Hadidi and Byron D. Gates: *"One-pot synthesis for doping and coating NMC 811 with B, Al, and Nb for enhanced stability"*, Energy Advances (Royal Society of Chemistry), 2026, DOI 10.1039/D5YA00314H. Submitted October 30, 2025, published June 10, 2026, Open Access (CC-BY-NC 4.0). Moradi and Hadidi carry the affiliation "Nano One Materials Corporation, Burnaby, BC"; the methodology uses the patented One-Pot/M2CAM process with express permission, cites the M2CAM applications US 2021/0359300 A1 and US 2022/0064019 A1, and acknowledges the collaboration with Nano One (MITACS/NSERC funding; Gates group, Simon Fraser University).

CONFIRMED — Key results of the paper

B-Al-Nb-modified NMC 811, doping and coating in a single one-pot step. Capacity retention after 100 cycles at 1C: ~91 % versus 75.8 % for the unmodified reference material. Nb surface layer verified by STEM-EDS and XPS. The paper is already being cited by independent groups in the Ni-rich literature (including ACS Applied Energy Materials, ACS Energy Letters, Inorganic Chemistry).

Why this paper is the starting point

First, it documents the NMC capability of One-Pot/M2CAM in the peer-reviewed scientific canon — after the reported conclusion of the NMC projects with BASF and Umicore, the chapter has not vanished but is *concluded and published*. Second, it flanks existing Nano One IP: US 11,121,370 and US 11,811,056 claim the one-pot $LiNbO_3$ coating expressly for NMC 811 as well; Example 19 of the family describes a complete one-pot NMC 811 synthesis (Li_2CO_3 + Ni/Mn/Co carbonates + oxalic acid, calcination). Third, the element choice B–Al–Nb provides the key to the following chapters: it corresponds exactly to the stabilization strategies of the commercial Western high-nickel programs.

ANALYTICAL ASSESSMENT — Reading the author situation

Dr. Lida Hadidi is the inventor of the one-pot LFP core family US 12,319,590 (WO2022094703A1) and left Nano One in March 2026; her Google Scholar profile carries a verified ualberta.ca address (University of Alberta). Publication with Nano One affiliation and express M2CAM permission points to an orderly, cooperative transition — not to know-how flowing to competitors. Her departure also falls within the generational handover communicated as planned succession: February 2026, Alex Holmes (COO since 2021) promoted to President & CSO; June 1, 2026, founder-CEO Dan Blondal announces retirement effective June 12 (advisory role thereafter) — two days after this paper was published. Inventor and founder step back in the same window in which the R&D; deliverables land (paper, Worley ISBL package, Candiac expansion): the choreography of a phase change toward commercialization, not the signature of a crisis.

The same author: the LFP patent side

CONFIRMED — US 12,319,590 B2 — the one-pot LFP core family

Filed October 5, 2021, granted June 3, 2025, assignee Nano One Materials Corp., sole inventor: Lida Hadidi (family WO2022094703A1). The claims describe a process built from two aqueous suspensions — Li^+/phosphate on one side, an iron source from the group Fe_2O_3 (hematite), FeOOH or Fe_3O_4 with an organic acid, organic alcohol or salt of an organic acid on the other — whose combination, precipitation, drying and calcination yields $LiMPO_4$/C with up to 3 wt% carbon.

Both chemistry pillars of this report therefore share the same scientific authorship: the LFP core patents carry Hadidi's name as sole inventor, the NMC 811 paper carries her name as co-author — backed by her history as an industrial LFP postdoctoral researcher. Two connection points: the LFP patent expressly claims hematite as an iron source — the direct patent bridge to the Iron Chain thesis — and the boron research at U.S. Borax (LFP boric acid coatings, "research ongoing") lands exactly on this patent base: high-nickel dopant toolbox and LFP core patents belong to the same process space, shaped in part by one and the same hand.

CHAPTER 2

Proximity to the LG Patents

The purchased foundation: Hanyang University

In March 2022, LG Chem acquired more than 40 patents on Ni-rich cathode materials from the Energy Storage & Conversion Materials Laboratory at Hanyang University (the group around Yang-Kook Sun) — according to press reports for "tens of billions of won" — with the stated goal of producing NCMA cathodes with over 80 % nickel content for LG Energy Solution. Since March 2023, LG Chem has been actively offering this portfolio for licensing to other cathode manufacturers and publicly positions it as essential for high-nickel production.

The aluminum match

The scientific basis of the NCMA chemistry comes from the same group: an Al doping of 2 mol% raised the capacity retention of a graded Ni-rich NCM over 1,000 full-cell cycles from 88 % to 95 % (Kim et al., ACS Energy Letters). Aluminum stabilizes the layered lattice, reduces cation mixing and enables cobalt reduction — the core idea of the "four-component" LG cathode built into the Ultium pouch cells of the GM joint venture.

The boron match — with an identical benchmark

In the Sun group's NCM90, B doping produces rod-shaped, textured primary grains that cushion the mechanical strain of the H2–H3 phase transition in the deeply charged state — result: 91 % capacity retention after 100 cycles (Park et al., Advanced Energy Materials 2018). The Hadidi paper reports ~91 % after 100 cycles at 1C for its B-Al-Nb NMC 811 — the same figure at the same cycle count, but in a single one-pot step instead of co-precipitation with separate doping and coating stages.

> ANALYTICAL ASSESSMENT — What the benchmark match means
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> The paper replicates the gold standard of the Hanyang/LG patent empire with a radically simplified process. For a cell maker or CAM producer commercially using or licensing the B/Al stabilization, One-Pot is thereby publicly demonstrated as an alternative, shortened process route. This is an analytical link between two confirmed facts, not a documented business relationship.

Two side notes complete the picture: LG Chem originally planned to source NCMA externally from L&F; before commercializing its in-house solution — L&F; is one of the three actors in the existing competitive dossier. And LG Chem's own product page today lists "precursor-free cathode materials" as an active development field — the same direction One-Pot has pointed to for years.

CHAPTER 3

Raw-Material Supply: the Partner Network as a Dopant Chain

Niobium — CBMM (partner since 2021)

CONFIRMED — CBMM co-development, Phases 1 and 2 completed

May 2021: co-development agreement to optimize the one-pot process for Nb-coated Ni-rich cathodes with niobium from CBMM, the world's largest niobium supplier. February 2022: Phase 1 completed — Nb coating demonstrated on NMC 811. Later, Phase 2: Nb-coated single-crystal NMC with Ni > 90 % via One-Pot/M2CAM; the stated joint goal is an "integrated and differentiated supply chain" for Nb-coated single-crystal cathodes. The coating forms without additional process steps and is applicable to liquid as well as solid-state electrolytes.

On the market side, CBMM reports a 500 % increase in niobium-oxide exports for cathode applications since 2019 and describes high-nickel chemistries with 0.5–1 % Nb addition as close to commercialization in Asia — Nb doping is thus no longer a laboratory topic but an active commercialization path in which Nano One has been documentedly positioned through the CBMM partnership for five years.

Boron — U.S. Borax / Rio Tinto (status in flux)

U.S. Borax (Rio Tinto) covers roughly 30 % of global borate demand and actively positions battery-grade boric acid (Optibor BQ) as a cathode-material additive. An in-house Batteries review (Zheng 2022) systematizes boron applications across all cell components; the current technical bulletin expressly confirms ongoing research for LFP: boric acid coatings stabilize cycling capacity over extended cycle counts, with optimization continuing. For Nano One's LFP line (Candiac), boron is thus the dopant with an explicitly open, supplier-driven research agenda.

CONFIRMED — Rio Tinto partnership with Nano One (June 2022)

US$10 million equity investment (4,643,148 shares at C$2.70; ~4.9 %), earmarked inter alia for the Candiac acquisition and the one-pot LFP conversion. Parallel collaboration agreement: study of Rio Tinto battery-metal products — including iron powders from Sorel-Tracy — as one-pot feedstock; know-how contribution of the Critical Minerals and Technology Centre (lithium, scandium). Rio Tinto also holds the Arcadium lithium division.

ANALYTICAL ASSESSMENT — Borax divestment: how to read it

Rio Tinto is exploring the sale of its entire U.S. borates business (Boron mine, refinery/terminal at Los Angeles, Owens Lake; advisers UBS/JPMorgan; more than a dozen interested parties including WE Soda, Magris Resources, US Silica; binding offers were expected by June 2026, and no award had been announced as of this writing). This refines the thesis rather than weakening it: mine, refinery, products and research program move with the buyer — the physical boron supply chain stays Western; only the corporate parent changes. Boron was recently added to the U.S. critical minerals list; China buys roughly one third of the mine's output.

ANALYTICAL ASSESSMENT — Side note, verified: the possible Magris B–Nb convergence

Two individual facts are independently confirmed: Magris Resources is a repeatedly documented bidder for the U.S. Borax assets (Bloomberg/Reuters, incl. via the Bakersfield Californian and Tehachapi News, as of June 2026); Magris has also owned the Niobec mine in Québec since 2015 (with CEF Holdings and Temasek) — one of only three primary niobium producers worldwide and the only one outside Brazil, as Magris itself markets it under "Magris Performance Materials." A winning bid for the borate assets would therefore genuinely unite B and Nb within the same corporate portfolio. What remains open is solely the outcome of the bidding process itself — not the underlying individual facts.

Iron, lithium, NMC metals — Sumitomo Metal Mining (partner since 2023)

> CONFIRMED — SMM investment and collaboration agreement
> September/October 2023: strategic equity investment of C$16,879,949.85 (5,498,355 shares at C$3.07). The collaboration agreement states as its goal the acceleration of commercial production of LFP CAM and nickel-rich CAM chemistries such as NMC — the NMC scope is in the contract language. September 2025: SMM confirms Nano One as a "key technology partner" of its LFP growth strategy; the collaboration has covered product evaluation, performance testing, economic modelling, a comprehensive IP review and process trials in Japan.

As a vertically integrated mining, refining and CAM group, SMM is simultaneously a building block of the existing Iron Chain thesis (HPAL hematite as a potential one-pot iron feedstock) and an established high-nickel CAM supplier in the Panasonic/Toyota ecosystem — the bridge between the raw-material chapter and the OEM chapter of this report.

Phosphate and engineering — Worley / JESA / OCP

With Worley Chemetics' completion of the one-pot LFP ISBL package (June 25, 2026), the standardized, licensable plant package is in place; through the Worley JV JESA there is access to the phosphate base of OCP Group. Together with the redundant iron sources of the Iron Chain thesis (SMM HPAL, Talon by-products, Rio Tinto — including IOC, which remains in the core business), the raw-material side of all paper dopants plus the LFP feedstocks can be mapped within the documented partner network.

CHAPTER 4

OEM Application: Who Builds or Patents These Chemistries?

GM (and Honda) via LG: NCMA in Ultium

The Ultium pouch cells of the GM/LGES joint venture run LG's Al-doped NCMA high-nickel chemistry — the commercial embodiment of the Hanyang portfolio from Chapter 2. Via the Ultium platform this chemistry also reached Honda (Prologue). The paper's Al dopant thus has the largest running application case in the Western EV industry.

Tesla: doping claims and the iron-nickel blend

CONFIRMED — WO2023137022A1 / US 2024/0383770 A1 — claims reviewed in the original

Tesla's application "Doped Cathode Active Materials" (priority January 12, 2022; inventors Li, Gowda, Mehta) claims doped cathodes in two formula spaces: Li(1+a)Tm(1-a-b)M(b)O(c) with c = 2 (layered oxide) and Li(Tm)(2-b)M(b)O(c) with c = 4 (spinel formula). Dopant list (Claim 6): Al, Ca, B, Mg, Ti, Ta, Zr, Mo, W, Y, Co, Na — boron is claimed, niobium appears neither in the claims nor in the description (tantalum does, niobium's chemical twin).

CONFIRMED — Worked examples and legal status of the Tesla application

Worked examples: cobalt-free Ni-Mn layered oxide (Ni0.65Mn0.35, "substantially no cobalt", operating voltage ~4.35 V); four dopants (Zr+Ti+Al+Mg) cut the energy loss after 200 cycles from 19.5 % to 4.8 %. The WO status "Ceased" merely marks the regular end of the PCT phase — the national phases are running (US 18/689,756, EP 4387932, CN/JP/KR pending).

ANALYTICAL ASSESSMENT — The spinel surprise

With Tm = Ni/Mn, Formula II (c = 4) reads literally onto doped Li(NixMn2-x)O4 spinels; the application's CPC classification explicitly includes the LNMO spinel class C01G53/54. Tesla thus claims doping in the LNMO formula space as well — the terrain of Nano One's HVS history and the LNMO JDA thesis of Report 4 — while the examples show a mid-nickel layered oxide. Process-wise, Tesla remains conventionally multi-step (spherical hydroxide/carbonate precursor + dopant powders + LiOH/Li2CO3, calcination 700–1,000 °C, no integrated coating) — exactly the gap One-Pot closes.

Added to this is Tesla's blend patent WO 2024/229047 (iron-phosphate base LFP/LMFP with 0.1–15 % nickel-oxide active material, from the Dahn orbit) — the Dopant Chain's bridge to the Iron Chain thesis: even the largest buyer of iron cathodes thinks iron and nickel chemistry together.

Toyota: niobium at the cell level

LiNbO3 coatings are the established protective standard of sulfide solid-state cells that Toyota is industrializing — with SMM as CAM partner in the Toyota/Panasonic ecosystem. The paper's Nb dopant thus also addresses the solid-state path; Nano One's own patents US 11,121,370 / US 11,811,056 claim precisely this one-pot LiNbO3 coating, NMC 811 included.

ANALYTICAL ASSESSMENT — Chapter 4 synthesis

Every dopant in the paper has a paying or patenting application case: Al at GM/LG (Ultium/NCMA) and in Tesla's NCA history; B in the Hanyang/LG portfolio and in Tesla's claim set; Nb at Toyota (solid state), in CBMM's Asian commercialization and in Nano One's own IP. The intersection of these three doping strategies is demonstrated in the paper in a single process step.

CHAPTER 5

Resolved Checkpoints

5.1 Sumitomo niobium patents: layered, not spinel

ANALYTICAL ASSESSMENT — Finding

The SMM niobium patent families (some with Panasonic Energy as co-applicant) concern lithium-nickel-manganese composite oxides made from nickel-manganese hydroxide precursors (fired at 750–1,000 °C), with Ti doping in the bulk and Nb segregation at the grain boundaries of the primary particles; alongside, SMM published on Nb-assisted suppression of oxygen evolution at 4.5 V. This is layered-oxide chemistry throughout (low-cobalt layered Ni-Mn), not the 5 V spinel $LiNi_{0.5}Mn_{1.5}O_4$. The wording "Sumitomo without an LNMO focus" in Report 4 stands; a clarifying footnote on the ambiguous GreyB terminology is recommended. (Confidence: high; the original document was reviewed in excerpt only.)

5.2 Tesla WO2023137022A1: claims reviewed

See Chapter 4: B claimed, Nb not included, spinel formula space covered, national phases pending, multi-step process route.

5.3 Borax sale: ongoing, no award

CONFIRMED — Status as of July 17, 2026

Binding offers were expected by June 2026; in early July, Rio Tinto merely confirmed that the strategic reviews of the North American borates and iron/titanium divisions were proceeding as planned ("testing the market"). No buyer announced.

ANALYTICAL ASSESSMENT — Valuation nuance and entity footnote

An independent analysis values the borates business at US$1.0–1.2 billion (2025 EBITDA ~US$210 million; the reported US$2 billion would equal 9.5x EBITDA) and recalls that a sale attempt already failed in 2008 for lack of acceptable bids — a no-sale outcome is a real scenario. In parallel, RTIT (Rio Tinto Fer et Titane, Sorel-Tracy) is under strategic review. For the Iron Chain thesis this is a footnote on the supplying entity, not a falsification risk: the thesis rests on redundant by-product iron sources (SMM HPAL, Talon, Rio Tinto), and Rio Tinto's Canadian iron base IOC has sat in the core iron-ore division — exempt from the review — since 2025.

CHAPTER 6

Risks and Falsification Criteria

The core thesis of this report would need to be revised or weakened if any of the following occurs:

- LG Chem/LGES publicly names an alternative one-step process route for B/Al-stabilized high-nickel cathodes, in-house or from a third party — the distinctiveness of the one-pot demonstration would lapse.
- The CBMM collaboration is terminated or not carried into a Phase 3 (scale-up/commercial validation).
- SMM removes the NMC scope from the collaboration or ends the partnership; the September 2025 confirmation would be devalued.
- The buyer of the U.S. Borax business discontinues the battery boron program (Optibor BQ, LFP coating research) — the boron strand would lose its supplier-side driver.
- Tesla's national phases of WO2023137022A1 (esp. US/EP) are abandoned — the weight of the Tesla doping argument would decline.
- Future Nano One publications (patents, filings) show no further maintenance of the NMC and Nb-coating families — the "concluded but published" reading of the NMC chapter would become pure past tense.
- Peer-review criticism of, or replication failure for, the 91 % results of the Energy Advances paper.

THESIS · SPECULATION — Points deliberately left open

Whether an OEM or cell maker will actually source the B-Al-Nb combination from a one-pot supplier is not documented and is not asserted here. Likewise it remains open whether Nano One's commercial recipes match the paper's composition — the working thesis of this series remains that the recipes, as trade secrets, hold independent value, possibly exceeding that of the process itself.

CHAPTER 7

The Licensing Angle: One Platform, Two Chemistry Spaces

The one-pot LFP plant package completed by Worley Chemetics in June 2026 is the commercial object of the licensing model. This chapter frames what a licensee factually acquires beyond it: access to a process platform whose demonstrated and patented chemistry space spans both major cathode worlds.

CONFIRMED — What is documented

LFP side: US 12,319,590 (inventor Hadidi; hematite/FeOOH/Fe3O4 as iron sources, LiMPO4/C) plus the licensable Worley ISBL package (June 25, 2026). High-nickel side: US 11,121,370 / US 11,811,056 (one-pot LiNbO3 coating expressly incl. NMC 811; Example 19 with a complete one-pot NMC 811 synthesis) plus the peer-reviewed B-Al-Nb demonstration on NMC 811 (Energy Advances 2026, ~91 % after 100 cycles). Both chemistry spaces rest on the same reactor concept: one mixing step, one firing step, doping and coating integrated.

ANALYTICAL ASSESSMENT — The added value for licensees

Whoever licenses One-Pot thus acquires not a single-purpose LFP solution but a platform with a documented upgrade path to high-nickel NMC 811 — substantial, real added value: a CAM plant built on One-Pot is conceptually not tied to a single cell chemistry but can follow the market between the iron and nickel worlds, while competitors must maintain two separate process routes (co-precipitation plus separate doping and coating stages) for the same flexibility. One qualification applies: which chemistry spaces a specific licence agreement covers is contract-specific and not public — what is documented is the technical and patent-side availability of both spaces on the same platform, not their blanket co-licensing.

CHAPTER 8

Synthesis

One published experiment (Chapter 1) demonstrates the doping toolbox that defines LG's purchased Hanyang patent empire (Chapter 2), with raw materials that Nano One's own investors and partners can supply (Chapter 3), for chemistries that GM, Tesla and Toyota build or patent today (Chapter 4). The Dopant Chain complements the Iron Chain: there, the feedstocks of the LFP mass market; here, the refining elements of the high-nickel and solid-state path — both converge in the same reactor concept. Now we deliver.

APPENDIX

Primary Sources and References

[1] Chen, R.; Moradi, V.; Hadidi, L.; Gates, B. D.: "One-pot synthesis for doping and coating NMC 811 with B, Al, and Nb for enhanced stability", Energy Advances (RSC), 2026, DOI 10.1039/D5YA00314H. Submitted Oct 30, 2025, published Jun 10, 2026, CC-BY-NC 4.0.

[2] Nano One Materials Corp.: press releases on the CBMM collaboration — co-development agreement (May 2021); Phase 1 completion, Nb coating on NMC 811 (February 2022); Phase 2 completion, Nb coating on Ni>90 % via One-Pot/M2CAM. nanoone.ca/news.

[3] Nano One Materials Corp. / Rio Tinto: "Strategic Partnership and US$10M Investment" (June 2022) and closing release: 4,643,148 shares at C$2.70; collaboration agreement incl. Sorel-Tracy iron powder study and Critical Minerals and Technology Centre. nanoone.ca / riotinto.com.

[4] Nano One Materials Corp. / Sumitomo Metal Mining: collaboration agreement and C$16,879,949.85 investment (Sep 25, 2023; closing Oct 5, 2023; 5,498,355 shares at C$3.07); scope: LFP CAM and nickel-rich CAM chemistries such as NMC. Progress release "Advance Collaboration on LFP Commercialization" (September 2025).

[5] LG Corp./LG Chem: "LG Chem to Enforce Its Patent Rights in High-Nickel Cathode Battery Materials" (March 2023) — acquisition of >40 Hanyang patents (March 2022), active licensing offer; press coverage of the Hanyang purchase (incl. Best Magazine, March 2022); LG Chem product page "Cathode Material" (precursor-free as development field).

[6] Kim, U.-H.; Myung, S.-T.; Yoon, C. S.; Sun, Y.-K.: Al-doped gradient NCM, 95 % vs. 88 % capacity retention over 1,000 full-cell cycles, ACS Energy Letters (2017/2018 series).

[7] Park, K.-J. et al. (Sun group): B-doped NCM90, rod-shaped microstructure, 91 % capacity retention after 100 cycles, Advanced Energy Materials 8, 1801202 (2018).

[8] Tesla, Inc.: WO 2023/137022 A1 "Doped Cathode Active Materials and Methods Thereof" (priority Jan 12, 2022; inventors Li, Gowda, Mehta), Claims 1–6; national phases US 18/689,756 (US 2024/0383770 A1), EP 4387932, CN/JP/KR. Google Patents / WIPO.

[9] Tesla, Inc.: WO 2024/229047 A1 "Blended Cathode Active Material Including Iron Phosphate Based and Nickel Oxide Based Materials" (published November 2024).

[10] Nano One Materials Corp.: US 11,121,370 B2 and US 11,811,056 B2 (one-pot $LiNbO_3$ coating, expressly incl. NMC 811; Example 19: complete one-pot NMC 811 synthesis); US 12,319,590 B2 (one-pot LFP core family, WO2022094703A1): filed Oct 5, 2021, granted Jun 3, 2025, sole inventor L. Hadidi; claims incl. iron sources Fe_2O_3/FeOOH/Fe_3O_4 with organic acid, product $LiMPO_4$/C with up to 3 wt% carbon (registry data via Justia/USPTO).

[11] Zheng, C. (U.S. Borax Inc., Rio Tinto): "Examining the Benefits of Using Boron Compounds in Lithium Batteries", Batteries 2022, 8, 187, DOI 10.3390/batteries8100187.

[12] U.S. Borax / Rio Tinto: Technical Bulletin "Battery-grade boric acid for lithium-ion battery cathodes" (Optibor BQ), borax.com — incl. the passage on ongoing LFP coating research; brochure "Inside Electric Vehicles: The Borate Connection".

[13] CBMM: market data on niobium oxide in cathodes (500 % export growth since 2019; high-nickel Nb chemistries near commercialization in Asia), via Charged EVs (February 2024) / niobium.tech.

[14] Bloomberg/Reuters coverage of the Rio Tinto borates divestment (November 2025 to July 2026): valuation up to US$2 billion; bidders WE Soda, Magris Resources, US Silica; advisers UBS/JPMorgan; binding offers expected by June 2026; company statement July 2026 ("testing the market"). Secondary: mining.com, Northern Miner, Australian Resources & Investment, Tehachapi News/Bakersfield Californian.

[15] Mining valuation analysis (March 2026): borates valuation US$1.0–1.2 billion (2025 EBITDA ~US$210 million), failed 2008 sale attempt, RTIT review (estimate US$1.9–2.3 billion), IOC in the core iron-ore division since 2025.

[16] Sumitomo Metal Mining (some with Panasonic Energy): patent families on Ti/Nb-modified lithium-nickel-manganese composite oxides (Nb grain-boundary segregation, hydroxide route, 750–1,000 °C), via Justia registry; SMM study on Nb-assisted suppression of O_2 evolution at 4.5 V (via BatteryBits/Volta Foundation).

[17] Nano One Materials Corp. / Worley Chemetics: "Complete One-Pot LFP Cathode Package and Advance to Market" (June 25, 2026).

[18] Nano One Materials Corp.: "Retirement of Founder and CEO Dan Blondal, President & Chief Strategy Officer Alex Holmes Appointed to CEO Role" (ACCESS Newswire, June 1, 2026; effective June 12, 2026; Holmes President & CSO since February 2026, previously COO since 2021; Blondal continuing in an advisory role). nanoone.ca/news.

[19] Magris Resources / Magris Performance Materials: ownership of the Niobec mine (Québec) since 2015 (acquired from IAMGOLD for US$530 million with CEF Holdings and Temasek; 100 % owner of operator Niobec Inc.), "one of only three global producers of niobium, and the only producer located outside of Brazil," via magrispm.com/niobec and Major Mines & Projects (miningdataonline.com).