产品	运用场景	材料体系	现存问题点	解决方案	性能特征
电解液	EV	LMFP	受锰离子姜-泰勒效应影响，磷酸锰铁锂材料在循环过程中会出现锰溶出现象。溶出的锰离子会沉积在负极，阻塞锂离子传输通道，破坏SEI膜，高温条件下溶出会进一步加剧，从而导致高温循环及存储性能较差。	1、锰离子络合型 添加剂：H34 2、优化溶剂高温稳定性，使用EC/PC/EMC/DEC组合溶剂体系 3、组合改善高温型正负极成膜添加剂：MMDS、LiODFB等	4.2V-4.3V，45℃，1C/1C循环，1600-2000周，容量保持率≥80%
		LFP	LFP作为动力电池的主流正极材料之一，具备安全性高、成本低、循环寿命长等优势，但仍存在材料本身电子电导率偏低，理论比容量偏低的问题，导致高能量密度与大倍率充放电性能不好兼同时兼顾，以及低温充放电性能仍需改善等。	1、优化溶剂体系，使用EC/PC/DMC/EMC/EA/EP/ACN改善浸润性、大倍率充放电动力学性能、以及低温充放电性能。 2、使用低内阻成膜添加剂：M376、M145、M423等。 3、使用双氟代磺酰亚胺锂（LiFSI）与六氟磷酸锂共同作为电解液的锂盐，提升电导率，改善大倍率及低温充放电性能。	25℃ 4C/1C阶充循环2000周，容量保持率≥80%； 45℃ 4C/1C阶充循环1500周，容量保持率≥80%。
		NCM	NCM材料的结构稳定性较差，其层状结构在充放电过程中易发生相变（层状→尖晶石→岩盐结构）以及释氧等问题，影响循环寿命，高电压下会更为严重。并且其热分解温度低，能量密度更高，导致更易发生热失控等安全问题。同时由于钴资源的稀缺，其成本也更高。	1、对于4.45V高电压三元对硅碳体系，使用耐高压溶剂M187、M125，提升体系稳定性，也可以部分替代FEC，改善高温存储及循环性能。 2、使用可以在正极成膜的成膜添加剂稳定正极界面，改善循环及高温存储性能，如M376等。 3、使用磷腈类物质改善，如PFPN等，提升电解液阻燃性，稳定界面，改善安全性能。	4.4V NCM613/AG，25℃ 4C/1C阶充循环2000周，容量保持率≥80%， 45℃ 4C/1C阶充循环1800周，容量保持率≥80% 4.45V NCM613/AG，45℃ 1C/1C循环1500周，容量保持率≥80%。
	ESS	LFP/Gr	1、缺乏准确的循环预测手段，10000周长循环如何保障； 2、大电芯温升高，电芯实际运行温度在30℃，高温循环性能需要改善； 3、厚电极低保液体系：正极压实密度≥2.55g/cc，面密度≥400g/m2，保液系数≤3.5g/Ah，制程界面不良，长循环性能存疑； 4、单电芯能效低于95%，储能经济效益遇到瓶颈。	1、配方保证VC总量，通过高温循环来加速验证 2、使用LiFSI、DTD、MMDS等高温添加剂改善电芯高温性能 3、通过降低锂盐浓度/降低EC浓度/提升DMC浓度，降低电解液的粘度，优化浸润和制程界面 4、使用新型添加剂M145、M101等，降低电芯内阻，提升能效	循环性能： 25℃ 0.5P/0.5P 8000-12000周，容量保持率≥70%； 45℃ 0.5P/0.5P 6000-10000周，容量保持率≥70%； 能量效率：≥95%
	3C	LCO/Gr	①基于消费类锂电池高能量密度拓宽电压上限的需要，目前所使用的非水有机电解液化学窗口通常低于4.4 V，当充电截止电压高于4.4 V 时，电解液便会发生氧化分解，这将导致电池容量急剧下降。 ②电压上升到为4.5 V 左右时正极发生O3→H1-3→O1 相变，电荷补偿过程中，当钴元素的电子不足时，将会促使氧元素参与其中，从而会使材料的架构发生改变，稳定性也随之发生改变。	溶剂体系：添加较高含量的耐氧化性强羧酸酯溶剂拓宽电解液的电化学稳定窗口。耐高压溶剂M187、M125等新型溶剂适配。 添加剂：选用腈类添加剂，在高电压下发生氧化分解，形成保护性界面层，-CN优先与LCO正极上的高价过渡金属原子配位，从而抑制Co3+的溶解并改善电极/电解液界面。配合FEC、LiODFB、PS等低阻抗成膜添加剂提升电池的倍率性能和循环稳定性。	循环性能：1C/1C 常温循环800周，高温循环500周，容量保持率≥80% 高温存储：60℃7天高温存储，容量保持率≥90% 低温性能：-20℃，0.2C放电，容量保持率≥80%
		LCO/Si-C	需要解决基于LCO正极问题的基础上，聚焦解决硅基负极的储锂合金化反应机制导致锂化过程中硅材料会发生严重的体积膨胀问题。	适当添加更高含量的FEC保护负极界面因重复SEI生成及修饰带来的结构破坏。	循环性能：1C/1C 常温循环≥1000周，高温循环700周，容量保持率≥80% 高温存储：60℃7天高温存储，容量保持率≥90%，厚度膨胀≤5% 低温性能：-20℃，0.2C放电，容量保持率≥80%
		NCM/Gr	随着Ni含量的升高，正极在循环过程中的相变增加，正极易产生微裂纹增加Ni离子的溶出，使得界面稳定性降低，并进一步促进电解液的氧化分解。	高HOMO能级耐氧化溶剂+正负极成膜添加剂+低阻抗倍率型添加剂（LiODFB/DTD)+适当的浸润性改善	循环性能：1C/1C 常温循环≥1000周，高温循环800周，容量保持率≥80%
	启停电源	LCO/Gr	1、K值，启停电池电解液电导率较高，电解液电子绝缘性下降，电池容易发生“掉电”现象。 2、高温产气，启停电池为了实现高性能，电解液界面保护添加剂的用量相对较低，电极电解液界面热稳定性较差，电池容易发生“鼓胀”现象。 3、功率不足，启停电池点火瞬间电流达到100A，电池电压因为极化，极速下降，多次点火，电池容易发生“哑火”现象。	1、采用电极钝化添加剂H05，改善K值问题； 2、采用络合过渡金属离子添加剂M309，改善过渡金属离子溶出，缓解产气副反应； 3、采用高倍率添加剂M187，改善倍率放电初期压降，提高电池功率特性。	循环性能：25℃，1C/1C，300~800周，容量保持率≥80% 高温性能：60℃7天满电存储，体积膨胀≤5%； 高温循环：45℃，1C/1C，300~500周，容量保持率≥80%； 低温性能：-20℃，0.2C放电，容量保持率≥60% 倍率性能：≥60C，瞬间倍率130C
		NCM/Gr			
		LMFP/Gr			
		$LiMn_2O_4$/Gr			
	钠电	层状金属氧化物	1:结构稳定性不足:循环时会发生过渡金属离子迁移和晶格畸变 2.界面副反应严重:高电压下（>4.0 V）电解液易分解，在电极表面形成不稳定的固态电解质界面产气 3.空气 / 湿度敏感性	电解液改善策略： 1.金属离子螯合剂； 2.固态电解质界面改善剂：S30 3.高电压溶剂：M455等 4.电解液稳定剂：	25℃循环>95.6%@1000cycle 45℃循环>85.3%@1000cycle
		聚阴离子	1.离子电导率低：Na^+扩散速率慢（<10^{-10} cm^2/s） 3.循环稳定性不足：体积膨胀引发结构坍塌	电解液改善策略： 1.低粘度溶剂：SWE 2:成膜改善剂：S27，H38	25℃ 0.5C/0.5C循环>98.9%@744 cycle 1C/1C循环>95.5%@1138cycle
		普鲁士蓝	1.空位缺陷：$Fe(CN)_6^{4-}$空位导致结构坍塌 2.铁离子溶解：循环中 Fe^{2+}溶出引发容量衰减 3.体积膨胀：Na^+脱嵌导致晶格畸变（体积变化 > 20%）	电解液改善策略： 成膜添加剂:S27，H38	25℃ 循环>80%@7000cycle
	一次电		电压滞后和极化严重：1、电解液离子电导率不足，导致内阻大，放电电压下降快； 2、电极/电解液界面副反应（如析氢、钝化膜形成）影响放电效率； 低能量密度：传统一次电池电解液的氧化还原能力有限，导致电池容量较低； 自放电率高：电解液与电极材料的副反应（如锌负极腐蚀）导致储存期间容量损失；	高浓度电解液：如LiTFSI/DME体系，提高离子电导率和稳定性。	宽温域工作：离子液体电解液可在-30~80℃下稳定运行； 低自放电：优化后的电解液（如Li/CF_x电池）年自放电<1%； 高功率输出：低内阻电解液满足脉冲放电需求；
	新材料体系	5V镍锰	材料优点：1）电压平台高，约为4.7V，能量密度高（约690Wh/kg）；2）无需添加钴等贵金属元素，成本低。不足之处在于：1）反应过程中会有锰元素歧化反应后溶解在电解液中并沉积在负极表面，进而使得SEI膜持续消耗再生，耗费活性锂，降低循环寿命；2）高电压会造成常规电解液体系分解，进而产生氢氟酸腐蚀正极材料，导致电池产气	电解液改善策略： 1、溶剂优化策略：耐高压溶剂开发M187、M125等新型溶剂 2、锰离子络合型添加剂：H34 3、正极界面保护行添加剂：H46 4、电解液“噬酸”物质：H40等	使用赛纬组合电解液方案：60℃循环 > 99.2%@100cycle
		富锂锰	材料优点：富锂锰基的理论能量密度可达到900Wh/kg 材料缺点： 1、首次放电效率很低； 2、材料在循环过程析氧，带来安全隐患； 3、循环寿命很差； 4、倍率性能偏低	电解液改善策略： 1、电解液补锂物质开发 2、电解液捕获氧物质开发：M139、M140 等 3、正极界面保护行添加剂：H46等	使用赛纬组合电解液方案：60℃循环 > 89.2%@100cycle
		无负极	材料优点：电池容量高。电池材料成本降低 材料缺点： 1、首次放电效率很低； 2、电池析锂风险大，电池安全性降低 3、循环寿命很差；	电解液改善策略： 1、电解液补锂物质开发 2、低内阻物质开发：H49	使用赛纬组合电解液方案：60℃循环 > 85.2%@100cycle

产品	名称	产品种类	性能特征
原材料	溶剂	EMC DEC EC	EMC：水分：≤15PPM；纯度：≥99.99% DEC：水分：≤15PPM；纯度：≥99.99% EC：水分：≤15PPM；纯度：≥99.99%
	锂/钠盐	$LiPF_6$ $NaPF_6$	$LiPF_6$：水分：≤10PPM；纯度：≥99.95% $NaPF_6$：水分：≤10PPM；纯度：≥99.9%
	添加剂	LiFSI LiDFOB $LiPO_2F_2$ LiDFOP DTD TMSP TMSB	LiFSI：水分：≤50PPM；纯度：≥99.99% LiDFOB：水分：≤200PPM；纯度：≥99.95% LiPO2F2：水分：≤100PPM；纯度：≥99.0% LiDFOP：水分：≤50PPM； DTD：水分：≤80PPM；纯度：≥99.5% TMSP：水分：≤50PPM；纯度：≥99.2% TMSB：纯度：≥99.5%
功能新材料	固态/半固态电解质	固态电解质：LLZTO 凝胶电解质：H19:W737=6:4，单体总浓度7%，引发剂W349	LLZTO的电导率超过10^{-3} s/cm； 凝胶电解质方案对应钠电体系，25℃常温循环600周，容量保持率与液态base持平；针刺不起火，不冒烟。
	浸润诱导剂	M360为小分子的白色有机物，使用NMP溶解后，正极混浆使用，可以均匀分散；正极烘片的时候，80℃左右NMP挥发后，M360会在浆料里面原位析出。注液后，M360会溶解到碳酸酯电解液里面	厚电极高压实铁锂体系，洗液速率明显提升；并且作为成膜添加剂参与到化成反应，对电池性能起到正向作用

Products	Apllications	Material Systems	Challenges	Solutions	Performance Metrics
Electrolyte	EV	LMFP	Mn^{2+} dissolution due to Jahn-Teller effect, leading to SEI degradation and poor high-temperature cycling/storage performance.	1. Mn^{2+}-complexing additives (e.g., H34) 2. High-temperature-stable solvent blend (EC/PC/EMC/DEC) 3. Dual-functional additives (MMDS, LiODFB) for CEI/SEI stabilization	4.2–4.3 V, 45°C, 1C/1C cycling: 1,600–2,000 cycles with ≥80% capacity retention.
		LFP	As one of the mainstream cathode materials for power batteries, lithium iron phosphate (LFP) exhibits advantages such as high safety, low cost, and long cycle life. However, it still suffers from intrinsic limitations including low electronic conductivity and relatively low theoretical specific capacity. These inherent drawbacks result in difficulties in simultaneously achieving high energy density and superior rate capability, along with the need for further improvement in low-temperature charge/discharge performance.	1. Optimize the solvent system by employing EC/PC/DMC/EMC/EA/EP/ACN to enhance wettability, rate capability, and low-temperature charge/discharge performance. 2. Utilize low-impedance film-forming additives , such as M376, M145, and M423, to reduce internal resistance. 3. Adopt a dual-salt electrolyte system combining LiFSI andLiPF6 to improve ionic conductivity, thereby enhancing both high-rate and low-temperature charge/discharge performance.	25°C: 4C/1C, 2,000 cycles (≥80% capacity retention) 45°C: 4C/1C, 1,500 cycles (≥80% capacity retention).
		NCM	The structural stability of NCM ($LiNixCoyMnzO_2$) materials is relatively poor, as their layered structure is prone to phase transitions (layered → spinel → rock-salt) and oxygen release during charge/discharge processes, significantly impairing cycle life—particularly under high-voltage conditions. Additionally, NCM materials exhibit a low thermal decomposition temperature, and while they deliver higher energy density, this also increases the risk of thermal runaway and safety hazards. Furthermore, due to the scarcity of cobalt resources, NCM cathodes face higher production costs.	1、 For high-voltage (4.45 V) NCM-SiC systems , employ high-voltage-resistant solvents (M187, M125) to enhance system stability, which can also partially substitute fluoroethylene carbonate (FEC) to improve high-temperature storage and cycling performance. 2. Utilize cathode film-forming additives (e.g., M376) to stabilize the cathode-electrolyte interface, thereby enhancing cycling stability and high-temperature storage performance. 3. Introduce phosphazene-based compounds (e.g., PFPN) to improve electrolyte flame retardancy, stabilize interfacial layers, and enhance safety performance.	1. At 4.4 V and 25°C, the cell maintains ≥80% capacity retention after 2000 cycles under a 4C charge / 1C discharge step protocol. 2. At 4.4 V and 45°C, the cell achieves ≥80% capacity retention after 1800 cycles under the same 4C/1C step cycling conditions. 3. At 4.45 V and 45°C, the system retains ≥80% capacity after 1500 cycles under a 1C/1C charge-discharge protocol .
	ESS	LFP/Gr	1、 Absence of reliable cycling prediction methodologies The lack of accurate prognostic tools for ultra-long-term cycling (e.g., 10,000 cycles) raises significant concerns regarding performance guarantees, necessitating the development of advanced predictive models combining electrochemical degradation mechanisms with machine learning approaches. 2. Thermal management challenges in large-format cells Suboptimal thermal dissipation leads to elevated operational temperatures (~30°C), exacerbating capacity fade. This thermal accumulation necessitates urgent improvements in high-temperature cycling stability through advanced thermal regulation systems and thermally-stable electrolyte formulations. 3. Performance limitations in thick electrode designs with constrained electrolyte retention Current specifications: Cathode compaction density: ≥2.55 g/cm^3 Areal loading density: ≥400 g/m^2 Electrolyte-to-capacity ratio: ≤3.5 g/Ah These parameters, coupled with interfacial incompatibilities during manufacturing, raise fundamental concerns about long-term cyclability due to: Lithium-ion transport limitations Inhomogeneous interfacial contact Progressive electrolyte depletion Suboptimal single-cell energy efficiency (<95%)	1、 Formulation Optimization with Accelerated Validation The electrolyte formulation maintains a controlled total vinylene carbonate (VC) content, with accelerated degradation validation conducted through high-temperature cycling tests to evaluate long-term stability. 2. High-Temperature Performance Enhancement Strategic incorporation of thermal-stabilizing additives including: Lithium bis(fluorosulfonyl)imide (LiFSI) 1,3,2-Dioxathiolane-2,2-dioxide (DTD) Methanedisulfonate (MMDS) These compounds collectively improve cell performance under elevated temperature conditions through synergistic stabilization of electrode-electrolyte interfaces. 3. Electrolyte Rheology Optimization The electrolyte system is modified through: Reduced lithium salt concentration Decreased ethylene carbonate (EC) content	1. Cycle Life at 25°C: Test Conditions: 0.5C charge / 0.5C discharge (0.5P/0.5P) Cycle Stability: 8,000–12,000 cycles Capacity Retention: ≥70% 2. Cycle Life at 45°C: Test Conditions: 0.5C charge / 0.5C discharge (0.5P/0.5P) Cycle Stability: 6,000–10,000 cycles Capacity Retention: ≥70% 3. Energy Efficiency: Minimum Requirement: ≥95%
	3C	LCO/Gr	1.The current non-aqueous organic electrolytes, with electrochemical stability windows typically below 4.4 V, undergo oxidative decomposition when charged beyond 4.4 V to meet the demand for higher energy density in consumer lithium batteries, resulting in rapid capacity degradation. At elevated voltages around 4.5 V, the cathode undergoes O3→H1-3→O1 phase transitions. During charge compensation, insufficient electron donation from cobalt triggers oxygen participation, consequently altering the material's structural framework and stability.	Solvent System: Incorporation of oxidation-resistant carboxylate solvents with high concentration expands the electrochemical stability window of the electrolyte. Novel high-voltage-tolerant solvents (e.g., M187, M125) demonstrate superior compatibility. Additives: Nitrile-based additives undergo preferential oxidative decomposition at high voltages, forming protective interfacial layers. The -CN groups coordinate with high-valent transition metal atoms on the LCO cathode surface, effectively suppressing Co^{3+} dissolution and optimizing electrode/electrolyte interfacial stability. Synergistic combination with low-impedance film-forming additives (FEC, LiODFB, PS) enhances rate capability and cycling stability.	1. Cycling Performance: Room Temperature (25°C): 800 cycles at 1C charge/discharge, capacity retention ≥80% Elevated Temperature (45°C): 500 cycles at 1C charge/discharge, capacity retention ≥80% 2. High-Temperature Storage Stability: 60°C storage for 7 days, capacity retention ≥90% 3. Low-Temperature Performance: Discharge at -20°C (0.2C rate), capacity retention ≥80%
		LCO/Si-C	address the critical issue of severe volume expansion in silicon-based anodes during lithiation, caused by their alloying reaction mechanism for lithium storage, while building upon existing solutions for LCO cathode challenges.	Incorporating an appropriately increased concentration of FEC effectively mitigates structural degradation at the anode interface caused by repetitive SEI formation and modification processes.	1. Cycling Performance: Room Temperature (25°C): ≥1000 cycles at 1C charge/discharge, capacity retention ≥80% Elevated Temperature (45°C): 700 cycles at 1C charge/discharge, capacity retention ≥80% 2. High-Temperature Storage Stability: 60°C storage for 7 days, capacity retention ≥90%, thickness expansion ≤5% 3. Low-Temperature Performance: Discharge at -20°C (0.2C rate), capacity retention ≥80%
		NCM/Gr	The increased Ni content in the cathode exacerbates phase transitions during cycling, leading to microcrack formation that accelerates Ni^{2+} dissolution. This phenomenon significantly compromises interfacial stability and subsequently promotes oxidative decomposition of the electrolyte.	The electrolyte system employs a synergistic combination of: High-HOMO-level oxidation-resistant solvents to extend electrochemical stability windows; Dual electrode film-forming additives for stabilizing both cathode-electrolyte and anode-electrolyte interfaces; Low-impedance rate-enhancing additives (LiODFB/DTD) to improve charge transfer kinetics; Optimized wettability modifiers to ensure complete electrode infiltration.	Cycling Performance Specifications: Standard Conditions (25°C): ≥1,000 cycles at 1C charge/1C discharge Capacity retention ≥80% Elevated Temperature (45°C): 800 cycles at 1C charge/1C discharge Capacity retention ≥80%
	Start/stop	LCO/Gr	1、 High K-Value & Self-Discharge ("Voltage Drop") Elevated electrolyte conductivity reduces electronic insulation, leading to parasitic current leakage. Result: Accelerated open-circuit voltage (OCV) decay ("voltage drop" phenomenon). 2. High-Temperature Gas Evolution ("Swelling") Trade-off between power performance and interfacial stability:	1. The electrode passivation additive H05 is employed to address K-value deterioration. 2. The transition metal ion-complexing additive M309 is utilized to mitigate transition metal dissolution and suppress gas evolution side reactions. 3. The high-rate additive M187 is incorporated to reduce initial voltage drop during high-rate	1. Cycling Performance (25°C): 1C charge / 1C discharge, 300–800 cycles Capacity retention ≥80% 2. High-Temperature Storage Stability (60°C): 7-day full-charge storage Volume expansion ≤5% 3. High-Temperature Cycling (45°C): 1C charge / 1C discharge, 300–500 cycles Capacity retention ≥80% 4. Low-Temperature Performance (-
		NCM/Gr			
		LMFP/Gr			
		$LiMn_2O_4$/Gr			
	Na-ion	Layered oxides	1. Insufficient Structural Stability: Transition metal ion migration and lattice distortion occur during cycling. 2. Severe Interfacial Side Reactions: Electrolyte decomposition at high voltages (>4.0 V) leads to unstable SEI formation and gas evolution on electrode surfaces. 3. Air/Moisture Sensitivity: Prone to degradation upon exposure to ambient atmosphere.	Electrolyte Optimization Strategies: 1. Metal Ion Chelators 2. Solid-Electrolyte Interphase Modifiers (e.g., S30) 3. High-Voltage Solvents (e.g., M455) 4. Electrolyte Stabilizers	Cycle Performance: 25°C Cycling: >95.6% capacity retention @ 1000 cycles 45°C Cycling: >85.3% capacity retention @ 1000 cycles
		Polyanions	1. Low Ionic Conductivity : Na^+ diffusion rate < 10^{-10} cm^2/s 2. Insufficient Cycling Stability : Structural collapse induced by volumetric expansion	Electrolyte Optimization Strategies: 1. Low-Viscosity Solvent: SWE 2. Film-Forming Modifiers: S27, H38	Cycling Performance at 25°C: 0.5C charge/0.5C discharge: >98.9% capacity retention @ 744 cycles 1C charge/1C discharge: >95.5% capacity retention @ 1138 cycles
		PBAs	1. Vacancy Defects : Structural collapse induced by $Fe(CN)_6^{4-}$ vacancies. 2. Iron Dissolution : Capacity fade caused by Fe^{2+} leaching during cycling. 3. Volumetric Expansion : Lattice distortion (>20% volume change) from Na^+ de/intercalation.	Electrolyte Optimization Strategy: Film-forming additives: S27, H38	Cycling Performance at 25°C: 80% capacity retention after 7,000 cycles
	Primary		1. Severe Voltage Hysteresis and Polarization Cause 1: Low ionic conductivity of electrolyte → high internal resistance → rapid discharge voltage drop Cause 2: Electrode/electrolyte interfacial side reactions (e.g., hydrogen evolution, passivation layer formation) → reduced discharge efficiency 2. Low Energy Density Limited redox capability of conventional primary battery electrolytes → low specific capacity 3. High Self-Discharge Rate Parasitic reactions between electrolyte and electrode materials (e.g., Zn anode corrosion) → capacity loss during storage	Concentrated Electrolyte Strategy: Implementation of high-concentration electrolyte systems (e.g., LiTFSI/DME) significantly enhances ionic conductivity and electrochemical stability	Wide-Temperature Operation: Ionic liquid electrolytes demonstrate stable performance from -30°C to 80°C. Low Self-Discharge: Optimized electrolytes (e.g., in Li/CF_x batteries) exhibit <1% annual self-discharge. High-Power Output: Low-resistance electrolytes meet pulse discharge requirements.
	Advanced systems	5V nickel-manganese (LNMO) cathode	Material Advantages: 1. High voltage plateau (~4.7 V vs. Li^+/Li) enables superior energy density (~690 Wh/kg); 2. Cobalt-free composition reduces material costs. Limitations: 1. Mn disproportionation leads to dissolution and deposition on the anode, causing continuous SEI consumption/regeneration and active Li loss, thereby degrading cycle life; 2. High voltage induces decomposition of conventional electrolytes, generating HF that corrodes the cathode and triggers gas evolution.	Electrolyte Improvement Strategies: Solvent Optimization: Development of high-voltage-resistant solvents (e.g., M187, M125). Manganese Ion Chelating Additives: H34 for Mn^{2+} dissolution suppression. Cathode Interface Protective Additives: H46 to stabilize CEI layers. Acid Scavengers: H40 to neutralize acidic byproducts (e.g., HF).	Electrochemical Performance: Cycling stability >99.2% capacity retention after 100 cycles at 60°C using the Smoothway electrolyte formulation.
		Li-rich Mn-based cathode	Material Advantages: The Li-rich Mn-based cathode exhibits a theoretical energy density of up to 900 Wh/kg. Material Limitations: Low initial Coulombic efficiency; Oxygen evolution during cycling, posing safety risks; Poor cycling stability; Suboptimal rate capability.	Electrolyte Optimization Strategies: Development of lithium-replenishing additives for electrolytes Oxygen-scavenging additives (e.g., M139, M140) Cathode interface protective additives (e.g., H46)	Capacity retention >89.2% after 100 cycles at 60°C using the Smoothway electrolyte formulation.
		Anode-free	Material Advantages: High battery capacity with reduced material costs. Material Limitations: Low initial Coulombic efficiency; High lithium plating risk, compromising safety; Poor cycling stability.	Electrolyte Optimization Strategies: Development of lithium-compensating additives Low-impedance additive development: H49	Capacity retention >85.2% after 100 cycles at 60°C using the Smoothway electrolyte system.

Material Category	Product Category	Products	Characteristics
Raw Materials	Solvents	EMC DEC EC	EMC：water content≤15PPM；purity≥99.99% DEC：water content≤15PPM；purity≥99.99% EC：water content≤15PPM；purity≥99.99%
	Li/Na Salts	$LiPF_6$ $NaPF_6$	$LiPF_6$：water content≤10PPM；purity≥99.95% $NaPF_6$：water content≤10PPM；purity≥99.9%
	Additives	LiFSI LiDFOB $LiPO_2F_2$ LiDFOP DTD TMSP TMSB	LiFSI：water content≤50PPM；purity≥99.99% LiDFOB：water content≤200PPM；purity≥99.95% LiPO2F2：water content≤100PPM；purity≥99.0% LiDFOP：water content≤50PPM； DTD：water content≤80PPM；purity≥99.5% TMSP：water content≤50PPM；purity≥99.2% TMSB：purity≥99.5%
Advanced Functional Materials	Solid/Semi-Solid Electrolytes	Solid Electrolytes：LLZTO Gel Electrolytes：H19:W737=6:4，monomer concentration of 7%，Initiator W349	LLZTO exhibits ionic conductivity exceeding 10^{-3} S/cm； The gel electrolyte formulation, designed for sodium-ion systems, demonstrates:
	Wetting Agent	M360 is a small-molecule white organic compound. When dissolved in NMP, it enables homogeneous dispersion in cathode slurry. During cathode drying (~80°C), NMP volatilizes, inducing in-situ precipitation of M360. Upon electrolyte injection, M360 redissolves into carbonate-based electrolytes.	Thick-electrode high-density LFP systems exhibit significantly enhanced wetting rates. The additive concurrently functions as a film-forming agent during formation, contributing positively to electrochemical performance.