

Sodium Nickel Iron Manganese Layered Oxide Cathode Material For Sodium Ion Batteries

Item Number: CL12

Introduction

High performance sodium nickel iron manganese oxide layered cathode material designed for sodium ion batteries delivers exceptional rate capability, high specific capacity, outstanding low temperature discharge retention, and superior slurry processing stability for commercial energy storage system cell manufacturing.

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Application	Description	Key Benefit
Stationary Grid Energy Storage	Large-scale battery energy storage systems (BESS) for renewable energy integration and grid frequency regulation.	Low material cost combined with long cycle stability and safe thermal characteristics under continuous operation.
Industrial Cylindrical Cell Fabrication	Commercial 18650 and 21700 cell production lines for industrial power tools and uninterruptible power supplies (UPS).	Excellent tap density (1.34 g/cm³) and smooth slurry coating characteristics enable uniform high-speed electrode manufacturing.
Low-Temperature & Harsh Environment Power	Battery modules operating in arctic conditions, cold-chain logistics, and unheated outdoor installations.	Exceptional low-temperature capacity retention (87.89% at -20°C) ensures dependable power delivery in extreme climates.
High-Rate Electric Mobility	Power packs for two/three-wheel electric vehicles, low-speed EVs, and automated guided vehicles (AGVs).	Maintains over 91.58% capacity retention at high 5.0C discharge rates, supporting rapid acceleration and fast power delivery.
Advanced Sodium-Ion Battery Research	Academic and corporate R&D laboratories developing next-generation sodium chemistries and electrolyte formulations.	Highly consistent physical specifications and low residual alkali provide repeatable baseline metrics for coin and pouch cell testing.

Specification Parameter	Unit	Target Specification Indicator	Typical Value	Test Method / Instrument
Product Identifier	-	CL12	CL12	Standardized Material Code
Appearance	-	Black Powder	Black Powder	Visual Inspection (目视)
Tap Density (堆积密度)	g/cm³	≥ 1.20	1.34	GB/T 5162-2006
Specific Surface Area (比表面积)	m²/g	0.3 - 1.0	0.68	BET Specific Surface Analyzer (氮吸附)
Moisture Content (H2O)	ppm	≤ 500	432	Moisture Analyzer (卡尔费休)
Particle Size D10	µm	≥ 2.0	3.45	Laser Particle Size Analyzer (激光粒度仪)
Particle Size D50	µm	8.00 ± 2.00	7.64	Laser Particle Size Analyzer (激光粒度仪)
Particle Size D90	µm	≤ 24.00	17.03	Laser Particle Size Analyzer (激光粒度仪)
Sodium (Na) Content	wt%	20.50 - 21.00	20.72	Atomic Absorption Spectroscopy (AAS)
Combined Na + Fe + Mn Content	wt%	50.50 ± 1.00	50.63	GB/T 1223.25-1994 Gravimetric Method
Slurry pH	-	≤ 13.00	12.82	pH Meter (PG-1)
Discharge Specific Capacity (放电比容量)	mAh/g	≥ 120.0	127	Coin Half-Cell, 4.0V-2.0V, 0.1C Discharge

C-Rate Discharge Current	Relative Capacity (%)	Electrochemical Transport Characteristics
0.2C	106.40%	Maximum sodium-ion de-intercalation efficiency
0.5C	103.20%	High energy extraction under moderate loads
1.0C	100.00%	Reference capacity baseline
2.0C	98.40%	Minimal polarization voltage drop
3.0C	96.33%	Sustained fast-discharge power output
4.0C	94.45%	Outstanding high-power retention
5.0C	91.58%	Excellent ultra-high rate capability

Operating Temperature (°C)	Capacity Retention Ratio (%)	Environmental Performance Profile
25°C	100.00%	Ambient baseline capacity
-10°C	91.58%	Superior low-temperature ion diffusion
-20°C	87.89%	Robust operation under sub-zero conditions

Parameter / Condition	Standard Value / Metric	Operational Notes
Cathode Slurry Formulation Ratio	Active Material : SP : CNT : PVDF(5130) = 95.5 : 1.7 : 0.8 : 2.0	Optimized high-active mass fraction formulation
Slurry Solid Content	53%	Suitable for commercial industrial roll-to-roll coaters
Slurry Viscosity (Initial)	3540 mPa·s	Tested under 7% Relative Humidity (RH)
Slurry Viscosity (3 Hours)	4430 mPa·s	Stable viscosity growth profile
Slurry Viscosity (12 Hours)	6020 mPa·s	Controlled rheology over extended pot life
Slurry Viscosity (24 Hours)	6820 mPa·s	Prevents rapid phase separation or severe gelling
Environmental Exposure Resilience	7% RH for 5 hours exposure	Controlled moisture uptake; capacity does not decay