

Li-PAN/CA: Chemical Interactions and Cell Performance Enhancement Mechanisms for 3 Key Applications

Core Concept: Polar/Ionic Interfaces Based on $\text{--COO}^-\text{Li}^+$ / --COOH / --OH + Li-PAN Polymer Network $\rightarrow$ Adhesion, Li^+ Transport & Interfacial Stabilization

① Si Anode Slurry Additive CMC/SBR + Li-PAN/CA

Chemical / Interfacial Interactions

- CA $\text{--COOH}/\text{--OH}$ and polar groups of Li-PAN interact with --OH groups on the SiO_x surface through hydrogen bonding and polar interactions
- Li-PAN polymer chains bridge Si/C, conductive additives and the current collector $\rightarrow$ maintain contact during Si expansion
- Ionic $\text{--COO}^-\text{Li}^+$ groups facilitate Li^+ transport pathways within the electrode
- May suppress exposure of fresh Si surfaces and repeated SEI formation



Impact on Cell Performance

ICE $\uparrow$ | Cycle Life $\uparrow$
High-Rate Capability $\uparrow$

② SWCNT Functional Additive SWCNT + Li-PAN/CA

Chemical / Interfacial Interactions

- SWCNT = long-range electronic network / Li-PAN/CA = ionic and polar interfacial network
- Polar groups in the polymer/CA promote CNT-Si/C-binder contact $\rightarrow$ help maintain the CNT network
- Brings electron (e^-) and Li^+ transport pathways into close proximity $\rightarrow$ may improve interfacial reaction kinetics
- Polymer network may buffer and reconnect CNT contacts disrupted by Si expansion



Impact on Cell Performance

High-Rate Capability $\uparrow\uparrow$
Cycle Life $\uparrow$ | Potential CNT Reduction

③ Si/C Surface Coating Additive 1–3% Aqueous Coating / Spray · Blade

Chemical / Interfacial Interactions

- Li-PAN/CA forms a thin polar/ionic functional layer on the Si/C surface
- Multiple $\text{--COOH}/\text{--OH}$ groups of CA show strong affinity for SiO_x surfaces $\rightarrow$ particle-surface anchoring
- Coating layer may strengthen interfacial adhesion with binder/CNT and mitigate particle agglomeration
- Reduced direct electrolyte-Si contact and fresh-surface exposure $\rightarrow$ potential SEI stabilization



Impact on Cell Performance

ICE $\uparrow\uparrow$ | Cycle Life $\uparrow$
High-Rate Capability $\uparrow$

CPS-LiPC Manufacturing Processes

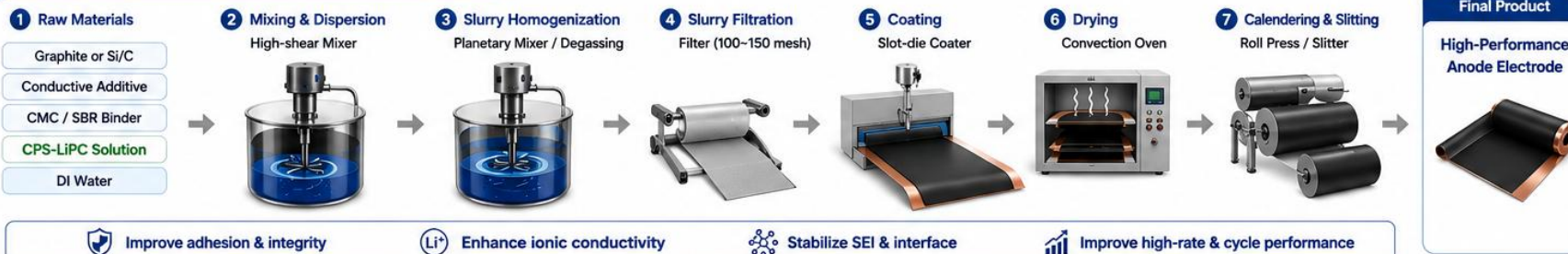
Three Key Technology Fields | Water-Based • Eco-Friendly • High Performance



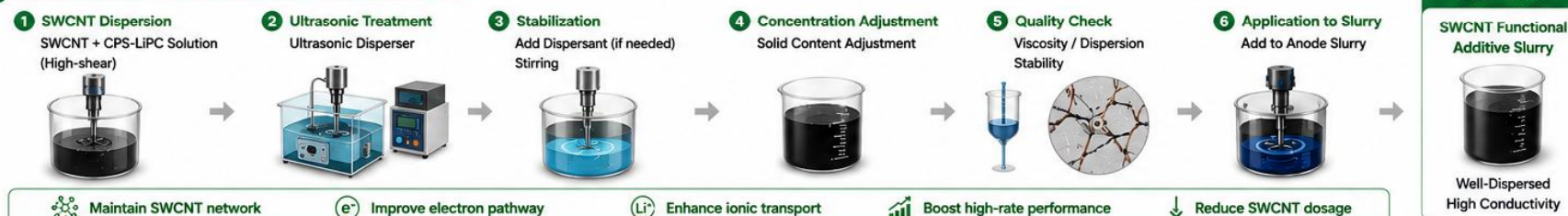
CPS-LiPC Key Advantages

- ✓ Water-based & Eco-Friendly
- ✓ Stable & Reproducible
- ✓ Excellent Dispersion
- ✓ Cost Effective
- ✓ High Performance Materials
- ✓ Scalable Manufacturing

1 CPS-LiPC for Anode Slurry Functional Additive



2 CPS-LiPC for SWCNT Functional Additive



3 CPS-LiPC for Si/C Functional Coating (Spray-Dry)



Process Notes

✓ All processes are water-based & eco-friendly

✓ pH control : ~6.5 ~ 7.0

✓ Solid content & viscosity optimized for each application

✓ Scalable from lab to mass production

Li⁺ Ionic Conductivity | e⁻ Electronic Conductivity

Structural Stability | Interface Stability