H-3232W Single-Walled Carbon Nanotube (SWCNT) Conductive Paste (Water Based)

1.Product Description

H-3232W is a stable liquid conductive paste prepared using **high-purity single-walled carbon nanotubes (SWCNTs)** as the core conductive material, combined with a specially developed **water-based** environmentally friendly dispersant. Deionized water is used as the only solvent, and the product is manufactured through advanced multi-stage dispersion processes including high-shear mixing and high-pressure homogenization.

Single-walled carbon nanotubes are one-dimensional nanomaterials formed by seamlessly rolling a single graphene sheet into tubular structures. With a diameter of only **1–2 nm** and an extremely high aspect ratio (up to tens of thousands), SWCNTs exhibit outstanding intrinsic electrical conductivity and excellent capability to construct continuous one-dimensional conductive networks.

H-3232W completely avoids organic solvents such as NMP, ensuring zero VOC emissions and compliance with green manufacturing standards in the lithium battery industry. Through multi-stage catalytic purification processes, the contents of metal impurities and magnetic substances are strictly controlled, eliminating safety risks caused by residual metal catalysts commonly found in carbon nanotube materials, including battery self-discharge, gas generation, and cycle degradation.

The finished conductive paste features uniform dispersion, minimal nanotube aggregation, and excellent storage stability. Even at extremely low addition levels, it can build a continuous three-dimensional conductive network inside electrodes, improving electrode conductivity, rate capability, and cycle life while significantly reducing the volume fraction occupied by conductive additives and increasing battery energy density.

2. Physical and Chemical Properties

Test Item	Specification	Unit	Test Method
Appearance	Uniform black slurry	N/A	Visual inspection
Solid Content	1.00 ± 0.10	wt.%	Oven drying method
SWCNT Conductive Additive Content	0.40 ± 0.04	wt.%	Calculated based on formulation ratio
Water-based Dispersant Content	0.60 ± 0.06	wt.%	Calculated based on formulation ratio
Fe Content	≤50	ppm	Atomic absorption spectroscopy
Co Content	≤5	ppm	Atomic absorption spectroscopy
Ni/Cr/Cu/Zn Content	≤2	ppm	Atomic absorption spectroscopy
Magnetic Substance Content	≤0.2	ppm	Atomic absorption spectroscopy
Slurry Viscosity	≤4000	mPa·s	Rotational viscometer DV2T

3. Key Advantages

1. Ultra-low Addition Level, Significantly Improving Energy Density

Compared with multi-walled carbon nanotubes and conductive carbon black, SWCNTs have a much lower percolation threshold. Only **0.04–0.08 wt%** addition is required to achieve excellent conductivity.

The reduced conductive additive content provides more space for active materials, effectively increasing battery capacity and energy density.

2. Outstanding Electrical Conductivity for Fast-Charging and High-Power Applications

SWCNTs possess significantly higher intrinsic electrical conductivity than multi-walled carbon nanotubes, effectively reducing electrode internal resistance.

Under high-rate charging and discharging conditions such as **4C/8C**, electrodes exhibit lower polarization and stable discharge voltage platforms, making the product suitable for advanced fast-charging power batteries and high-power energy storage systems.

3. Flexible One-Dimensional Structure for Silicon-Carbon Anode Systems

SWCNTs are extremely thin and flexible, allowing them to tightly wrap around silicon-based particles.

During the approximately **300% volume expansion and contraction** of silicon materials during charge/discharge cycles, SWCNT networks can maintain continuous conductive pathways, prevent conductive network failure, and significantly extend battery cycle life.

4. Ultra-low Metal Impurities for High Safety and Long Cycle Life

The contents of **Fe, Co, Ni, Cr, Cu, Zn**, and magnetic substances are strictly controlled.

Trace metal impurities may trigger internal battery side reactions, self-discharge, and gas generation. The low-impurity specification makes H-3232W suitable for high-safety, long-life energy storage batteries and power lithium batteries.

5. Fully Water-Based Environmentally Friendly System with Excellent Production Compatibility

The only solvent used is deionized water. The product contains no toxic organic solvents such as NMP, reducing VOC emissions and environmental treatment costs.

It is fully compatible with existing water-based LFP electrode coating production lines and can be directly introduced without equipment modification.

6. Excellent Dispersion Stability and Coating Process Compatibility

The dispersant system is precisely optimized to balance dispersion performance and electrode binder compatibility.

The slurry features controllable viscosity, excellent flowability, and low tendency for secondary aggregation during mixing. It enables high-quality coating without defects such as pinholes, particles, or scratches.

7. Strong Blending Compatibility

H-3232W can be used independently or combined with other conductive materials, including:

- Multi-walled carbon nanotubes (MWCNTs)
- Conductive carbon black
- Artificial graphite

The synergistic combination allows customers to balance cost and electrochemical performance while meeting different product positioning requirements.

4. Applications

H-3232W is an **aqueous single-walled carbon nanotube (SWCNT) conductive paste** designed for fully water-based electrode slurry preparation processes. It can be widely used in various electrochemical energy storage systems and conductive functional material applications, including:

1. **Lithium-ion battery systems:**
    1. Lithium iron phosphate (LFP) cathodes
    2. High-nickel ternary cathodes
    3. Silicon-carbon composite anodes
    4. Graphite anodes
2. **Advanced battery applications:**
    1. High-rate fast-charging batteries
    2. Long-cycle energy storage lithium batteries
    3. Power lithium batteries
    4. Consumer electronics batteries
3. **Next-generation battery systems:**
    1. Solid-state lithium batteries
    2. Lithium-sulfur batteries
    3. Sodium-ion batteries
4. **Electrochemical devices:**
    1. Electric double-layer capacitors (EDLCs)
    2. Hybrid capacitors
5. **Flexible conductive coating materials:**
    1. Transparent conductive inks
    2. Flexible electrodes
    3. Antistatic coatings
    4. Electromagnetic shielding coatings
6. **Compatible with traditional conductive additives**, such as graphite, multi-walled carbon nanotubes (MWCNTs), and conductive carbon black, enabling integration into customers' existing slurry production lines.

5. Packaging and Shipping

5.1 Packaging Specifications

Packaging Size	Container	Pallet Arrangement
20 kg	20 L plastic pail with pull-ring lid	9 drums per layer, 2 layers per pallet
200 kg	200 L blue plastic drum	4 drums per layer, 1 layer per pallet
1000 kg	HDPE IBC tank	1 tank per pallet

6. Storage Conditions and Shelf Life

1. **Storage Conditions:**
    - Relative humidity: ≤95% RH
    - Storage temperature: 5–50°C
    - Avoid direct sunlight, freezing temperatures, and prolonged high-temperature exposure.

2. **Shelf Life:**
    - Under sealed factory packaging and recommended storage conditions, the shelf life is **6 months from the production date**.
    - After opening, the slurry may gradually lose water and settle. It is recommended to use the product within a short period.
    - Remaining slurry must be resealed and stored properly. Reuse is allowed only after confirming that viscosity and dispersion performance meet requirements.

7. Usage Recommendations

7.1 Recommended Carbon Nanotube Addition Level

Recommended CNT addition level in electrode systems:

0.04–0.08 wt%

7.2 Handling Guidelines

a) Before use, inspect the packaging container for leakage. Leakage indicates sealing failure, which may cause reduced solid content and increased moisture, affecting conductivity performance. Any abnormal batch should be tested and confirmed before use.

b) Maintain a clean and dust-free slurry preparation environment. Mixing tanks, pipelines, and equipment contacting the slurry should be clean and dry. Corrosion-resistant and wear-resistant materials should be used to prevent metal contamination.

c) Open and dispense only the required amount for each production batch. Long-term exposure of opened containers is not recommended. Remaining slurry should be resealed under clean conditions. Before reuse, viscosity and dispersion status should be checked.

d) Proper protective measures should be taken during operation to prevent slurry splashing onto equipment or raw materials. Any spilled slurry should be cleaned promptly and collected in dedicated PP containers for compliant disposal.

e) Due to the strong van der Waals forces between single-walled carbon nanotubes, SWCNTs are naturally prone to aggregation. Customers should verify compatibility with high-shear and high-pressure homogenization dispersion processes in advance to ensure uniform dispersion in water-based electrode slurries and maximize conductive performance.

Disclaimer

1. *Actual product specifications shall be based on the batch inspection report supplied with each shipment. This technical datasheet is provided for reference only.*
2. *The performance data and application recommendations are based on laboratory testing and production validation. Customers should conduct their own compatibility and process evaluations before commercial production.*
3. *The company does not guarantee performance under specific customer formulations or application conditions. Any variation caused by formulation, processing conditions, or environmental factors should be evaluated by the customer.*
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