Paint Mist Filter Cotton Technical White Paper

In core fields such as industrial coating, automotive spraying, furniture painting, and construction machinery surface treatment, paint mist, as the primary pollutant generated during spraying operations, contains a large amount of liquid paint droplets, solid paint powder, organic volatiles (VOCs), and fine particulate matter. If discharged without effective filtration, it will not only pollute the workshop environment, damage equipment and fans, affect coating quality, but also cause air pollution and environmental compliance risks. As the core filtration consumable for dry spray booths, coating production lines, and exhaust gas pretreatment systems, paint mist filter cotton bears the critical role of efficiently capturing paint mist, intercepting paint residue, balancing air resistance, protecting downstream equipment, and reducing exhaust emission load. It is the fundamental component for coating environmental governance and quality assurance.

As environmental standards continue to upgrade (such as comprehensive air pollutant emission standards, VOCs treatment requirements) and coating processes evolve toward automation and high precision, traditional paint mist filtration materials have struggled to meet the filtration needs of high-concentration, high-viscosity, multi-type paint mist (solvent-based, water-based paint, powder coating, UV paint). The market has set more stringent technical requirements for paint mist filter cotton in terms of filtration efficiency, paint-holding capacity, moisture resistance, low air resistance, durability, and flame retardancy. Advanced technologies such as gradient density structure, composite fibers, 3D filtration, and solvent-resistant modification have gradually become mainstream in the industry, driving paint mist filtration to upgrade from 'simple interception' to 'efficient capture, long-term stability, and environmental adaptation'.

This white paper provides systematic exposition on the core technology, material classification, performance parameters, production process, selection logic, installation and maintenance, industry applications, and technical trends of paint mist filter cotton. It offers professional and actionable technical reference for enterprises in coating line design, equipment selection, consumable procurement, environmental compliance, and

cost optimization, helping enterprises achieve the comprehensive goals of efficient production, quality assurance, environmental compliance, and cost reduction.

I. Core Functions and Application Scenarios of Paint Mist Filter Cotton

The core function of paint mist filter cotton is to capture overspray paint mist particles (particle size 1-100μm) generated during the spraying process through mechanisms such as physical interception, viscous adsorption, and gradient dirt holding. It prevents paint mist from adhering to fans, pipelines, and downstream purification equipment, while controlling paint residue and particulate emissions to meet environmental discharge requirements. Its functional value runs through the entire coating production process, directly affecting production stability, product quality, and environmental compliance.

In dry spray booth scenarios, paint mist filter cotton serves as the core filtration unit, installed at the bottom floor, side exhaust surface, or top plenum box of the spray room, directly capturing scattered paint mist during spraying. It is the first and most critical protective barrier of dry coating systems. Compared with water curtain spray booths, dry systems combined with high-performance paint mist filter cotton offer advantages of zero wastewater discharge, low operation and maintenance costs, and small floor space, suitable for most dry spraying scenarios such as automotive parts, construction machinery, furniture, and hardware.

In the field of automotive vehicle and parts coating, paint mist filter cotton needs to adapt to high-capacity, continuous operation requirements. For different coating characteristics such as automotive paint, varnish, and color paint, it achieves efficient capture without paint mist rebound or clogging, with stable air resistance. This ensures uniform airflow inside the spray booth without turbulence, prevents secondary adhesion of paint mist to workpieces that could cause pinholes, impurities, or orange peel defects in the coating, ensuring body coating smoothness and pass rate.

In furniture and wood product coating scenarios, paint mist often contains high-viscosity resin and wood paint particles, with relatively high operating environment humidity (60%-80%RH). This requires filter cotton with strong moisture resistance and

high paint-holding capacity, not prone to moisture absorption, caking, or collapse. It should adapt to various coatings such as UV paint, water-based wood paint, and nitro lacquer, while meeting the needs of furniture factories for continuous operation and low maintenance.

In the field of construction machinery and heavy equipment coating, workpieces are large with high spray volume and paint mist concentration. This requires large dirt-holding, thick, high-strength paint mist filter cotton that can withstand high-density paint mist impact without being easily damaged or penetrated, reducing replacement frequency. It adapts to high-flow, high-load spraying scenarios for heavy components, steel structures, and ship parts.

Additionally, paint mist filter cotton is widely used in exhaust gas pretreatment systems (as pre-filtration before activated carbon adsorption and catalytic combustion to protect downstream equipment), spray workshop exhaust purification, laboratory small spray booths, automotive repair spray booths, and other scenarios. With advantages of strong adaptability, convenient installation, and controllable cost, it has become the standard consumable in the paint mist treatment field.

II. Core Technology and Material Classification

The performance core of paint mist filter cotton lies in fiber structure design, material selection, and gradient density process. Through multi-layer, variable-density fiber networks, it achieves 'coarse interception on the surface, deep capture in the middle layer, and stable dirt retention in the inner layer', balancing filtration efficiency, paint-holding capacity, and air resistance. Mainstream products are divided into three major categories by material to adapt to different paint mist characteristics and working condition requirements.

Glass Fiber Paint Mist Filter Cotton (Paint Mist Felt/Anti-Paint Mesh)

Made from high-strength continuous monofilament glass fibers through fluffing and gradient compression molding, it is the most common paint mist filtration material in the industry. With thick fiber diameter, large pores, and fluffy structure, it offers advantages of high paint-holding capacity, low air resistance, high temperature resistance, and strong flame retardancy. Regular temperature resistance is 150-

260°C, with fire rating reaching UL94V-0 or DIN F-1 level. Suitable for capturing large particle paint mist and paint residue (≥10μm), mainly used for bottom floor filter in dry spray booths and primary paint mist capture.

The structure adopts progressive density design (loose on the windward side, dense on the leeward side), which can store paint mist layer by layer without quick clogging. Initial air resistance is low (20-40Pa), with paint-holding capacity up to 3000-8000g/㎡ and long service life. The disadvantage is that fibers are prone to shedding and moisture resistance is average, making it unsuitable for high-humidity water-based paint scenarios. Additionally, glass fiber dust irritates the human respiratory tract.

Polyester Fiber Paint Mist Filter Cotton (Synthetic Fiber Cotton)

Made from polyester filament fibers through hot pressing, impregnation, and 3D fluffing processes, it can adapt to different paint mist types through density control and surface modification. Compared with glass fiber, it offers advantages of no fiber shedding, strong moisture resistance, solvent resistance, good flexibility, and environmental friendliness without irritation. It adapts to all types of paint mist including water-based paint, solvent-based paint, UV paint, and high-solids coatings, gradually becoming the mainstream in mid-to-high-end coating lines.

Classified by process into standard type, impregnated type, anti-static type, and solvent-resistant type: The impregnated type has adhesive resin coated on the surface, enhancing paint mist adhesion and capture capability with filtration efficiency reaching 90%-95%; The anti-static type can eliminate static electricity, avoiding paint mist rebound caused by static; The solvent-resistant type is optimized for strong solvent paints, not prone to swelling or deformation. The structure is mostly gradient multi-layer or 3D structure with paint-holding capacity of 2000-5000g/㎡ and initial air resistance of 30-60Pa, offering strong stability and wide adaptability.

Composite/Specialty Paint Mist Filter Cotton (DPA Cotton, Honeycomb Composite Cotton)

Dedicated for high-end scenarios, using synthetic fiber + glass fiber composite, 3D honeycomb structure or diamond pocket structure design. The representative product is DPA paint mist filter cotton. The core technology is deep-layer 3D dirt retention. The

windward side is a loose capture layer, the middle layer is a dense dirt-lock layer, forming internal 3D dirt-holding cavities. It can efficiently capture 2.5-10μm fine paint mist with filtration efficiency up to 99.8%, and paint-holding capacity up to 27kg/㎡, which is 3-5 times that of ordinary products.

It offers advantages of ultra-strong moisture resistance, anti-collapse, low air resistance decay, and long service life. It adapts to high-concentration, high-viscosity, fine paint mist scenarios such as automotive OEM coating, high-end precision spraying, and continuous production lines. Additionally, some products composite activated carbon layer, enabling synchronized adsorption of partial VOCs, achieving integrated paint mist and odor treatment for scenarios with higher environmental requirements.

III. Core Performance Parameters and Technical Specifications

The performance of paint mist filter cotton directly determines filtration effectiveness, service life, and system energy consumption. Core parameters must comply with GB/T 14295, EN779, GB/T 6165-2021 and other standards. Enterprises should focus on the following indicators when selecting products.

Filtration Efficiency

The core indicator, referring to the capture rate of paint mist particles of different sizes. Classified by grade into G2-G4 (coarse), F5-F6 (medium).

Coarse (G2-G3): For ≥10μm paint mist, efficiency 60%-85%, suitable for low-concentration, large paint residue scenarios.

Medium (G4-F5): For ≥5μm paint mist, efficiency 85%-95%, suitable for conventional coating lines.

High-Efficiency (F6+): For ≥2.5μm fine paint mist, efficiency 95%-99.8%, suitable for high-end precision coating.

Paint-Holding Capacity (Dust-Holding Capacity)

Measuring the paint mist storage capacity, in g/㎡ or kg/㎡, directly determining replacement cycles.

Standard Glass Fiber: 3000-6000g/㎡.

Polyester Impregnated Type: 2000-4000g/㎡.

High-End DPA Type: 10000-27000g/㎡.

Higher paint-holding capacity means lower replacement frequency and lower operation and maintenance costs.

Air Resistance Characteristics

Initial Air Resistance: Glass fiber 20-40Pa, Polyester 30-60Pa, Composite 40-70Pa.

Final Resistance: 200-250Pa (replacement required upon reaching this level to avoid sudden airflow decrease and energy consumption increase).

Quality products have smooth air resistance increase, stable airflow throughout service life, without affecting spray booth airflow balance.

Physical and Environmental Adaptability

Thickness: 30mm, 50mm, 60mm, 80mm, 100mm (standard 50-100mm).

Gram Weight: 220-350g/㎡ (glass fiber), 250-400g/㎡ (polyester).

Temperature Resistance: Glass fiber 150-260°C, Polyester 80-120°C, Composite 100-150°C.

Moisture Resistance: Polyester ≥80%RH, Glass fiber ≤60%RH, Composite adapted for high-humidity environments.

Flame Retardancy: DIN F-1, UL94V-0 grade, to avoid paint mist combustion risk.

Strength: Tensile and impact resistant, no collapse, rupture, or fiber shedding when saturated.

IV. Production Process and Quality Control

Quality paint mist filter cotton adopts four core processes: gradient density molding, high-temperature hot pressing, impregnation modification, and 3D fluffing, with full-process quality control ensuring stable performance.

Raw Material Selection adopts alkali-free glass fiber and food-grade polyester filament with uniform fiber thickness, no impurities, high strength, complying with RoHS environmental directives, no odor, no harmful volatiles. Glass fiber requires surface modification treatment to reduce fiber fly; Polyester fiber requires anti-static, solvent-resistant, and moisture-resistant modification to adapt to complex paint mist environments.

The molding process adopts automated gradient compression production lines to achieve progressive density increase of fibers from windward to leeward sides,forming multi-layer 3D filtration structure, ensuring paint mist is captured and stored layer by layer, avoiding local clogging. The impregnation process uses environmental adhesive resin, uniformly coated on the fiber surface to enhance paint mist adhesion and capture capability without affecting breathability.

Quality testing covers filtration efficiency, initial air resistance, paint-holding capacity, temperature resistance, flame retardancy, fiber shedding rate, thickness uniformity and other indicators. Each batch of products is tested by third-party laboratories according to GB/T 6165-2021 standard to ensure performance compliance.

A product traceability system is also established to record the entire process from raw materials to finished products, ensuring batch-to-batch consistency.

V. Selection Logic and Adaptation Principles

Selection of paint mist filter cotton requires comprehensive judgment based on paint mist type, concentration, spray volume, ambient temperature and humidity, system airflow, and environmental requirements, following the principles of 'matching paint mist characteristics, gradient filtration, balancing efficiency and lifespan, and economic adaptation'.

Selection by Paint Mist Type

Solvent-based paint (paint, varnish): Prioritize glass fiber cotton or solvent-resistant polyester cotton, with high temperature resistance, solvent resistance, and large paint-holding capacity.

Water-based paint: Select moisture-resistant polyester cotton or composite cotton, which will not cake or collapse in high-humidity environments.

UV paint/high-solids paint: Select impregnated polyester cotton or DPA composite cotton with strong adhesion and not prone to clogging.

Fine paint mist (≤5μm): Select F5-F6 grade medium-efficiency cotton or DPA high-efficiency cotton with filtration efficiency ≥95%.

Selection by Spray Volume and Concentration

Low concentration, small batch (hardware, small parts): Select 30-50mm thickness, G3-G4 grade cotton, high cost-effectiveness.

Medium concentration, regular volume (furniture, automotive parts): Select 50-60mm thickness, G4-F5 grade cotton, balancing efficiency and lifespan.

High concentration, large batch (vehicles, construction machinery): Select 80-100mm thick, F5-F6 grade DPA composite cotton with high paint-holding capacity and long lifespan.

Selection by System and Environment

Dry spray booth bottom: Select thick glass fiber floor cotton or polyester 3D cotton, impact-resistant with large paint-holding capacity.

Side/top exhaust: Select thin medium-efficiency polyester cotton with low air resistance and uniform airflow.

High-humidity environment (southern regions, rainy season): Must select moisture-resistant polyester cotton to avoid moisture absorption failure.

Areas with strict environmental regulations: Select high-efficiency composite cotton + activated carbon layer to simultaneously reduce paint mist and VOCs.

VI. Installation, Replacement, and Operation & Maintenance Standards

Correct installation and standardized operation and maintenance are key to ensuring paint mist filter cotton performance, extending lifespan, and stabilizing airflow. The following standardized procedures should be followed.

Installation Standards

Before installation, clean the filter frame and dust and paint residue inside the air ducts to ensure no debris, no sharp edges or corners, avoiding damage to the filter cotton.

The windward side of the filter cotton should face the direction of paint mist flow, with gradient density layers correctly installed (loose layer on windward side, dense layer on leeward side).

Lay flat without wrinkles or damage, with edges tightly fitting the frame. Seal gaps with sealant/retaining strips to prevent air leakage and short-circuiting.

Completely eliminate air leakage and short-circuiting.

For thick filter cotton, use V-shaped/maze installation to increase filtration area and improve paint-holding capacity and filtration efficiency.

When installing glass fiber cotton, wear protective equipment to avoid fiber contact with skin and respiratory tract.

Replacement Cycle Determination

Regular cycles: Glass fiber cotton 1-3 months, polyester cotton 2-4 months, DPA composite cotton 4-8 months (adjusted according to spray volume).

Status determination: Filter cotton surface completely covered by paint mist, turned black and hardened; Air resistance reaches 2-3 times initial value (≥200Pa); Spray booth airflow significantly decreased with paint mist overflow; Coating shows impurity defects.

During replacement, operate after shutdown to avoid paint mist dispersion. Dispose of old filter cotton according to hazardous waste regulations (paint residue-containing waste is classified as hazardous waste).

Daily Operation & Maintenance

Inspect filter cotton status, air resistance, and airflow weekly, and maintain operation records.

Regularly clean paint buildup in air ducts and fans to reduce secondary pollution.

Strengthen inspection during high-humidity seasons to prevent filter cotton moisture absorption, caking, and collapse.

It is strictly prohibited to wash paint mist filter cotton with water, as cleaning destroys the structure, drastically reduces efficiency, and easily breeds mold.

VII. Typical Industry Application Solutions

Automotive Vehicle and Parts Coating

Adopt three-stage filtration configuration: G4 coarse filter cotton at air inlet → F5 medium-efficiency polyester cotton at spray room top → DPA composite cotton (80-100mm) at bottom. Core advantages: Efficiently capture automotive paint mist with filtration efficiency ≥98%, stable air resistance, lifespan of 4-6 months, ensuring body coating without impurities or orange peel, adapted for continuous high-capacity production lines, meeting National VI and higher environmental standards.

Furniture and Wood Coating

Select 60-80mm moisture-resistant polyester impregnated cotton, adapted to UV paint and water-based wood paint, resistant to 80%RH high-humidity environment, no caking or fiber shedding, paint-holding capacity 3000-4000g/㎡, replacement cycle 2-3 months. With V-shaped installation, adapted to large-volume, continuous operation requirements of furniture factories, protecting fans and exhaust gas treatment equipment, reducing workshop paint mist pollution.

Construction Machinery/Steel Structure Coating

Select 100mm thick high-strength glass fiber cotton or DPA composite cotton with paint-holding capacity ≥8000g/㎡, resistant to high-concentration, large paint mist impact, no collapse or rupture, initial air resistance ≤50Pa, final resistance ≤250Pa, service life 3-6 months. Adapted to high-flow spraying of heavy components, reducing replacement frequency, lowering operation and maintenance costs, meeting environmental discharge requirements for large workshops.

Automotive Repair/Small Spray Shops

Select 50mm economical glass fiber cotton or polyester cotton with low cost and convenient installation, filtration efficiency 85%-90%, adapted to small-batch,

intermittent operations, effectively controlling paint mist pollution in repair shops, meeting environmental compliance needs of small venues.

VIII. Technical Development Trends

High Performance

Upgrading toward high efficiency with low resistance, ultra-high dirt holding, and fine particle capture. Gradient density, 3D structure, and nano-fiber composite technologies are being applied at scale. Filtration efficiency exceeds 99.9%, and paint-holding capacity increases to more than 5 times that of ordinary products, adapting to higher precision coating and stricter environmental standards.

Multi-Functional Composites

Integrated products combining paint mist filtration + VOCs adsorption + flame retardancy + anti-static functions are becoming mainstream. Through activated carbon composite, flame-retardant modification, and anti-static treatment, a single filter material achieves multiple functions, simplifying filtration systems, reducing costs, and improving environmental treatment effectiveness.

Environmental and Safety Upgrades

Fully synthetic glass-fiber-free materials are becoming widespread, eliminating fiber dust pollution; Research and development of degradable and recyclable filter materials are advancing,reducing solid waste; Strengthened flame-retardant and explosion-proof performance adapts to high-flash-point coating scenarios, improving operational safety.

Intelligent Adaptation

Linkage with intelligent coating systems, through air resistance sensors and online monitoring modules, enabling real-time monitoring of filter cotton saturation status and automatic replacement alerts; Combined with big data to optimize selection and replacement cycles, achieving precise operation and maintenance and cost reduction.

IX. Conclusion

As the core consumable for coating environmental governance and quality assurance, paint mist filter cotton directly affects production efficiency, product quality, environmental compliance, and operation and maintenance costs. With the upgrading of industrial coating and tightening of environmental standards, high-performance, multi-functional, customized, and environmentally-friendly paint mist filter cotton has become an inevitable industry trend, providing key support for the widespread adoption of dry coating, VOCs treatment, and green production.

This white paper systematically expounds the technology, performance, selection, operation and maintenance, and applications of paint mist filter cotton, providing enterprises with technical reference throughout the entire process.