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Global Chromium-free and Fluoride-free Copper Foil Passivating Agent Supply, Demand and Key Producers, 2026-2032

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Abstracts

The global Chromium-free and Fluoride-free Copper Foil Passivating Agent market size is expected to reach $ 39.26 million by 2032, rising at a market growth of 48.9% CAGR during the forecast period (2026-2032).

Chromium-free and Fluoride-free Copper Foil Passivating Agent refers to a class of specialty surface-treatment chemicals formulated for copper foil that contain no intentionally added chromium-based passivating species, including hexavalent and trivalent chromium compounds, and no fluoride-based active components. These agents form an ultra-thin protective and/or functional passivation layer on the copper foil surface through chemical adsorption, conversion reaction, coordination, polymer film formation, electrochemical deposition, or combinations thereof. The treatment is designed to suppress oxidation, tarnishing and corrosion during copper foil manufacturing, storage and downstream processing while maintaining low electrical resistance and, depending on the formulation, improving surface energy and adhesion to downstream electrode materials. The products can be applied to electrodeposited copper foil and rolled annealed copper foil, particularly copper foil used as an anode current collector in lithium-ion batteries for electric vehicles, stationary energy storage and consumer electronics. The market excludes chromium-containing passivation agents, fluoride-containing chromium-free conversion agents, generic copper cleaners, micro-etchants, plating chemicals and anti-tarnish chemicals not intended for copper foil passivation.

Key FindingsThe market entered a new commercial phase in 2025 with the launch of dedicated chromium- and fluoride-free copper foil passivation technologyCommercial competition remains highly concentrated, with Chemetall’s Gardolene D representing

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the principal verified first-mover product familyElectric vehicle batteries constitute the largest addressable downstream opportunity, while stationary energy storage is becoming an increasingly important growth engineAsia Pacific represents the core demand center, supported by China's dominant position in global battery and related material manufacturingMarket TrendsThe central technology trend is shifting from conventional hexavalent-chromium passivation and transitional Cr(VI)-free systems toward fully chromium-free and fluoride-free surface chemistry. This change represents more than the removal of hazardous substances: next-generation passivation is increasingly expected to perform several functions simultaneously, including oxidation resistance, heat resistance, low electrical resistance, controlled surface energy and strong compatibility with anode coatings. Chemetall’s commercial Gardolene D technology illustrates this transition by combining corrosion protection with improved surface energy and electrode conductivity; company testing reported battery-life improvement of up to 6% after 1,000 cycles at 25°C compared with conventional Cr(VI)-passivated copper foil. Another important direction is process compatibility. Copper foil producers operate continuous, high-speed and tightly controlled production lines, making technologies that can be introduced without major equipment reconstruction substantially easier to qualify. Future product development is therefore expected to emphasize water-based, ultra-thin and multifunctional films, tighter bath-control windows and formulations compatible with increasingly thin and low-roughness battery copper foils.Market DynamicsDriversThe primary demand driver is expansion of lithium-ion battery manufacturing, particularly for electric vehicles and stationary energy storage. Global lithium-ion battery nameplate manufacturing capacity exceeded 4 TWh by the end of 2025, creating a substantially larger addressable base for copper current-collector materials and associated surface-treatment chemicals. At the same time, battery manufacturers increasingly require current collectors that combine low resistance, stable surface chemistry, stronger electrode adhesion and long storage stability. Environmental and supply-chain sustainability requirements provide an additional structural driver. Regulation (EU) 2023/1542 establishes a framework intended to reduce harmful substances and improve the environmental performance and traceability of batteries, while customer-level chemical-management policies are also pushing material suppliers toward safer process chemistry. These forces favor chromium- and fluoride-free technologies even where their use is not explicitly mandated by a single regulation.RestraintsThe principal restraint is the high technical qualification threshold. Passivation is applied to an extremely thin functional interface, yet relatively small changes in coating composition, bath concentration, surface coverage or drying conditions can affect oxidation resistance, electrical resistance, anode adhesion and long-term cell performance simultaneously. Copper foil manufacturers and battery customers therefore require extensive line trials, accelerated

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aging, electrode-processing tests and battery-cycle validation before replacing mature passivation processes. Existing chromium-based treatments also benefit from long production histories and established process windows. Because the chromium- and fluoride-free segment only entered dedicated commercial-scale supply recently, customers may adopt it gradually rather than through rapid line-wide replacement, especially where current processes remain technically acceptable and capital assets have long qualification cycles.OpportunitiesThe largest opportunity is substitution of conventional passivation chemistry on existing lithium-battery copper foil lines. This is particularly attractive when a new chemistry can operate within existing treatment equipment because the customer's conversion decision can then focus on chemistry qualification rather than major capital expenditure. China provides the most immediate commercialization opportunity because it manufactured well over 80% of global batteries in 2025 and supports a dense ecosystem of battery cells, anode materials and copper foil producers. Chemetall’s cooperation with Londian Wason, its first customer in China for Gardolene D, illustrates the importance of joint supplier-customer qualification in accelerating adoption. Beyond China, localization of battery production in Europe, North America and other Asian markets creates additional opportunities for qualified global formulations and localized technical service. Stationary energy storage also provides an expanding second demand pillar alongside electric vehicles.ChallengesThe industry must solve a difficult performance trade-off between corrosion protection and electrical/interfacial performance. Increasing film thickness or introducing strongly insulating organic components can improve oxidation resistance but may negatively affect sheet resistance or electrode bonding, while excessively reactive treatments can alter copper surface morphology. Maintaining consistent performance on ultra-thin foil at high line speeds therefore requires narrow process control and strong application engineering. Another challenge is the limited operating history of fully chromium- and fluoride-free formulations compared with established chromate technologies, requiring suppliers to accumulate long-duration battery data across different electrolytes, anode chemistries and cell formats. Intellectual-property barriers, proprietary customer qualification standards and the need to demonstrate stable bath life and wastewater advantages will further influence entry. Competitive pressure will consequently favor companies combining surface-chemistry expertise with on-site technical service rather than commodity chemical suppliers alone.Industry Chain AnalysisThe industry chain begins with specialty organic corrosion inhibitors, organofunctional coupling and film-forming materials, non-fluoride inorganic functional salts, chelating and complexing agents, surfactants, pH-control components and high-purity process water. Midstream passivating-agent suppliers formulate these materials into tightly controlled aqueous treatment systems and provide bath analysis, concentration management, line commissioning and surface-performance testing.

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Copper foil manufacturers constitute the direct customer group and integrate passivation into the final surface-treatment stage of ED or RA copper foil production. The resulting treated foil is subsequently coated with anode active materials and supplied through electrode and cell manufacturing processes into electric vehicles, stationary storage systems, consumer electronics and other rechargeable batteries. Value creation is concentrated less in raw-material cost than in formulation know-how, nanometer-scale interfacial control, process-window stability, customer qualification capability and the ability to demonstrate that corrosion protection can be improved without sacrificing conductivity or electrode adhesion. Compatibility with existing reel-to-reel production infrastructure materially reduces the switching barrier for copper foil manufacturers. Segment InsightsFor market segmentation, Passivation Chemistry is the most appropriate primary By Type framework, comprising Organic-based Passivating Agent, Inorganic-based Passivating Agent and Organic-Inorganic Hybrid Passivating Agent. These categories are mutually distinguishable according to the principal film-forming mechanism and can accommodate future formulations as commercial competition expands. Treatment Process should be retained as a technology dimension, separating Chemical Passivation from Electrochemical Passivation, while Copper Foil Substrate should be treated as an applicability dimension comprising Electrodeposited Copper Foil and Rolled Annealed Copper Foil. Current commercial evidence confirms that next-generation chromium- and fluoride-free treatment can be designed for both ED and RA substrates.From a technology-development perspective, multifunctional organic-inorganic approaches are likely to receive increasing attention because the target film must combine oxidation protection, heat resistance, adhesion and low electrical resistance within an extremely thin layer. Chemical and electrochemical routes can coexist because copper foil manufacturers use different line architectures and surface-treatment sequences; therefore, future market penetration is more likely to depend on performance and retrofit compatibility than on a single universally dominant deposition mechanism. The ED copper foil segment represents the broadest near-term addressable substrate base due to its widespread use in lithium-ion battery current collectors, while RA copper foil provides an additional specialized opportunity where flexibility, surface characteristics or product design favor rolled material. Downstream Market OpportunitiesElectric Vehicle Batteries represent the principal downstream opportunity because EV manufacturing remains the largest structural driver of lithium-ion battery deployment and requires large volumes of high-performance copper current collectors. Energy Storage Batteries form the second major opportunity as grid-scale, commercial and residential storage deployments expand, placing greater emphasis on cycle life, long-term reliability and cost. Consumer Electronics Batteries remain an established application requiring thin current collectors and consistent interface quality, although their growth profile is more mature. Other

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Batteries cover specialized rechargeable systems in aerospace, industrial equipment and emerging mobility applications. Across these applications, the strongest commercial opportunity is not simply increasing copper foil consumption but raising the penetration of chromium- and fluoride-free treatment within each square meter of qualified battery foil as copper-foil producers convert existing passivation processes.Regional InsightsAsia Pacific is the largest addressable regional market because battery cells, anode materials and copper foil manufacturing remain strongly concentrated in the region. China is particularly important: in 2025 it accounted for over 80% of global battery-cell production and more than 90% of anode active material production for electric-car batteries, creating a concentrated customer base for copper-foil surface treatment. The first announced Chinese application of Gardolene D by Londian Wason further indicates that China is becoming an early commercialization and qualification center for this technology. Japan and South Korea remain strategically important because of their established battery, copper foil and specialty-chemical capabilities, although the addressable volume base is smaller than China. Europe represents an important technology- and regulation-driven market, where battery sustainability requirements and local cell manufacturing investment can accelerate interest in lower-hazard surface chemistry. North America is also expanding battery manufacturing capacity, creating opportunities for qualified copper-foil suppliers and supporting chemical vendors as regional supply chains develop. Nevertheless, near-term market adoption is expected to remain linked closely to Asian copper foil production because passivating agents are consumed at the foil manufacturing stage rather than at final vehicle assembly. Competitive Landscape AnalysisThe Chromium-free and Fluoride-free Copper Foil Passivating Agent market is currently characterized by first-mover concentration rather than a mature multi-supplier competitive structure. Chemetall, the surface-treatment business of BASF Coatings, established the clearest commercial benchmark with the global launch of Gardolene D in October 2025, including Gardolene D 6701 and Gardolene D 6702. The company positioned the technology as the first chromium- and fluoride-free copper foil passivation solution and subsequently entered a strategic implementation partnership with Londian Wason, the first announced customer in China. Adjacent surface-finishing suppliers already possess copper corrosion-protection technologies, but product-level verification is essential because Cr(VI)-free does not necessarily mean chromium-free: for example, technologies based on Cr(III) remain outside the defined market. Competition is therefore expected to broaden from three directions—global surface-treatment specialists extending existing copper-treatment portfolios, Asian specialty-chemical companies developing battery-material process chemistry, and copper foil manufacturers commercializing or externalizing internally developed passivation know-how. Near-term competitive differentiation will center on corrosion resistance, electrical resistance, anode adhesion, line speed, bath

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stability, retrofit compatibility, wastewater characteristics and the depth of customer qualification support rather than price alone.

Report Scope

This report studies the global Chromium-free and Fluoride-free Copper Foil Passivating Agent production, demand, key manufacturers, and key regions.

This report is a detailed and comprehensive analysis of the world market for Chromium-free and Fluoride-free Copper Foil Passivating Agent and provides market size (US$ million) and Year-over-Year (YoY) Growth, considering 2025 as the base year. This report explores demand trends and competition, as well as details the characteristics of Chromium-free and Fluoride-free Copper Foil Passivating Agent that contribute to its increasing demand across many markets.

Highlights and key features of the study

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent total production and demand, 2021-2032, (Tons)

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent total production value, 2021-2032, (USD Million)

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent production by region & country, production, value, CAGR, 2021-2032, (USD Million) & (Tons), (based on production site)

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent consumption by region & country, CAGR, 2021-2032 & (Tons)

U.S. VS China: Chromium-free and Fluoride-free Copper Foil Passivating Agent domestic production, consumption, key domestic manufacturers and share

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent production by manufacturer, production, price, value and market share 2021-2026, (USD Million) & (Tons)

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Global Chromium-free and Fluoride-free Copper Foil Passivating Agent production by Type, production, value, CAGR, 2021-2032, (USD Million) & (Tons)

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent production by Application, production, value, CAGR, 2021-2032, (USD Million) & (Tons)

This report profiles key players in the global Chromium-free and Fluoride-free Copper Foil Passivating Agent market based on the following parameters - company overview, production, value, price, gross margin, product portfolio, geographical presence, and key developments. Key companies covered as a part of this study include Chemetall GmbH(BASF Coatings), etc.

This report also provides key insights about market drivers, restraints, opportunities, new product launches or approvals.

Stakeholders would have ease in decision-making through various strategy matrices used in analyzing the World Chromium-free and Fluoride-free Copper Foil Passivating Agent market

Detailed Segmentation:

Each section contains quantitative market data including market by value (US$ Millions), volume (production, consumption) & (Tons) and average price (US$/kg) by manufacturer, by Type, and by Application. Data is given for the years 2021-2032 by year with 2025 as the base year, 2026 as the estimate year, and 2027-2032 as the forecast year.

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent Market, By Region:

United States

China

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Europe

Japan

South Korea

ASEAN

India

Rest of World

Market Segmentation

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent Market, Segmentation by Type:

Organic-based Passivating Agent

Inorganic-based Passivating Agent

Organic-Inorganic Hybrid Passivating Agent

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent Market, Segmentation by Treatment Process:

Chemical Passivation

Electrochemical Passivation

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent Market, Segmentation by Copper Foil Substrate:

Electrodeposited Copper Foil

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Rolled Annealed Copper Foil

Global Chromium-free and Fluoride-free Copper Foil Passivating Agent Market, Segmentation by Application:

Electric Vehicle Batteries

Energy Storage Batteries

Consumer Electronics Batteries

Others

Companies Profiled:

Chemetall GmbH(BASF Coatings)

Key Questions Answered

1. How big is the global Chromium-free and Fluoride-free Copper Foil Passivating Agent market?
2. What is the demand of the global Chromium-free and Fluoride-free Copper Foil Passivating Agent market?
3. What is the year over year growth of the global Chromium-free and Fluoride-free Copper Foil Passivating Agent market?
4. What is the total value of the global Chromium-free and Fluoride-free Copper Foil Passivating Agent market?
5. Who are the Major Players in the global Chromium-free and Fluoride-free Copper Foil Passivating Agent market?
6. What are the growth factors driving the market demand?

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