

PATENT PORTFOLIO

Our patent portfolio is intentionally designed as a set of Platform Patents, not ingredient patents. This strategy protects the architecture, mechanisms, and functional behavior of each technology family not the specific recipe.

Humidity-Activated Rechargeable N-Halamine-Coated Zeolite Compositions:

This invention covers humidity-activated, rechargeable N-halamine coatings applied to zeolite substrates to create oxidative, odor-destroying, VOC-reducing functional media. The coated zeolites generate controlled HOCl at the surface when exposed to ambient humidity, enabling long-lasting odor, ammonia, and microbial suppression in high-load environments. Applications include cat litter, animal bedding, poultry houses, barns, turf infill, kennels, waste management systems, and large-area odor/VOC control. The patent protects the coating chemistry, recharge mechanism, oxidative activation behavior, and all uses where N-halamine-coated zeolite provides superior performance over uncoated mineral media.

Consumer Pet Care - Animal Agriculture - Commercial & Institutional Facilities - Turf, Landscaping & Sports Surfaces - Waste Management & Sanitation - Industrial Odor & VOC Control - Environmental Remediation & Absorbent Media - HVAC, Filtration & Indoor Air Quality - Food Supply Chain & Storage - Municipal & Public Works - Retail & CPG Licensing - Research & Institutional Testing

Hybrid N-Halamine Aqueous Spray Compositions with Organosilane Antimicrobials and Film-Forming Biopolymers:

This invention provides aqueous N-halamine spray compositions combined with organosilane antimicrobials and optional film-forming biopolymers to deliver immediate oxidation, long-lasting antimicrobial activity, odor reduction, and surface durability. The hybrid system forms a thin, protective, rechargeable micro-film suitable for kitchens, bathrooms, glass, tile, stainless steel, automotive interiors, RVs, boats, and general household surfaces, as well as high-performance textiles, sports gear, athletic equipment, protective padding, gloves, helmets, footwear, and foam-based materials used in hockey, football, lacrosse, skiing, and other athletic environments. The compositions provide rapid microbial reduction, sweat-odor suppression, soil-release benefits, and extended protection between cleanings. The patent covers the hybrid chemistry, film-forming mechanisms, recharge pathways, and all consumer, commercial, textile, and sports-equipment applications.

Consumer Household & Janitorial - Healthcare & Medical Facilities - Hospitality & Lodging - Textiles & Apparel Manufacturing - Sports & Athletic Equipment - Personal Protective Equipment & Workwear - Automotive Interiors & Aftermarket - Marine & RV Interiors - Commercial Cleaning & Facilities Maintenance - Industrial & Manufacturing Surfaces - HVAC & Air Handling Filters - Retail & CPG Licensing - Institutional & Government Facilities - OEMs & Aftermarket Suppliers

Aqueous N-Halamine Coating Systems for Porous Mineral Substrates and Rechargeable Oxidative Functional Media:

This invention covers universal aqueous N-halamine coating systems designed for porous mineral substrates other than zeolite, including clays, silica, pumice, perlite, diatomaceous earth, ceramics, and other absorbent carriers. The coated minerals generate controlled oxidative activity for odor destruction, VOC reduction, microbial suppression, and environmental remediation. Applications include animal care products, industrial absorbents, environmental cleanup media, odor-control granules, and VOC-destructive functional substrates. The patent protects the coating architecture, oxidative activation behavior, substrate classes, and all uses where aqueous halamine-coated minerals provide enhanced performance.

Industrial Absorbents & Spill Response - Environmental Remediation & Soil Treatment - Consumer Pet Care (litter & bedding) - Animal Agriculture & Livestock Facilities - Waste Management & Composting - Food Processing & Packaging (absorbent pads, liners) - HVAC & Filtration Media - Construction & Building Materials (cementitious absorbents) - Turf, Landscaping & Sports Surface Management - Retail & CPG Licensing - Municipal & Public Works (sewer, odor control) - Research & Laboratory Consumables

Mineral-Hosted Functional Additives for Fire-Resistance and Optional Antimicrobial Performance Across Coatings, Textiles, Plastics, Foams, Gypsum, Cementitious Materials, & Composites:

This invention covers mineral-hosted functional additives—such as zeolite, silica, clay, and other mineral carriers—engineered to deliver fire-resistant (FR), antimicrobial (AM), or combined FR+AM performance across a wide range of material systems. The platform includes single-layer FR particles, single-layer antimicrobial particles, and dual-layer FR+AM embodiments, each designed to integrate into coatings, textiles, plastics, foams, gypsum, cementitious materials, and composite structures. These additives enhance flame retardancy, reduce ignition and flame spread, suppress microbial growth, and improve durability without altering material appearance or processing. The patent protects the full architecture, compositions, particle structures, and methods of incorporating these mineral-hosted additives into industrial, commercial, and textile applications.

Construction & Building Materials - Textiles & Apparel - Automotive & Transportation Interiors - Foams & Bedding - Plastics & Polymer Compounds - Coatings & Paints - Composites & Aerospace - Marine & Offshore - Electrical & Electronics Enclosures - HVAC & Insulation - Medical & Healthcare Textiles - Industrial OEM Components - Fire Safety & Passive Protection Systems - Retail & Licensing

Hybrid N Halamine Coated Superabsorbent Polymers Using Solvent Based Deposition for Antimicrobial Odor Control VOC Oxidation Ethylene Reduction and Medical Hygiene Applications

The invention provides hybrid N-halamine-coated superabsorbent polymers (SAPs) produced through solvent-based deposition methods. The coated SAP granules, powders, fibers, and composite structures generate controlled hypochlorous acid (HOCl) upon exposure to ambient humidity or absorbed biological fluids. This oxidative activation delivers antimicrobial activity, odor suppression, ammonia oxidation, volatile organic compound (VOC) degradation, ethylene oxidation, and enzyme inactivation. The platform enables high-performance oxidative SAPs for hygiene products, wound dressings, meat/seafood/poultry absorbent pads, animal husbandry substrates, environmental odor-control media, food-preservation packaging, medical absorbents, and hybrid SAP/zeolite blends. The invention protects the coating architecture, oxidative mechanisms, substrate classes, and all applications where humidity-activated N-halamine SAPs provide superior antimicrobial, odor-control, and VOC/ethylene-reduction performance.

Hygiene & Baby Care - Medical & Wound Care - Food Packaging & Preservation - Meat/Seafood/Poultry Absorbent Pads - Animal Husbandry & Livestock - Consumer Pet Care - Industrial Absorbents & Spill Response - Environmental Remediation - Agricultural Produce & Ethylene Control - Personal Care & Feminine Hygiene - OEMs & Converters - Retail & CPG Licensing - Research & Laboratory Consumables

Anchored, Non-Volatile, Rechargeable Oxidative Media for Food Preservation Across the Entire Food Ecosystem:

This invention covers a modular, substrate-agnostic oxidative platform using coated zeolites, coated superabsorbent polymers (SAPs), and other porous mineral carriers to control ethylene, VOCs, odors, moisture, and microbial pressure across the entire food ecosystem. The platform includes humidity-activated oxidative media for produce preservation, high-moisture oxidative SAPs for meat/seafood/poultry pads, and porous-substrate sachets, films, inserts, and container systems for floral, dairy, bakery, and cold-chain logistics. These coated substrates generate controlled oxidative activity, extend freshness, reduce spoilage, stabilize closed environments, and improve quality during storage, shipping, and retail display. The patent protects the coating architecture, oxidative mechanisms, substrate classes, and all applications across packaging films, pads, sachets, refrigerated environments, shipping containers, and cold-chain distribution.

Produce & Fresh Produce - Meat, Seafood & Poultry Processing - Dairy, Bakery & Floral Preservation - Cold Chain Logistics & Refrigerated Transport - Active Food Packaging & Pads - Food Processing & Manufacturing Facilities - Retail Grocery & Supermarket Display - Food Service & Restaurants - Refrigerated Warehousing & Distribution Centers - Agricultural Storage & Postharvest Handling - OEM Packaging Suppliers & Converters - Food Safety, QA & Testing Labs - CPG Licensing & Co-packing - Seafood/Meat Retail & Butcher Channels

Aqueous Silicon Dioxide SiO₂ Micro-Layer and Hybrid Coating Platform for Biological, Polymeric, Marine, Aviation, Solar, Wind, Rail, Industrial, Automotive, and Aerospace Substrates:

This invention provides an aqueous, non-film-forming silicon dioxide (SiO₂) micro-layer and inorganic/organic hybrid coating platform engineered to form sub-micron, chemically anchored micro-layers across a wide range of substrates. The platform includes substrate-specific embodiments for biological surfaces (e.g., plant cuticles, turf), optical polymeric visibility surfaces (e.g., polycarbonate, acrylic lenses and visors), flexible plasticizer-rich vinyl, synthetic seating and interior substrates (PU, PVC, HDPE, ABS, EVA, PP, PC), and exterior structural substrates (gelcoat, epoxy and polyurethane topcoats, painted metal, fiberglass, carbon-fiber composites). The compositions bond via silanol condensation and hybrid silica network formation to deliver one or more functional outcomes without adding measurable film thickness: controlled surface energy or hydrophobicity, soil-release, micro-roughness smoothing, optical clarity enhancement, UV and thermal resilience, reduced adhesion of salt/soot/particulates/biological contaminants, plasticizer-safe performance on flexible vinyl, and improved cleanability and durability under ambient, in-service cure conditions. Aqueous Silicon Dioxide SiO₂ Micro Layer and Hybrid Coating Systems for Biological and Polymeric Substrates

Biological & Agricultural Surfaces - Optical & Visibility Surfaces (lenses, visors, displays) - Flexible Vinyl & Interior Seating Materials - Automotive Interiors & Exterior Trim - Marine & Offshore Surfaces - Aviation & Aerospace Interiors and Exteriors - Renewable Energy Surfaces (solar panels, wind turbine blades) - Rail & Mass Transit Surfaces - Industrial Equipment & Structural Composites - Coatings, Paints & OEM Surface Treatments - Textiles & Upholstery - Turf, Landscaping & Sports Surfaces - Medical & Healthcare Surfaces - Electronics Enclosures & Optical Plastics - Packaging & Consumer Goods Surfaces

Botanical and Mineral Surface-Active Treatment with Dry-State Persistence and Multi-Pathway Action for Bedbugs, Ants, Spiders, Mosquitoes, Biting Midges, and Other Insects:

A water-based botanical and mineral surface treatment is disclosed. The composition includes a botanical oil component, a mineral component, an organic acid component, and a surface-retention system that forms a non-volatile microlayer after drying.

The treatment provides sensory disruption, surface chemistry interference, mineral-based desiccation stress, behavioral repellency, and contact-based physiological stress to insects including bedbugs, ants, spiders, mosquitoes, biting midges (no-see-ums), and other insects that rely on surface interaction. The formulation operates through non-neurotoxic, multi-pathway mechanisms and remains effective after drying. The invention includes concentrate and ready-to-use embodiments, manufacturing processes, and methods of treating surfaces in residential, hospitality, and institutional environments.

Moisture-Activated N-Halamine Surface Treatments for Organic Manure-Derived Bedding and Urease-Driven Ammonia Suppression

This invention covers moisture-activated, surface-bound N-halamine treatments engineered for organic manure-derived bedding materials including recycled manure solids (RMS), poultry litter, composted bedding, bio-digester solids, and other organic fiber/fines used in livestock housing. The aqueous treatment deposits a thin, non-volatile oxidative layer that remains dormant when dry and becomes locally active only during moisture events such as urine deposition, humidity spikes, or re-wetting cycles. Upon activation, the treated surface suppresses urease-producing microorganisms, slows urea hydrolysis, and reduces ammonia formation at the source—addressing the biological root cause of odor and hygiene degradation in dairy, poultry, and livestock facilities.

Unlike chlorine dioxide (ClO₂) sprays, acids, alum, or bulk disinfectants, the disclosed system does not rely on free-gas oxidants, pH manipulation, or single-use kill. Instead, it **provides event-based, moisture-triggered oxidative suppression that aligns with real barn conditions and persists across multiple wet/dry cycles. Optional embodiments include cationic silane antimicrobials (e.g., AEGIS) for dual-mechanism biological control and an aqueous recharge spray for restoring oxidative capacity after extended use. The invention protects the chemistry, activation mechanism, substrate classes, urease-suppression behavior, and all agricultural, environmental, and odor-control applications where moisture-activated N-halamine coatings provide superior performance over untreated organic bedding.**

Dairy & Livestock Bedding – Poultry Litter & Deep-Litter Systems – Compost & Bio-Digester Solids – Manure Management & Circular Agriculture – Barn Odor & Ammonia Control – Animal Welfare & Housing Hygiene – APAC High-Humidity Livestock Systems – North American RMS Bedding – Environmental Odor Mitigation – Agricultural Waste Valorization – Soil Amendment Stabilization – Regulatory Ammonia-Reduction Compliance – Large-Scale Dairy & Poultry Integrators – Agricultural Supply & Bedding Manufacturers – Research & Institutional Field Trials

PFAS-FREE SOLVENT-BASED DUAL-LAYER AND SINGLE-PASS SILICON DIOXIDE HYBRID COATING PLATFORM FOR GLASS SUBSTRATES:

The present invention relates to solvent-based silicon dioxide surface-engineering compositions for glass substrates. More particularly, the invention relates to PFAS-free, solvent-based, dual-layer and single-pass inorganic hybrid coating systems that chemically bond to glass surfaces to provide mechanical reinforcement, abrasion resistance, hydrophobicity, optical clarity, and controlled wear behavior. The invention further relates to structural dual-layer architectures comprising a chemically bonded base layer and an abrasion-resistant topcoat, as well as single-pass hybrid architectures for applications where moderate abrasion, high throughput, or simplified processing is required. The invention is PFAS-free and relies on inorganic siloxane network formation rather than fluorinated surface chemistry or polymeric films.

Mobile device glass, automotive glass, architectural glass, solar glass, marine glass, aviation canopies, and other glass substrates.