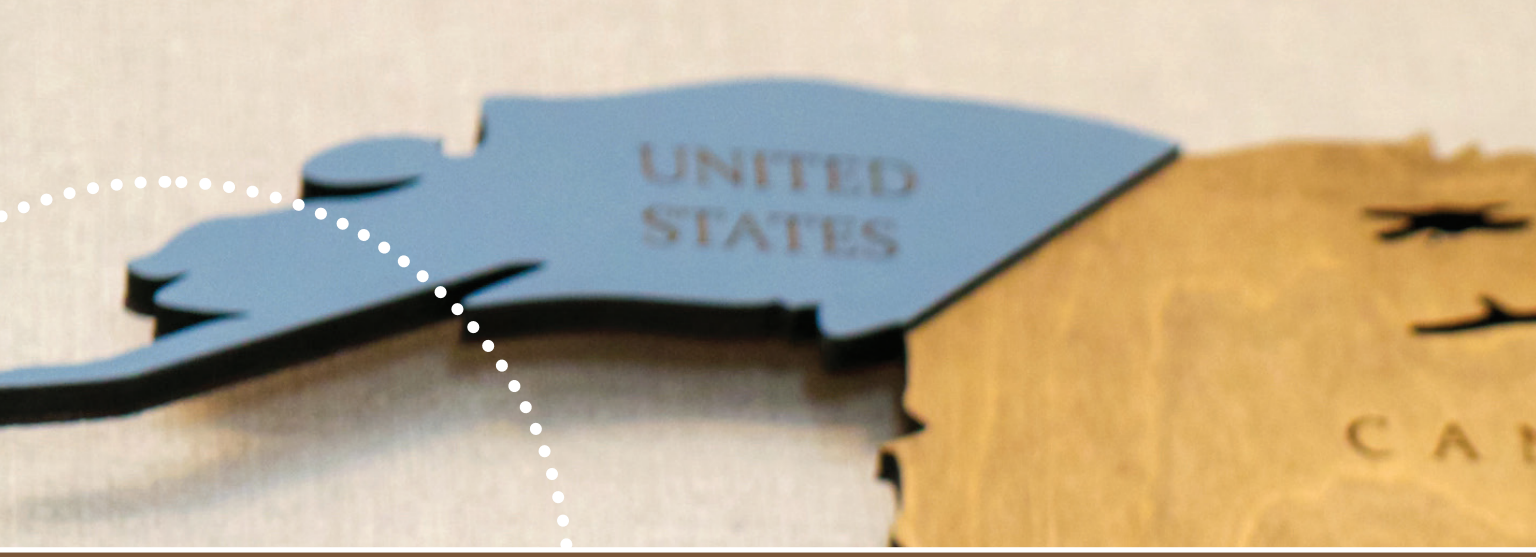

Global Trends, Part 1:

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Understanding the trajectory of the coatings industry is essential for business leaders and strategic marketers, but it's equally important to assess whether innovations and product launches align with the megatrends shaping the market. Aligning a company's innovation portfolio and strategic initiatives with these megatrends ensures long-term relevance and impact, avoiding the pitfalls of short-lived gains.

Numerous lists of megatrends are available; though the wording may vary, they typically converge on similar themes. Drawing from our extensive experience collaborating with companies across the global coatings industry value chain, ChemQuest has identified the following key influences:

- **Environmental sustainability**
- **Health awareness**
- **Mobility**
- **Digitalization**
- **Demographic shifts**
- **Urbanization**
- **Globalization and "glocalization"**
- **Social instability and inequality**

The megatrends with the most bearing on the North American market include environmental sustainability, health awareness, mobility, and digitalization. While the others also shape the industry, their impact is more pronounced outside North America and will be discussed in the July-August 2025 issue of *CoatingsTech*.

Environmental Sustainability

Environmental sustainability involves designing, producing, using, and disposing of materials to minimize environmental harm while preserving resources for future generations. This megatrend has historically shaped the coatings industry and will remain a key driver for years to come. The term "circular economy" has become a mainstay for coating and raw material suppliers, and two key parts of companies' circular economy initiatives are the use of bio-based materials and recyclability.

NORTH AMERICA

Bio-based Materials

Demand for bio-based raw materials is growing as consumers favor products from renewable resources over petroleum-based alternatives. Beyond reducing reliance on finite fossil reserves, bio-based coatings often offer a lower carbon footprint and greater biodegradability than petrochemical options.

This consumer appeal drives companies to prioritize bio-based efforts in coatings marketed toward consumers. One example of this is AkzoNobel's Rubbol WF 3350, launched in February 2025, which is a waterborne wood coating with 20% bio-based content. AkzoNobel describes the product as a sprayable opaque coating that is suitable for interior and exterior use. The company claims it matches the high performance standards of equivalent coatings, even in the harshest weather conditions.

Often referred to as "advanced" or "chemical" recycling, molecular recycling is another topic that is gaining traction in the coatings industry.

Another example is Liquitex's Bio-Based Heavy Acrylics, marketed to artists as "the world's first bio-based pro-grade fine art paint." This North American brand has replaced 50% of its acrylic resin with bio-based materials and substitutes other ingredients with renewable alternatives where available, pledging further adoption as options emerge.

Bio-based coatings draw from a variety of sources, such as corn, soy, sugarcane, algae, and other once-living organisms. A common strategy is to replace part of the binder (or its precursors) with bio-based materials, enabling significant renewable content. Soybean oil, a longstanding raw material in alkyd binders, exemplifies this approach.

Acrylic manufacturers are also advancing, with BASF's 2-Octyl Acrylate (2023), made from castor oil with 73% bio-based content, and Arkema's ethyl acrylate (2023), produced solely from bioethanol with 40% bio-carbon content. These monomers enable the development of polymers for various coatings applications, from decorative paints to industrial finishes.

Molecular Recycling

Often referred to as "advanced" or "chemical" recycling, molecular recycling is another topic that is gaining traction in the coatings industry. This term refers to processes that break down complex materials such as polymers into their fundamental building blocks using chemical reactions. This process yields raw materials that rival virgin feedstocks in purity and performance, unlike mechanical recycling, which often degrades quality.

Given the mass-balance approach typically used to track recycled content, here we'll focus on companies pioneering molecular recycling and the coating materials leveraging their outputs. Two North American leaders in this space are Eastman Chemical Co. and Trinseo.

Eastman's Polyester Renewal Technology (PRT), recently scaled to initial production, employs methanolysis to convert polyester waste into basic monomers. These recycled monomers feed into new polyesters for applications like coatings, with Eastman reporting a 20-30% reduction in greenhouse gas emissions compared to fossil-based processes.

Similarly, Trinseo's polymethyl methacrylate (PMMA) depolymerization facility in Rho, Italy, opened in June 2024, uses advanced chemical recycling to transform PMMA waste into high-purity recycled methyl methacrylate (rMMA). Headquartered in Wayne, Pa., Trinseo maintains that its rMMA matches virgin material performance with a significantly lower carbon footprint. This rMMA can be used to develop acrylic resins and latex binders for a variety of applications, including paints and coatings.

Health Awareness

With unprecedented access to information, consumers today are more aware than ever of how materials impact their health. This heightened awareness has increased scrutiny of raw materials (or "materials of concern") that may harm health or the environment, particularly when supported by data rather than conjecture. Combined with the COVID-19 pandemic's lasting effects, this trend has also spurred demand for antimicrobial coatings, reflecting a broader focus on health and hygiene.

Materials of Concern

Per- and polyfluoroalkyl substances (PFAS) stand out as the coatings industry's most prominent "material of concern," as the topic is continuously discussed in publications and trade conferences. This class of chemicals has gained significant attention across industries, from firefighting foams and cookware to paints and coatings, due to its combination of widespread use, persistence in the environment, and potential health risks.

While some companies have developed products as alternatives to PFAS-containing materials, others have proactively phased it out. Three notable players in the coatings space—3M, Clariant, and Micro Powders—have committed to completely eliminating PFAS from their raw materials by the end of 2025, signaling a strong shift toward alternatives considered safer.

Industry forecasts project robust growth for antimicrobial coatings, with compound annual growth rate (CAGR) estimates typically ranging from 11-15% over the coming years.

Antimicrobial Coatings

The COVID-19 pandemic triggered a surge in antimicrobial coating development and adoption. These coatings are designed to inhibit or prevent the growth of microorganisms (e.g., bacteria, fungi, mold, and viruses) on treated surfaces and are primarily marketed for healthcare settings, where hygiene, durability, and protection against microbial contamination are paramount. However, their use is expanding into air conditioning and ventilation systems, kitchen environments, and other consumer spaces, driven by health-conscious demand.

Nearly every major coatings company has either launched new antimicrobial products or refreshed existing lines since the pandemic, making specific examples too numerous to detail. It follows then that industry forecasts project robust growth for antimicrobial coatings, with compound annual growth rate (CAGR) estimates typically ranging from 11-15% over the coming years. Despite this momentum, concerns about traditional antimicrobial agents (e.g., metal-based additives like silver or copper) are tempering broad adoption. This has spurred innovation toward non-metallic and bio-based alternatives, including polymeric and enzyme-based technologies, balancing efficacy with safety.

Mobility

Focus on passenger safety and decreasing carbon emissions are key themes across the global transportation industry, including North America, driving progress in electrification and autonomous vehicles. Electric vehicles (EVs) have experienced particularly tremendous growth in recent years, with every major automobile manufacturer investing in EV models.

Despite shifting politics and trade policies, the EV market will continue to grow. With the expansion of the EV market, coatings play an important role in enabling and enhancing the future of mobility. Investments in North American vehicle manufacturing and battery plants require traditional automotive interior and exterior coatings while also driving significant growth in specialty coatings for batteries, battery packs, and sensors.

Coatings for EV Batteries

Coatings have become critical to improving EV battery safety, performance, and longevity. Dielectric coatings prevent arcing between metal components, while thermal management coatings help regulate temperature, ensuring batteries operate efficiently under various conditions. Intumescent coatings add an extra layer of fire protection, which is crucial for the flammable solvents found in lithium-ion battery cells.

Key players such as Solvay, PPG Industries, and AkzoNobel are actively innovating in this space. Large coating manufacturers have a full suite of products, from electrocoat to liquid and powder systems. Powder coatings have become increasingly attractive for battery applications. AkzoNobel has launched key powder products, like Resicoat EV, which are specifically designed for the EV market.

Growth in coatings for the EV market also offers opportunities for entirely new approaches. A promising technology to watch is AM Batteries' Dry Electrode Coating process. With this technique, the dry coating is spray-applied directly to the electrode and does not require heating or solvents. The process boasts reduced energy consumption and CO_2 emissions while improving production time.

Coatings for Sensors and Automation

Coatings play a crucial role in enabling the function and longevity of safety and proximity sensors in EVs and autonomous driving. Sensors and electrical components can include those for light detection and ranging (LiDAR), printed circuit boards (PCBs), electronic control units (ECUs), micro-electro-mechanical systems (MEMs), tire pressure monitoring systems (TPS), and emissions sensors. These coatings must be ultra-thin, lightweight, and offer excellent moisture, chemical, and solvent resistance while maintaining superior dielectric and thermal stability. Self-cleaning topcoats that repel dirt also present an opportunity to enhance sensor performance.

Sun Chemical's SpectraSense™ technology is a notable innovation in this space. Designed to optimize coatings for LiDAR systems, the technology reportedly improves the response of autonomous vehicle sensors by enhancing their interaction with visual, near-infrared, ultrasonic, and radio electromagnetic radiation. Additionally, Sun Chemical's solutions incorporate advanced pigments that improve the clarity and effectiveness of automotive photonics, a key component for the future of self-driving vehicles. These innovations contribute to more reliable and responsive safety and automation systems in modern vehicles.

As the EV market evolves, coatings will remain an essential factor in overcoming industry challenges. From extending battery life and sensor function to improving safety, thermal stability, and corrosion resistance, coatings innovations will be pivotal in shaping the future of electric mobility.

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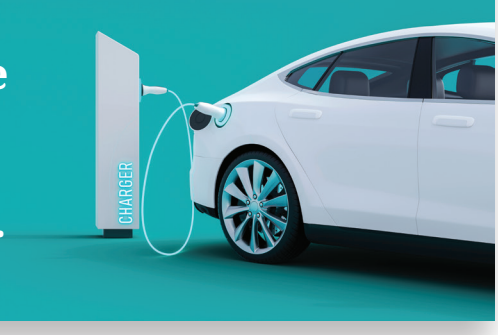

Digitalization and Industry 4.0

Digitalization and Industry 4.0 are reshaping the North American paints and coatings industry, driving faster R&D cycles, smarter manufacturing, and transformative innovation. Technologies such as artificial intelligence (AI), machine learning (ML), laboratory automation, and the Internet of Things (IoT) are giving companies a competitive edge across the value chain—from formulation design to production optimization and real-time customer feedback.

Digital Formulation and Automation

AI and big data are accelerating coatings R&D by enabling faster formulation optimization and reducing reliance on traditional trial-and-error approaches. AI-driven platforms like Alchemy Cloud and Albert Invent provide powerful digital infrastructure—including electronic lab notebooks (ELNs), integrated laboratory information management systems (LIMS), and AI-enhanced data analysis—to streamline product development workflows.

Automation tools such as those offered by Chemspeed Technologies are transforming lab operations by enabling high-throughput synthesis, formulation, testing, and application. This convergence of automation and AI reduces development timelines and enhances reproducibility.

Companies like Eastman Chemical are leveraging digital modeling and predictive analytics to simulate coating performance under various environmental conditions. This not only accelerates innovation but also reduces material waste and the need for physical testing.

Smart Manufacturing and Process Automation

Industry 4.0 technologies are revolutionizing coatings production by enhancing operational efficiency, improving quality, and lowering costs. Sherwin-Williams has adopted AI-driven process automation in its manufacturing facilities to improve batch consistency, reduce energy consumption, and optimize production parameters. Similarly, PPG is deploying IoT-enabled sensors to monitor critical production variables such as temperature, viscosity, and humidity in real time—allowing for adaptive process control and minimizing defects.

Solutions like Datacolor's automated color matching systems are also helping manufacturers streamline quality control and reduce formulation errors, ultimately improving throughput and customer satisfaction. In addition, companies such as Ford, ZF, and PPG are actively deploying smart factory technologies, using digital twins, predictive maintenance, and AI-powered analytics to drive performance across the production ecosystem.

Monitoring Performance and Customer Experience

Digitalization is also unlocking new value at the product level. R&D efforts continue on smart coatings with embedded sensing capabilities that provide early warnings of degradation, corrosion, or mechanical stress—enhancing safety and durability.

For the consumer interface, coatings companies are leveraging AI to elevate the user experience. For example, Sherwin-Williams' Color Expert app uses AI-powered tools to help consumers visualize color choices and receive personalized recommendations, combining convenience with high-tech innovation.

By embracing Industry 4.0 and digital technologies, the paint and coatings industry is entering a new era of efficiency, innovation, and sustainability. From AI-enhanced R&D and lab automation to smart manufacturing and functional coatings, these advances are redefining how products are developed, produced, and experienced. Companies that lead in digital transformation—like Eastman, PPG, Sherwin-Williams, and others—are setting the benchmark for the future of coatings in an increasingly connected and data-driven world.

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Flexibility Helps Ensure Long-Term Success

Aligning innovation and strategic initiatives with the megatrends shaping the coatings industry is essential for maintaining long-term relevance and impact. As environmental sustainability, health awareness, mobility, and digitalization continue to drive market transformation, companies must focus on adapting to these changes.

From the development of bio-based materials and antimicrobial coatings to the adoption of digital technologies and advancements in EV coatings, the coatings industry is evolving rapidly. Those who effectively respond to these megatrends will be best-positioned to thrive in a competitive and dynamic market, ensuring their products meet both current and future demands. ❊

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