



Preparing for Chance: The Coatings Industry's Path to Innovation *That Wins*

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“Chance favors the prepared mind.” Louis Pasteur used this phrase to describe the fact that many of the world’s human-made marvels are made possible through a combination of intellectual curiosity and timing, not by pure chance alone. Take the telegraph, for example. We may associate Samuel Morse with its invention, but the telegraph’s development was enabled by a prior discovery Danish physicist Hans Christian Oersted made by “chance”—the realization that electricity and magnetism are linked.

Intrigued by the idea that they might have a potential relationship, Oersted was able to show via experimentation that electric currents can affect the movement of nearby magnetic needles. This demonstration introduced the world to electromagnetism, a force that ultimately made intercontinental communication possible through the telegraph. Oersted made a connection that others missed because his mind was prepared to discover a relationship between the two forces—the chance encounter merely revealed the specific nature of their dynamic link.

THE PREPARED PAINT INDUSTRY

Even in its most primitive forms, paint has been a staple in the world for millennia. In modern times, the paint and coatings industry has adapted to various technological advances and a list of ever evolving societal and regulatory needs. Today, as the pace of change within the coatings industry accelerates, paint can no longer merely protect or beautify; there are growing demands for paint to go above and beyond its normal call of duty.

Like Oersted, chemists and formulators must have prepared minds as they work to develop breakthrough technologies that will meet evolving paint performance and functionality requirements. Today, several forces are driving a shift toward sustainable, multi-functional paint. These primarily include societal megatrends and evolving consumer preferences in the age of digital and social media. Everything from economic development around the world, increasing urbanization, and the current geopolitical environment, to a growing elderly population and millennials who rely on social media for news and purchase recommendations can affect whether a paint line or paint ingredient enjoys commercial success.

The prepared scientific mind does not solely work in the lab to identify the next great chemistry that will improve a particular paint characteristic; it also makes connections beyond the technology itself to determine how best to anticipate marketplace needs, regulatory trends, and the timing that may increase the likelihood of adoption. In other words, the coatings industry professional with a prepared mind is ready for the insight to help the right technology succeed in the right place at the right time.

HISTORY REPEATING ITSELF

Reflecting on the factors that helped groundbreaking paint technology developments of the past gain adoption illustrates how commercial success is often found at the intersection of technological evolution and market discontinuity. These connections that brought about lasting change can offer insight for current paints and coatings industry players who want to add value today and tomorrow.

Synthetic Binders Become the Standard in Waterborne Latex Paint

The first commercial synthetic rubber latex was created during World War II as a result of limited natural rubber latex supplies in the United States for military and industrial uses. While this innovation served several immediate purposes during the war, an overabundant supply post-war led manufacturers to determine new applications for their use, including as binders in house paint.

Performance initially suffered when synthetic latex chemistries were introduced into architectural paint. But within a decade, newer and improved synthetic latex binders and the waterborne paint formulations they facilitated were common and favored. Benefits including ease-of-use, reduced odor, and fast clean-up with water supported their adoption and longevity, despite lingering performance gaps.

Ultimately, the introduction of synthetic binders led to the widespread growth of waterborne architectural paint and a corresponding shift away from standard solventborne options. Essentially, economic necessity drove invention, and from invention came technology improvements that encouraged adoption.

Opaque Polymers Replace Titanium Dioxide as Opacifying Pigments

Economics were also the primary driver of the eventual success of opaque polymers as opacifying pigments in paint. Titanium dioxide (TiO_2) has traditionally been the primary raw material of choice for offering a standard paint function: hiding the surface underneath it. However, this highly successful material is also typically the most expensive

ingredient in a can of paint. Starting in the 1960s, coatings researchers started looking for alternatives to reduce this cost. Their efforts were met with limited success because of the exceptional refractive index of TiO_2 , until opaque polymers, which feature a hollow center that lends them a similar light scattering quality, were commercialized.

Yet even with a viable alternate technology option, TiO_2 retained the vast majority of market share until the late 1980s when the price of TiO_2 suddenly increased due to capacity restraints. Only then were companies willing to add opaque polymers to paint formulations as a partial TiO_2 replacement. Afterwards, even as TiO_2 prices normalized, opaque polymer adoption continued because the cost saving and other benefits proved their value compared to their pricier counterpart. Today, these light-scattering polymers are ubiquitous in architectural paints and newer applications including sunscreen, in which the hollow particles scatter harmful UV light.

Next-Generation Can Coatings Evolve to Exclude Materials of Concern

Next-generation can coatings are a current example that shows how technological evolution can arise through a mix of regulatory, consumer, and societal factors. The incumbent epoxy can coating technology has been an industry standard for more than 40 years, touted for its excellent corrosion protection abilities. While the chemistry has been enhanced for this primary purpose, research reports gaining traction within the last decade have indicated potential concern that bisphenol A (BPA), a building block of epoxy resins, may have negative health effects for humans if BPA leaches into foods and beverages packaged in cans.

This concern quickly caught the attention of consumers, regulatory bodies, and the media and developed into a movement against BPA—a backlash that was amplified by a combination of science and pseudo-science presented on social media. Continued and mounting consumer and regulatory demand for alternates to BPA pushed the coatings industry to develop and expand upon BPA NT (non-intent) technologies. Importantly, novel chemistries that can minimize additional materials of

concern beyond BPA have even been commercialized, in anticipation of possible market demand in the future from consumers and regulators.

THE FUTURE IS NOW

While economics, with some additional influences, historically drove technological advances—where to shift excess supply of a now but displaced material, how to reduce a too costly raw material—the backlash against a long-standing incumbent material that led to next-gen can coatings shows the increasing interplay among economic, societal, consumer, and regulatory factors. Looking to the future of paint and coatings, what are some of the global trends to prepare the mind for, when they intersect?

Big Cities, Diverse Opportunities

World population growth, and accompanying but varied rates of urbanization and economic development, are key drivers of change in the paints and coatings industry. The most recent data from the United Nations (as of 2015) puts the global population at around 7.3 billion people, with half of them living in cities. By 2030, the world population is expected to exceed 8.5 billion, with almost 60% of those billions of people living in urban areas. Importantly, 95% of that urbanization will take place in the developing world.

The market opportunities for paints and coatings in developing nations can differ from those found in the developed world. Considering that in certain African countries simply receiving a bike can change a person's life, paint in these communities is best used as a means for meeting basic human needs. Paint's fundamental beautification and protection functions excel in these circumstances. For example, communities may not need long-term durability from paint, but may instead prefer that it simply covers walls well and lasts for short terms.

As these developing nations urbanize, however, their needs, and their expectations of paint, tend to change. While economic development occurs at different rates, typically a new level of sophistication that extends even to paint accompanies increased wealth and disposable income. For example, as Chinese cities grew exponentially



starting in the mid- to late-1900s, so too did the opportunity to expand economy and premium line paint sales for first-time homeowners and apartment dwellers as more and more people flocked to urban environments. Now, however, in a more saturated market where people often move in and out of apartments and homes, growing opportunity exists in markets like decorative paint and construction repaint—a market that overall is projected to reach \$94 billion by 2026.

Increasingly sophisticated middle classes also demand differentiated paint characteristics. In dense cities, this

equates to opportunities surrounding paint functionality to combat air and other pollution that residents experience. In China, for example, people will typically repaint their apartment or home and leave while the paint dries; this is an unnecessary burden that they would prefer to avoid. Paint's potential to actively improve indoor air quality (IAQ) by removing air pollutants, such as formaldehyde, is desirable, as are paints that can improve quality of life through self-cleaning, antimicrobial, and even low emissions capabilities.

Cities themselves are also influencing the roles that paints and coatings may play. Everything from infrastructure to transportation is getting the smart treatment these days, and the rise of smart cities offers new possibilities. Perhaps bridge and tank coatings could indicate corrosion levels via sensors; perhaps traffic paint may revolutionize the accuracy and safety of autonomous, driverless vehicle navigation if sensors are included in coatings that line highways. The desire to integrate data and technology into the way cities are managed and experienced offers boundless opportunities for coatings that already play an integral role in protecting infrastructure—if the prepared mind can make the proper connections.

Shifting Consumer Preferences Are Signposts to Market Demand

Across the globe, the way end users consume paint is changing as well. Desire for convenience, customization, and sustainability can be attributed to a growing middle class, an aging population that prefers outsourced to do-it-yourself

(DIY) paint projects, and the rise of digital and social media that influences the vast majority of consumers' pathways to purchasing, especially tech-savvy millennials.

First, professional painters are being called upon in higher numbers. Both retiring baby boomers and millennials who

have yet to transition to homeownership are increasingly living in multi-residential housing rental units that are painted by professional painters in line with building owners' standards. This means that paint needs to appeal to contractors' preferences, with qualities including cost-effectiveness, pleasing aesthetics, and ease-of-application and retouch.

Critically, consumer preferences are changing too. With the growing influence consumers have over sales, and the access to information they have via digital and social media to make informed buying decisions, companies must remain mindful of products' details across their lifecycle—from the manufacturing process and ingredient selection through transportation and post-paint disposal. Consumers are increasingly focused on ethical, healthy, and environmentally conscious spending, and one way paints and coatings companies are responding to appeal to these forward-thinking consumers is by considering new distributed manufacturing models that can offer greater paint customization abilities with reduced manufacturing and transportation energy costs.

While some consumer preferences are dictated by viral social media trends, one of the benefits of consumers' amplified social media usage

is that the paints and coatings industry now has greater access to key market trends via social listening. Gone are the days of solely relying on conventional market research. Companies are able to listen to the conversations happening about their products on social media and use the data found to weave improvements into their product development cycle. This real-time interaction will accelerate the rate at which innovation occurs, so organizations need to be prepared to move at a rapid pace to meet consumer expectations and demands.

What secrets are we uncovering through social listening? Consumers now have a greater bias toward products that are good for them and good for the environment. These types of insights, along with the changing regulatory landscape, are pushing our industry to develop products that have a smaller carbon footprint (decreased TiO₂), low to zero VOCs, and contain less materials of concern (BPA, fluorocarbons, among others), as examples. Paints with antiviral properties may also meet consumer demand in the future for health-boosting coatings options.

MAKING THE CONNECTIONS THAT LEAD TO CHANGE

The key remains: Mindfulness and a prepared mind can help paints and coatings industry professionals anticipate future market needs and demands, pre-empt regulatory changes, and stay ahead of the curve in the new fast-paced and well-connected world. There are a plethora of opportunities for the paints and coatings industry to continue to innovate. The industry must keep its collective eyes, ears, and minds open to the major and subtle shifts that are occurring within and beyond the lab that may lead to the next *a-ha* moment. After all, the world will certainly want to hear the news via the telegraph's myriad successors. ✱

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