

Construction Chemicals:

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The recent rebound of the construction industry in most regions of the world is driving strong demand for construction chemicals, including concrete and cement admixtures, asphalt modifiers, adhesives and sealants, flame retardants, waterproofing chemicals, and protective coatings. The greatest growth is taking place in emerging economies, where governments are investing heavily in infrastructure and housing development, but rising consumption of construction chemicals is also occurring in the mature markets in North America and Western Europe. Construction chemicals that increase performance, reduce cost, facilitate installation, and speed up job completion are experiencing the greatest growth.

Several market research firms estimate that the global market for construction chemicals will be valued

at close to \$34 billion by 2020 to 2022. Research and Markets pegs the value at \$21.4 billion in 2016 and anticipates a compound annual growth rate (CAGR) of 7.9% between 2016 and 2022. The healthy rate is attributed to strengthening of the construction markets (infrastructure, industrial, commercial, and residential) in developing economies in Asia-Pacific, the Middle East and Africa, and South America combined with rapid population growth, rising disposable incomes, and increased urbanization and industrialization in these regions. Changing lifestyles and the desire for



Demand Continues to Rise

enhanced aesthetics, particularly in residential buildings and commercial structures, are other key drivers.

According to the Asia Development Bank, investment in Asia is expected to total approximately \$8 trillion by 2020. China was the world's largest construction market, accounting for approximately 20% of global demand in 2015, according to Grand View Research. Asia-Pacific, meanwhile, accounted for more than 45% of global construction chemicals sales in value terms. China and India together accounted for greater than 50% of the demand. Malaysia and Vietnam

are also experiencing significant growth in demand for construction chemicals.

Construction chemicals are of increasing importance to the construction industry because they impart design flexibility through their ability to modify and enhance the physical and chemical properties of structures, such as compressive strength, durability, the surface finish, and resistance to adverse climatic and working conditions, according to Markets and Markets. Many construction chemicals are also designed to improve workability, performance, and the compatibility of different construction materials, as well as protect construction materials and finished structures. “Depending on their intended use, construction chemicals can serve to increase the durability and improve the aesthetics of a building, reduce reliance on natural

resources used in construction projects, and conserve time, money, and energy during construction and throughout a building's lifespan,” adds Bill Wagner, global business director for Acrylics with Dow Construction Chemicals.

Leading players in the market include BASF, The Dow Chemical Company, RPM International, Sika, GCP Applied Technologies (recently spun out of W.R. Grace), Ashland, Arkema, and Fosroc International, among others.

Significant investment in R&D by these companies has led to notable advancements in construction chemical capabilities over the last 10 years, and most continue to invest in innovation at unprecedented levels, according to Volkmar Harnischmacher, vice president of Group Marketing at The Euclid Chemical Group (an RPM International business). Some of these efforts, according to Grand View Research, are targeted at developing products that meet increasingly stringent environmental regulations. The market research firm notes that the use of biochemicals in construction applications is just beginning but could prove to enable the development of breakthrough technologies in coming years.

“Demand for construction chemicals for infrastructure and residential applications has been steadily increasing since 2011,” says Wagner. “To meet this growing demand, companies have

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started to increase funding in research and development initiatives to create technologies that help increase efficiencies and maximize profits for building and facility owners. Newer profit-driven products address the wants and needs that end-users demand, resulting in new technologies that provide a variety of functions," he continues.

For instance, due to increasing demand from building owners for construction technologies that help minimize both cost and environmental footprint, newer technologies help to prolong the life of assets. Construction chemicals that enable the restoration of roofs rather than replacement are one such example. "Restoration, such as with elastomeric, reflective white roof coatings (vegetative and green roofs are others) makes financial sense—restoration can cost one-third to one-half as much as replacement—and is more ecological, because old roof material is not going to the landfill. As a result, there is a lot of R&D focused on restoration technologies," comments Charles Fitzgerald, director of Fluid Applied Roofing Technology with the Tremco Roofing Division of RPM International.

Restoration is not appropriate in all situations, however. Sophisticated technologies, such as infrared scanning, are used to evaluate a roof and determine if its condition is acceptable (structurally sound and no wet insulation, for instance). Customers then have a choice of different solutions with different prices and different warranty lengths. He adds that elastomeric coatings also provide great performance and are cost-effective. As a result, coatings sales have more than doubled for Tremco Roofing in just three years, becoming well accepted in all parts of the United States and Canada, according to Fitzgerald. Tremco focuses on higher-performance polyurethane systems that are blended with methylmethacrylate for a unique combination of durability and the elongation/elasticity required as the roof structure expands and contracts.

"Elastomeric roof coatings can indefinitely delay the need to engage in costly roof replacement projects," agrees Wagner. "In addition, with high turnover in commercial buildings, elastomeric roof coatings provide an ideal solution to roof replacement problems when a business may not necessarily occupy a space for more than a few years. Re-coating a roof every 8–10 years serves as a short-term, sustainable alternative to replacing the entire roof, and repairing a roof instead of replacing it is a cost-effective alternative that promotes good stewardship of resources and reduces material waste," he adds. Furthermore, using white, reflective elastomeric roof coatings to extend a roof's lifespan also contributes to the building's overall energy savings.

Dow has introduced a new acrylic binder with improved performance when exposed to ponded water, a feature that has been lacking in existing elastomeric roof coatings. Based on a novel, cross-linking technology, the CENTURION™ Acrylic Binder exhibits excellent water swell performance for an acrylic coating along with reduced property drift after being exposed to water, and can expand the number and types of roofs suitable for an acrylic coating, according to Wagner.

Concrete admixtures (waterproofing agents, plasticizers, accelerating agents,

retarding agents, dispersants, etc.) accounted for the largest percentage of sales in 2015 (~65%), according to Grand View Research. They are also experiencing the highest growth rate (8.9% CAGR), and are projected by Research and Markets to reach a value of \$12.4 billion in 2022. Looking at end uses, non-residential (warehouses, manufacturing and industrial buildings, hotels, and retail and office spaces) and infrastructure applications accounted for more than 60% of the market revenue share in 2015, according to Grand View Research.

"There is more reliance on concrete in a wider range of applications in both the U.S. and the rest of the world such that consumption of concrete is growing faster than that of cement," says Bill McCord, vice president of Group Business Development at The Euclid Chemical Group. Admixtures are generally engineered to increase performance and reduce the overall cost of materials for a given concrete project. Most admixtures are polycarboxylates of varying molecular weights (chain lengths) with different functional groups and three-dimensional polymeric structures, according to McCord. They act as dispersants and have a significant impact on performance. Because the quality and properties of concrete materials are different depending on where they are produced, typically, blends of different polycarboxylates are formulated to obtain a specific set of properties for a given concrete product. "Polycarboxylates have a significant impact on concrete performance; not surprisingly, there has been intensive research conducted in this area," observes McCord.

The biggest drivers of innovation in concrete admixtures relate to the desire of customers for lower job costs and reduced project timelines. In fact, green construction chemicals for concrete applications, even if they offer significant ecological advantages, do not sell if they do not offer cost and speed advantages. "Greener properties are nice to have but not a factor in the buying decision for these types of construction chemicals," McCord asserts.

One example of greener technology is fibers used as replacements for steel rebar. Using fibers can reduce energy

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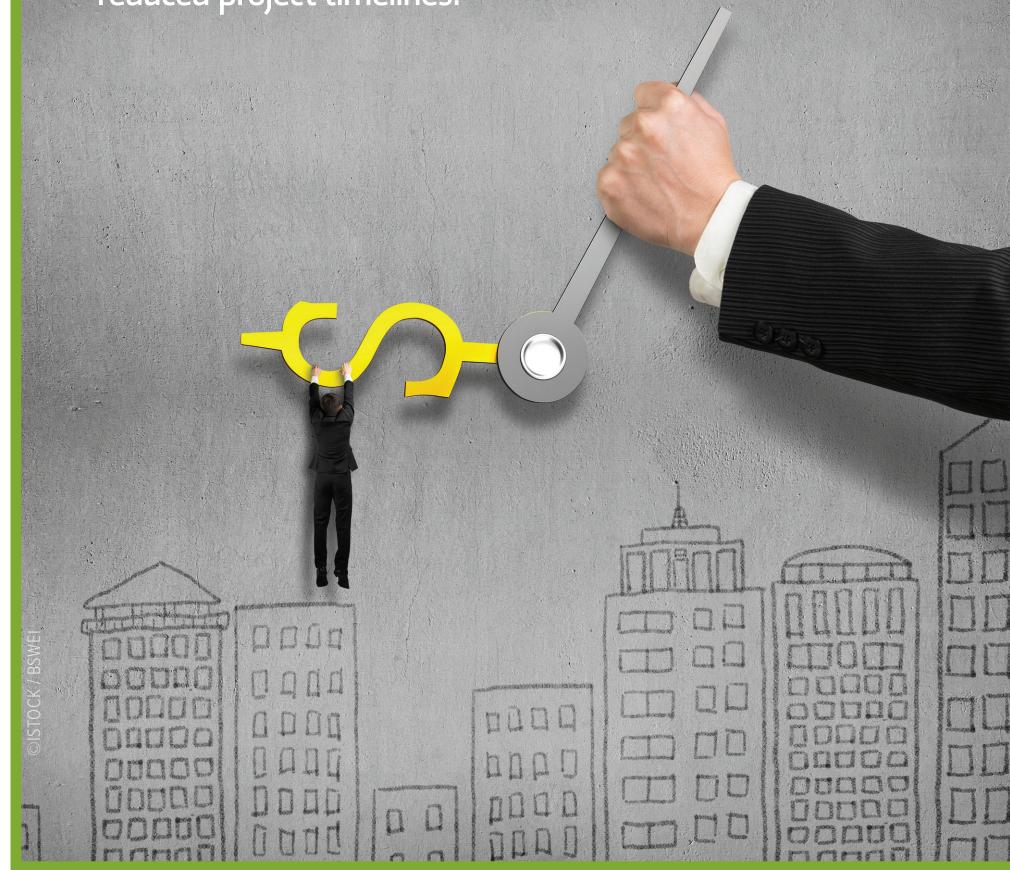
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consumption by as much as 40%. This advantage is not what is attracting contractors and architects to these new materials, however. Replacing rebar with fibers reduces the overall cost and timeline of construction projects, and for these reasons, there is growing interest in the use of stainless steel or synthetic (polypropylene/polyethylene) fibers. Project times are reduced because the fibers are pre-mixed in the concrete, whereas steel rebar must be installed at the job site. Steel fibers are used for jobs that would require high volumes of steel rebar, while synthetic fibers are used on projects for which a low volume of steel rebar needs to be replaced.

It is important to note that new products that help lower overall job costs are not necessarily less costly themselves. "Cheaper doesn't always mean a cheaper product; what customers are looking for is a lower overall cost for installation. A new product may actually have a slightly higher price but allow easier and more rapid installation, resulting in a lower overall cost for the job," explains Harnischmacher. Developing new products, therefore, requires an understanding not only of the performance of that product, but how it will be used and the application process as well," he adds. At Tremco, ecological factors, such as odor, VOC content, reflectivity, and the potential impact on heat island effects in cities are also considered, as are the needs of contractors, when new roofing materials are developed. "One of the biggest problems in the roofing industry is a lack of skilled/experienced labor. Consequently, contractors are looking for products that are easy to install and don't require the use of special equipment or extensive training," Fitzgerald observes.

Material availability, specifically the capability to deliver construction chemicals on time to the desired location—typically the job site itself—is also important. "It is absolutely necessary to be able to deliver on time when the customer needs it," states Harnischmacher. Transportation is another potential area for improvement. Shipping of heavy materials can add costs to any construction project, according to Wagner. "To address this issue, Dow offers latex

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powders that can minimize transportation costs associated with heavy liquids, if desired. As a preferred technology in Europe, these powder offerings reduce the need to transport and ship the weight of water for any formulation," Wagner notes. In cases where latex powders are shipped directly to the construction sites, instead of being mixed into formulations in a manufacturing facility, applicators can easily mix these powder coatings with water on-site.

Convincing contractors/applicators to adopt new construction chemical technologies can be a notable challenge, according to Wagner. "During training, many applicators master techniques using certain technologies as apprentices. Being accustomed to familiar products and understanding how they perform makes it difficult for applicators to trust and switch to an unknown

alternative," he explains. Incentives, such as lower costs, reduced application time, and proven performance, can help shift this mindset to using newer technologies.

Euclid works closely with its distributors and their customers to test new products in field trials that can last as long as six months to confirm that they perform as expected. "Conducting field trials is a very important step in moving new products from the lab to commercialization," notes Harnischmacher. Tremco gets feedback through its sales force, which is out speaking with potential customers and investigating roofs on a daily basis. Contractors also frequently provide feedback. In addition, the company has an ongoing program with Arizona State University; the school receives information on recently completed projects and surveys the performance of Tremco staff, its roofing

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systems, and the installing contractors. These reports are provided to Tremco Roofing for internal quality control and to track contractor performance.

In the roofing sector, Fitzgerald points to three areas of future development. First, he notes that concerns about the potential health risks of bituminous products (hot and cold asphalts), which are still widely used because they are cheap and fairly effective, will ultimately impact demand for these materials and lead to greater use of alternatives such as elastomeric coatings, resulting in further advances in performance. Second, he believes there is a need for more environmentally friendly roofing adhesives. Third is the desire for longer warranties of up to 50 years. Currently, no roofing products last that long without regular maintenance. While some companies are offering these warranties regardless, Tremco has taken a different approach. According to Fitzgerald, the company offers

these long warranties, but with all regular inspections and maintenance and restoration work covered up front and built into the price.

In the area of concrete admixtures and sealants, McCord believes that there are tremendous opportunities to develop more effective products by focusing on application engineering using technologies that already exist. For instance, advances in concrete sealer and coating technology have been achieved through the enhancement of raw material properties, but also formulation capabilities. "Water-based concrete coatings and sealers on the market today have performance properties similar to those of traditional solvent-based systems due to advances in surfactant chemistry," McCord notes. Euclid has introduced a new acrylic sealer with a VOC content of <100 g/L that has excellent tire-marking resistance and a solventborne sealer that offers extended service life even in hotter climates.

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One of the biggest needs for construction chemical technologies that Dow has observed is the ability to provide functionality while still addressing insulation and/or aesthetic needs.

"Understanding how a coating can serve as an alternative to existing materials is one method to providing function in these new technologies," Wagner says. As an example, Dow has developed a spray-applied coating for the reduction of sound vibration as an alternative to the use of carpeting and acoustic ceilings that absorb noise and minimize

sound transference between rooms. Liquid-applied sound damping (LASD) technology has been used to reduce noise, vibration, and harshness in applicances and vehicles, and is now emerging as an alternative to sound-dampening materials used in commercial building applications, according to Wagner. The easy-to-apply liquid coating can dampen sound while reducing material waste.

Dow has also introduced an elastomeric, sprayable liquid sealant and flashing product used in commercial buildings as an alternative to flashing tape. Dow LIQUIDARMOR™—CM Flashing and Sealant. "This new solution helps solve the challenge of easily flashing and sealing surfaces and gaps between building materials with complex geometries to provide a long-lasting protective barrier from air, moisture, and water," says Wagner. Using the product saves applicators time and money by reducing the need to cut and apply tape, and the result is a seamless and durable seal that helps insulate and protect buildings.

Dow also believes that as regulations continue to move toward requiring buildings to achieve a net-zero-energy

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impact, newer technologies will begin to exhibit more energy conservation and sustainability benefits with the need for life-cycle assessments to ensure performance, according to Wagner. In addition, as the building envelope continues to tighten to achieve reduced energy consumption, technologies will be introduced to reduce indoor air pollution that can occur when air flow is restricted. The company's FORMASHIELD™ Formaldehyde-Abatement Technology is a paint that helps remove formaldehyde from indoor air during application and continues to perform after the paint dries.

"Buoyed by higher-than-GDP growth rates, lower raw material cost inputs and a continued push for greener, more sustainable technologies, there remains a high level of activity and optimism in construction chemicals," states Ben Scharff, managing director at Grace Matthews. "From an M&A perspective, large players continue to be proactive in rounding out portfolios, extending geographies and penetrating new distribution channels. Recent transactions announced by RPM and GAF support the increased focus on selling 'solutions,' whereby companies look to provide total, packaged solutions to its customers from the foundation to the roof," he continues. In fact, Grace Matthews is seeing a lot of interesting assets in the market right now with the specific focus on high-quality carve-outs, such as the recent sale of 3M's polyurethane foam adhesives business. "With the reshaping of major players, including the spinout of GCP Applied Technologies, eventual resolution of the Sika/St. Gobain situation, and the pending Dow/DuPont merger, we anticipate the trend of high-quality carve-outs in construction chemicals to continue," observes Scharff.

"Companies involved in the construction chemical industry today are spending more money on R&D than ever before. It is a very exciting time. Despite the fact that tremendous progress has been made in the last 10 years, even more will be achieved in the next decade. It is a very exciting time to be in this business," concludes McCord. ♦