ADHESIVES SEALANTS

Sustainable Adhesive Technologies

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Creating Green Adhesives from Whey

Researcher at the Fraunhofer Institute for Ceramic Technologies



Targeted Tech Solutions Help Manufacturers Transition from Paper to Automation A company on the leading edge of



First-Ever ASC Sustainability Forum Tackles Key Issues Facing Industry

Professionals in the adhesives and sealants industry met in September to discuss the trends, challenges, and opportunities created by the drive for sustainability.

and Systems IKTS have developed a process that obtains high-purity ethyl acetate from whey.

ester chemistry deployed gamechanging digital solutions to stay ahead of the competition.



Adhesives and Sealants Play Crucial Sustainability Role in the EU Construction Sector Amid Energy Crisis

Adhesives and sealants help to facilitate more energy and material efficiency as the EU construction ecosystem becomes more sustainable.



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Better recycling programs and government and academic partnerships can help address the problem of plastic packaging waste in the U.S.



Buyers' Guide

Welcome to ASI's annual Buyers' Guide, a purchasing and applications resource for raw materials, equipment, and services used to manufacture adhesives and sealants, pressure sensitives, and related products such as tapes and labels.

DEPARTMENTS

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FROM THE EDITOR

>> Karen Parker, editor-in-chief

AN ECONOMIC CASE FOR SUSTAINABLE TECHNOLOGIES

Since I started this job three months ago, I have been looking forward to the November issue. I want to write about sustainability. Why? Because I believe it is one of the key issues facing the adhesives and sealants industry. In fact, I think it is going to be the key issue faced by all industries across the globe, for the near future. Several factors are driving the intense concern for sustainability. They include more scientific understanding about the effects of chemicals on people and the planet, the possibility of increased regulations from governmental bodies across the globe, and more consumer demand as people become more conscious of the impacts of their own purchasing choices.

From my perspective, there is a shift in industry from addressing specific concerns—such as VOC emissions or energy usage during curing—to a broader scope that scrutinizes all parts of the manufacturing process. This shift aligns with the increasing focus on climate change. In 2021, I noticed something I had not seen before in the 15 years I have covered the chemical industry. Almost weekly, I would receive another press release outlining another chemical company's sustainability goals, often using the Paris Agreement and the UN's Sustainable Development Goals as guides. These are not value statements or generalized corporate goals. Specific targets are set and the paths towards achieving those targets are outlined. I also saw companies shifting to a holistic, circular approach that begins with the sourcing of raw materials, to the manufacturing process, through to end-use industries, and finally recycling and reuse. Such ambitions necessitate cooperation with suppliers and customers up and down the value chain, joining the chain together and closing the entire materials/energy loop. These trends are not going away, in fact, they are increasing quickly. They also provide opportunities.

The Atlantic recently published an article by Robinson Meyer about initiatives to address climate change. Meyer cites a research note about the potential impact of the Inflation Reduction Act (IRA) released by the investment bank Credit Suisse in September. In that research note, analysts predict that the legislation "will have a profound effect across industries in the next decade and beyond," and that we are just beginning to understand how the law will impact the economy. What Meyer's article makes clear is that the "climate economy" is here, and it offers a lot of potential for new business. Among the industries that could see the most benefit from the IRA is the electric vehicle market, which offers growth potential for adhesives and sealants. Credit Suisse also reports that the United States is "poised to become the world's leading energy provider" and that the IRA could increase the energy production advantages of the United States beyond oil and natural gas to solar and wind, another area in which adhesives and sealants play a role. From Meyer's perspective, the most remarkable point made in the report is the declaration: "For big corporations, the IRA 'definitely changes the narrative from risk mitigation to opportunity capture." Meyers explains that companies should move away from worrying about the impacts to their business posed by future climate regulation and instead concern themselves with "missing out on the economic growth that the energy transition (and the IRA) will bring."

One key to harnessing the business potential of the climate economy is innovation. Companies that invest in R&D with a focus on sustainability will have an advantage; they will be capable of offering the solutions that investments in electric vehicles, wind and solar, and reuse and recycling need. Research is being conducted on many fronts, in academia, in government institutions, and in industry, to come up with new technology and science that offer solutions. As I read about new science, I plan to share it with you, both in this eMagazine and on **ASI**'s website, so be sure and visit our website frequently or follow **ASI** on social media so you can keep up to date on the latest innovations in sustainable technology.

In this month's issue, read about technology from Evonik that aids in the formulation of sustainable structural adhesives, learn how engineering adhesives can make maintenance, repair, and operations more sustainable, get the latest on how H.B. Fuller is tackling sustainability, and read about ASC's first-ever Sustainability Forum. Please reach out to me at parkerk@bnpmedia.com if you are developing new technology for the adhesives and sealants industry that you would like to share with readers.





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The Pressure Sensitive Adhesives (PSA) Short Course is designed to offer an in-depth knowledge of the fundamentals and latest developments for pressure sensitive adhesives. Presented by industry experts, this course covers formulation strategies, based on application and performance requirements. Learn how polymers, plasticizers, tackifiers and other additives are used for optimized processing and enhanced properties. Learn about the current methods of characterization including rheology, tack/shear test methods and details of PSA production. Gain an insight into the innovation and sustainability efforts in the PSA technology.

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- Converting, Coating and Application Equipment)
- Markets (Tapes and Labels, Medical, Structural)
- Innovations, Regulatory, Sustainability Efforts

WHO SHOULD ATTEND

Professionals involved with formulating or converting pressure sensitive adhesives for specific applications. Lab and Tech support personnel will gain valuable insight into the technology that will help them with formulations and understand the test methods. Technical, Sales and Marketing personnel working with manufacturers, suppliers and end user companies would greatly benefit by gaining technical depth for tailored solutions to product requirements.

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Caulks and sealants are primarily used in building, construction and transportation to bond surfaces together, fill gaps and serve as a physical barrier. Due to their use in bonding substrates with differing coefficients of thermal expansion, sealants are formulated to have higher elongation and paste like viscosities to allow for gap filling applications. Taught by industry experts, ASC's technical short course will help you gain a better understanding of the functions and applications of caulks and sealants. Participants are invited to attend the ASC EXPO at no additional charge to network with the industry and learn about the latest innovations in the industry.

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- Formulating with Additives (Adhesion Promoters, Fillers, Surfactants, Plasticizers, Rheology Modifiers)
- Specification Testing
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WHO SHOULD ATTEND

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Interested in speaking or have general questions: contact Connie Howe (connie.howe@ascouncil.org) or Mani Singh (mani.singh@ascouncil.org). Questions regarding registration and hotel: contact Malinda Armstrong at Malinda.armstrong@ascouncil.org.

SUSTAINABLE STRUCTURAL ADHESIVES



As the advantages of structural epoxy adhesives become more apparent, new curing agent technologies can help facilitate a more sustainable adhesive product.

By Sebastian Clermont, Ph.D., Manager Applied Technologies, Evonik Epoxy Curing Agents, and Sebastian de Nardo, Marketing Director, Evonik Epoxy Curing Agents

ncreasingly important to industrial manufacturing in recent years, structural adhesives offer a strong, costeffective, and fast joining technology. Automotive, aircraft manufacturing, shipbuilding, electronics, and the construction sectors have all benefited from the recent technical developments in adhesive bonding technology. Lightweight and multi-material designs, progressive integration and miniaturization, as well as increasing complexity have created a steady rise in the technical requirements placed on components and bonding processes.

Structural bonding offers practical advantages over material-locking, force-fitting, and other positive-locking joining processes. For example, it enables the bonding of material composites and composite materials consisting of dissimilar materials, such as metals, polymers, glass, ceramics, or low thickness, that were not previously achievable with other joining processes (or only at a significant disadvantage). Further advantages of adhesive bonding include homogeneous stress distribution or stress compensation by two-dimensional force transmission, the possibility of compensating component tolerances, and the additional function of seal and corrosion protection as well as vibration damping. Despite some challenges such as lower thermal resistance and the issue of de-bonding or instant strength, structural bonding has now become the preferred solution for many bonding and manufacturing processes across multiple market applications.

The Rise of Epoxy-Based Adhesives

In structural adhesives, the leading technologies besides acrylates and polyurethanes are based on epoxides, which are among the most widely used systems on the market today. The success of epoxides in structural adhesives primarily stems from their excellent mechanical properties, very good adhesion to a wide range of substrates, and their exceptionally good resistance to environmental influences such as moisture, chemicals, and temperature. In addition, they only slightly shrink during curing and generally contain no volatile matter. Although epoxides are still considered as rather brittle, this disadvantage can now be more than compensated for via a wide range of innovative additives and modification options. These include tougheners, flexibilizers, adhesion promotors, and fillers, which all result in structural epoxy adhesives that can withstand the highest stresses including high dynamic loads, high stress peaks, as well as many environmental influences over the entire product life.

Depending on the target application, epoxy adhesives can be formulated as one-component or two-component systems and cured at elevated or ambient temperatures. In addition, they offer a variety of possible applications, including pastes, films, solids, aqueous dispersions, liquids, or solvent-based adhesive systems. This diversity allows structural epoxy adhesives to be easily tailored to meet numerous different complex requirement profiles regarding processing, curing process, and target properties of the bonded joint.

Flexibility with Amine-Based Curing Agents

Based on various chemical platforms, Evonik's portfolio of products helps formulators to optimize their epoxy-based adhesives products in terms of performance, efficiency, and sustainability, while also supporting product innovations. Besides performance modifiers and additives, the use of high-quality amine-based curing agents and accelerators can also enhance structural epoxy adhesives. The curing agent itself can be considered one of the most important components in the epoxy adhesive formulation, as it has a specific influence on crucial process parameters such as application form, mixing ratio, viscosity, processing time, curing temperature, and curing rate, which can be adapted to suit the application. But, with aliphatic and cycloaliphatic amines, polyamides, amidoamines, as well as imidazoles and diverse dicyandiamide to choose from, selecting a suitable curing agent has become crucial to achieve the required final properties of the adhesive, including mechanical strength, flexibility, and impact strength, as well as thermal and chemical resistance. In summary, the less complex the adhesive formulation is, the bigger the impact the curing agent has on the final results.

Sustainable Adhesives Are in Demand

In structural epoxy adhesives, besides the general trends to improve adhesive performance, application processes and cost effectiveness, sustainability has become one of the most important drivers in the market. Today's necessity to address environmental, social, and economic challenges of climate change, alongside the increasing shortage of resources, has seen sustainability emerge as one of the most complex drivers in promoting technology changes in the adhesives industry. In addition, several regulatory aspects must also be considered.

As a solutions provider positioned in the middle of many diverse value chains, Evonik supports its customers to achieve their sustainability objectives through the development and production of structural adhesives that offer high performance and reliability, but that also address multiple sustainability aspects. For example, considering an adhesives' full life cycle offers several ways in which the sustainability of structural epoxy adhesives throughout the industry can be improved with the help of the curing agent (Figure 1).



Besides energy and resource consumption, waste, EHS aspects, and logistics, the most obvious route to improving sustainability is to use curing agents that stem from bio, bio-circular, or circular sources, or corresponding building blocks as basis for their synthesis. In recent years, academic and industrial research has focused on finding new amines, building blocks, or alternative synthesis pathways based on renewable raw materials to improve the carbon footprint of epoxy curing agents. One prominent and well-established example in the market is the use of fatty acids and cardanol building blocks (Figure 2) in the modification of amines to amidoamines, polyamides, or phenalkamines.



Renewable Raw Materials Present a Challenge

At the same time, this route contributes to a significantly improved EHS and handling profile of the corresponding curing agents compared to the neat amines they are derived from. As a result, it is possible to maintain excellent performance in adhesive formulations, but with curing agents based on up to 70% renewable content (Table 1). Nevertheless, it must also be mentioned that the carbon footprint of fatty acids, even if they are derived from renewable sources, is not automatically smaller than amine hardeners from traditional petrochemical sources.

Table 1. Epoxy curing agents based on renewable raw materials.



There are also a series of amines that can be synthesized from renewable resources, such as limonene diamine from the terpene limonene found in orange peel waste, lysine as a naturally occurring amino acid, or furanyl amines derived from sugar to name a few (Figure 2). However, the use of renewable raw materials is not always a sufficient argument for commercialization of such amines, especially when additional costs are added, due to challenging production or processing, or a drop-in solution cannot be provided, due to different properties, a lack of performance, or critical labeling. These restrictions are the primary reason for the very limited commercial availability of amine epoxy curing agents based on renewable resources in the market today.

One exception to this is Evonik's bio-based isophoronediamine, Vestamin[®] IPD eCO that uses a mass balance approach for renewable ISCC compliant acetone as the raw material basis, enabling it to be used as a full drop-in solution for conventional isophoronediamine but with a significantly improved carbon footprint.

Low VOCs and Low-Temperature Curing

There are also additional possibilities to improve the sustainability of structural epoxy adhesives in the curing agent application. This primarily involves improving the EHS and handling profile by substituting the critical raw materials or their modification, reducing the VOC, or changing the chemical basis. Here, the use of fatty acid building blocks in the modification of amines is a prominent example represented in Evonik's Ancamide[®] curing agent portfolio, where the modified amines offer an improved EHS profile due to their higher molecular weight resulting in lower vapor pressures with less critical irritation potential and odor. In addition, a longer pot-life can also be achieved and the low exotherm is complemented by more forgiving and less critical mixing ratios, resulting in significantly improved application properties. Another example substitutes mercaptane curing systems, which eliminate the sulfur odor and improves yellowing. Table 2 provides an overview of Evonik's epoxy curing agents designed to help improve the sustainability of processes.

Table 2. Epoxy curing agents for sustainable processes.

		ECA FOR SUSTAINABLE PROCESSES	
Sustainable		Product	Process benefit
Processes		Ancamine [®] 2014 AS/FG	
		Ancamine [®] 2442	1K low temperature cure
		Ancamine [®] 2337S	



For structural epoxy adhesives that require heat curing, particularly one-component systems based on dicyandiamide, the process energy consumption is a crucial factor in which catalysts and accelerators or alternative curing systems play a decisive role. Here, thermo-latent curing agents designed for low-temperature curing (from 70 °C) with fast property development for one-component structural epoxy adhesives can significantly improve the sustainability of the corresponding adhesive systems. Complemented by high thermal resistance and excellent shelf-life stabilities even at elevated temperature storage, these curing agents can also be utilized as an accelerator or co-accelerator for dicyandiamide-based adhesive systems.

Enabling Sustainable Technologies

Further sustainability aspects of structural epoxy adhesives concern their end use. Here, epoxy adhesives can offer clear advantages regarding performance, durability, and required maintenance, which are also complemented by good EHS profiles and low VOC content. In addition, they can be considered as enablers for multiple sustainable technologies in which they are an essential part. Accordingly, lightweight design is one of the key concepts for improving performance, weight reduction, and energy consumption in mobility or wind energy applications, for instance. Here, epoxy adhesives allow the efficient joining of different materials to enable more sustainable technologies that could not previously be realized with traditional joining methods. To address these increasing demands, Evonik offers a series of solutions ranging from industry standard, to unique and differentiated curing agents. One example is Ancamide 3030 or its long pot-life version (Table 3), which both are predominantly relied on by the wind energy sector for the bonding of rotor blades.

Additionally, for bonding dissimilar materials Evonik has developed a series of differentiated curing agents, for example a polyamide that exhibits excellent adhesion and peel strength on different materials, such as steel, aluminum, or engineering plastics. Without any special surface pre-treatment, adhesives formulated with this polyamide also provide good flexibility and thermal shock resistance accompanied by an outstanding environmental resistance, all at a relatively low viscosity, which also allows the formulation of higher filled adhesives with thermal

Table 3. Epoxy curing agents for sustainable technologies.



For the end-of-life sustainability aspects of structural epoxy adhesives, debonding forms a crucial part of a recycling strategy. However, it must be noted that sufficient solutions, particularly in the field of structural epoxy adhesives, are not currently available in the market. Hence, the concept of debonding on demand currently receives increasing attention in academic and industrial research.

In summary, it is clear that achieving sustainability in structural epoxy adhesives, especially with regards to the aspect of curing agents, cannot and must not be reduced to only considering renewable resources alone. All aspects of an epoxy adhesive's life cycle must be taken into account as far as possible, which not only includes the raw material aspects, but also the aspects of application, end use, and end of life, for which there are already a variety of solutions to address these aspects. Nevertheless, there remains room for improvement across the industry's value chains if we are to fully achieve fully sustainable structural epoxy adhesives.

NOTE: As the technology leader in amine synthesis and modification and curing agent formulations, Evonik's solutions for structural one-component and twocomponent epoxy adhesives cover almost the entire range of current amine curing technologies under its brands Ancamine, Ancamide and Amicure[®] as well as Curezol[®] and Imicure[®].

For additional information, visit evonik.com and evonik.com/crosslinkers.

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HOW SUSTAINABILITY IS DRIVING THE MRO MARKET



Maintenance, repair, and operations engineers can benefit from the sustainability and operational benefits of engineering adhesives.

By Kevin Maeyama of Bostik's Born2Bond[™] US team.

M aintenance, repair, and operations (MRO) is a market that historically has been reticent to change processes and adopt new practices. This is especially true when it comes to mechanical fasteners, and understandably so, as nuts and bolts have been relied upon for centuries to ensure the cogs of industry continue to turn safely, efficiently, and without breaking down.

While not all centuries old, MRO engineers now work and use mechanical fasteners across a vast cross section of industry, from general manufacturing and mining to food production, the automotive aftermarket, aerospace, and utilities. You'll find MRO engineers wherever machinery, hydraulics, engines, turbines, and compressors are used and need to be maintained.

Across all industries, in addition to using mechanical fasteners, what MRO engineers have in common is that they now face increasing pressure to ensure that their practices are as sustainable as possible and in support of global, national, and regional climate-change targets.

The urgency of the sustainability agenda is therefore one key reason that the tide is now turning, and MRO engineers are more ready to consider alternative solutions to traditional methods. They're looking for new ways to reduce their carbon footprint and to this end, engineering adhesives are increasingly being used in place of mechanical fastenings. While their use is not new in MRO, and indeed they provide benefits outside of sustainability, it is these adhesives' "green credentials" that are helping to change mindsets and driving more widespread adoption.



Engineering Adhesives' Sustainable Benefits

The most obvious sustainable benefit in using engineering adhesives over mechanical fastenings is that these adhesives reduce the number of tools and parts that are procured, transported, and stored. One adhesive solution can be used in place of hundreds of washers, reducing energy, resource, and fuel consumption in washer manufacturing and transporting as well as vastly decreasing storage requirements. In particular, Bostik's Born2Bond[™] team has calculated that one 50ml bottle of its anaerobic engineering adhesive will do the job of up to

800 M10 spring washers.

Additionally, applying engineering adhesives to nuts and bolts, gaskets, piping, and components performs the role of preventative maintenance and mitigates against failure, which lowers the need for new parts and also reduces downtime. MRO engineers look to avoid downtime not just for economic efficiency, but also because it can result in a number of unsustainable side effects, such as increased use of energy and resources.

Another important sustainable impact of utilizing engineering adhesives is that they reduce leaks through the increased reliability of adhesive bonding. Whether chemical, water, or gas, leaks result in wasted resources and reduced efficiency. Further, the materials used to clean spillages will often end up in landfills. In addition to sustainability benefits, workplace falls and slips are a considerable hazard in the workplace, so reducing liquid leaks is another way to further improve workplace safety.

Product ranges are regularly expanding as the sustainability demand grows across different territories. A case in point is Bostik's non-CLP classified range of anaerobic engineering adhesives that do not carry hazard labels. This allows them to enhance the safety and comfort of users while also reducing environmental impact. The range was launched in EMEA earlier in 2022 and will be launched in North America and other territories according to demand.

The demand for non-solvent-based adhesives is another significant development in the MRO market that engineering adhesives can address. Traditionally, engineers associated strong smells with strength; now, thankfully, more comfortable and indeed safer, more sustainable working environments are now more prioritized, giving rise to solvent-free and non-CLP classified ranges of adhesives. This also of course helps organisations to reduce their carbon footprint—a driving force across all industries.

Practical and Operational Benefits

Outside of sustainability, engineering adhesives are easy and fast to apply and are extremely versatile for different fastener sizes and application substrates. This increases operational efficiency and as such enables engineers' time to be focused on other tasks. They provide long-term reliability, high corrosion and weather protection, and are resistant to heat and chemicals, meaning their use is highly beneficial within a vast array of challenging environments. They also prevent vibrational loosening—which is the leading cause of mechanical failure—and offer a significant practical and operational benefit.



The Right Type of Engineering Adhesives

Anaerobic engineering adhesives offer a single-component, easy-to-use, and convenient solution that cures at room temperature. These solutions also are non-solvent based, so kinder to the environment and the people who are using them than other options. They can be used across a variety of MRO applications, including:

Threadlocking: Adhesives are applied to nuts and bolts to prevent loosening, and corrosion, reducing failure and the need to tighten bolts and perform unexpected repairs.

Gasketing: Anaerobic adhesives replace the pre-cut gaskets designed to adjoin two surfaces of metal flanges, decreasing inventory and preventing leaks.

Pipe Sealing: Solutions are applied to gaps between threaded pipe connections and fittings, preventing fluids or gases from leaking.

Retaining: Anaerobic adhesives fill spaces between mechanical, cylindrical components for reliable assembly of bearings, hubs, and shafts, eliminating the risk of fretting corrosion.

Additionally, MRO engineers can use service products with anaerobic adhesives to prepare and clean surfaces before use and to remove adhesives when no longer required. Service products include cleaners, lubricants, adhesive and gasket removers, anti-seize compounds, and solutions such as Seez-Release, designed to loosen rusted, corroded, and seized parts.

Born2Bond instant and anaerobic adhesives now complement already available Never-Seez[®] anti-seize compounds, Bostik MRO epoxies, and glue sticks.

Where We're Headed

With the extensive benefits described and wide-ranging products available, how are manufacturers helping to communicate the sustainable benefits of engineering adhesives? Increased training from adhesive manufacturers is one useful tool. Bostik uses real-life "use cases" to showcase the practicalities and benefits of use. In an industry where engineers are inherently practical, seeing is believing.

Overall, it is the sustainability agenda itself that is acting as a catalyst to accelerate the use of adhesives in MRO scenarios. It is likely, too, that their use and application will increase as their environmental benefits are further realized. However, sustainability is only one part of the equation. Adhesives are deserving of their place at the MRO table for their performance and reliability alone, even in the most challenging tasks.

Learn more about Bostik's range of engineering adhesives at **born2bond.bostik.com**. Learn more about Bostik at **bostik.com**.

Images courtesy of Bostik.



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FEATURE

ADHESIVES MANUFACTURER BUILDS A FOUNDATION OF SUSTAINABILITY



H.B. Fuller's Global Environmental Compliance and Sustainability Leader Jonathan Blaine outlines the company's approach to sustainability.

By Karen Parker, Editor-in Chief, ASI.

B. Fuller is working to build a solid foundation of sustainability. In the company's latest sustainability report, it outlines the progress H.B. Fuller has made toward its sustainability targets for 2025. These targets include reduction of energy and greenhouse gas (GHG) emissions intensity by 20% and waste and water intensity by 10% by 2025, compared to a base year of 2014. Beginning in 2021, they embarked on an advanced stage with the creation of a new sustainability technical subcommittee comprised of a multidisciplinary team of experts on various areas of intervention directly related to environment, social and governance (ESG) matters. This subcommittee focuses on continuous improvement, integration, and transparency across the enterprise, serving as a lever to develop, monitor, and report on sustainability related KPIs and programs.



For the November issue, **ASI** reached out to H.B. Fuller to understand more about its commitment to sustainability. Jonathan Blaine, Global Environmental Compliance and Sustainability Leader, H.B. Fuller, was kind enough to answer our questions. **JONATHAN BLAINE**



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ASI: What do you see as the main drivers of sustainability initiatives within the chemical/adhesives and sealants industries?

Blaine: There are a variety of factors that influence corporate sustainability initiatives. Across our industry, we see the four main drivers of sustainability as: government commitments and legal mandates; consumer demand and public opinion; investor and supply chain expectations; and customer requirements for more circular, energy efficient, recyclable, bio-based, and non-toxic products. However, more broadly, we are seeing another larger driver emerge: the transition from sustainability to a broader, more holistic focus on environmental, social, and governance (ESG).

Historically, sustainability has been a bit more limited to simply "being green" or caring about the environment. Now, from the ESG perspective, one of the critical drivers is on managing within numerous legal and regulatory frameworks, making it even more complex. Looking at things just from the point of view of classic "sustainability," most larger companies have adopted some form of targets and defined programs, while a few have signed on to international commitments. In large part, sustainability is still an evolving business demand, which many companies seem to still be learning to deal with, and largely in a reactionary way. Again, ESG makes that even more complex.

At H.B. Fuller, our ESG commitment and focus is deeply embedded in our company strategy and values, customer commitment, and responsibility to our shareholders. Each of which require understanding of the external forces mentioned above. We also pay close attention to macroeconomic pressures, energy constraints, supply chain, and geopolitical risks to our business. All these factors have a profound effect on our business operations and ESG focus.

ASI: What are the major concerns you hear from customers and investors in regard to sustainability?

Blaine: Customers and investors expect transparency around sustainability. They are most interested in information pertaining to climate change and socioeconomic factors, including labor, human rights, and diversity, with answers to questions related to governance, ethics, environmental impacts included. Customers and investors are increasingly using these factors in how they evaluate and qualify suppliers, as well as where they choose to invest, to ensure they partner with companies that are aligned with their ESG goals. From a commercial and product development perspective, we find that our own customers are focused on delivering greener, safer, and more durable products that address market needs, use renewable sources, and have a sustainability benefit evidenced by a proper life cycle assessment analysis (LCA).

ASI: What challenges have you faced when measuring your sustainability initiatives and results?

Blaine: A major role of H.B. Fuller Corporate Environmental Health Safety Security and Sustainability team at H.B. Fuller is to collect, track and report key sustainability performance data fully and accurately for improved decision-making. This includes managing a regular cadence of reporting from our 70-plus production plants and other sites across the globe, including warehouses and offices, on energy consumption, GHG emissions, and water and waste usage—our primary annual targets established in 2014.

One of the challenges we face is related to the data we receive from our manufacturing plants via our internal reporting system. Accurate data is the foundation for any sustainability program. We are in the process of improving the quality of our data, and the process we use to collect it, by implementing a new digital solution across our organization, which will support and strengthen the achievement of our targets, compliance with legal requirements, and responses to customers and independent rating organizations.

Another challenge, which we see as more of an opportunity, is in identifying tangible improvements at the facility level which will positively impact our sustainability results. With a global facilities network, identifying and implementing projects that will allow us to achieve our goals, enhance internal synergies, and drive wide implementation of good practices, is critical to continue delivering on our sustainability commitments. It likewise helps form the basis for new targets.

Also, the need to articulate a clear scope of what is considered sustainable, how to define it, and the ability to accurately measure the results are an important topic for the industry. For instance, something less sustainable at the raw material level may go on to enable a more sustainable, efficient system at the end of the value chain understanding how much of a technology facilitates this bigger picture of sustainability is critical, yet very challenging as products expand into multiple applications, customers, and markets.

ASI: How does your company see its role in responding to concerns about global warming, and has that role shifted in the last 20 years?

Blaine: The world around us is changing rapidly, so companies, like ours, must be good stewards of the planet's finite resources. We strive to reduce our footprint on the environment by operating our business with a focus on quality, environmental stewardship, and sustainability; meeting our environmental targets; operating in accordance with the regulations in the global communities we do business; and measuring and reporting our progress using globally respected frameworks.

Over the last 20 years, much has been studied and learned about global warming. As more and more information and data become available on climate change, we are increasingly using these findings to create solutions to help our customers minimize their impact as well as in our own business planning. Currently, we are in the process of performing a detailed climate risk assessment of our operations. Our team also is evaluating options for the use of more renewable energy, reforestation and carbon sequestration initiatives, where such projects make sense at our sites around the world. And we are continuing to do our part by being fully committed to the 10-year sustainability targets we established in 2014 and are currently evaluating new targets to put in place for 2025 and beyond, which **Ware more tables waste**. Upening less waste.

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FEATURE

CREATING GREEN ADHESIVES FROM WHEY



Researcher at the Fraunhofer Institute for Ceramic Technologies and Systems IKTS have developed a process that obtains high-purity ethyl acetate from whey.

n collaboration with TU Dresden, Fraunhofer researchers have developed a process for obtaining valuable, highpurity ethyl acetate from whey. This can be used, for example, to produce environmentally friendly adhesives, thereby replacing conventional ethyl acetate extracted from fossil-based raw materials. It also eliminates the need for costly disposal of the molasses produced during whey.

Every day, large quantities of whey are produced as a by-product of the dairy industry. In Germany alone, this amounts to 12.6 million tons a year. For each kilogram of cheese, for example, 9 kilograms of whey are produced. Some of this is processed further, such as into whey-based drinks with fruit additives or other mixed drinks. The lactose and proteins contained in the whey can also be separated and used in other ways, for example, as a raw material in pharmaceuticals or in baby food. However, once the proteins and lactose have been separated, molasses remains. Disposing of this substance is very complicated and expensive, due to its relatively high salt content.

Researchers at the Fraunhofer Institute for Ceramic Technologies and Systems IKTS in Hermsdorf, together with TU

Dresden, have now developed a process for extracting valuable ethyl acetate, a colorless solvent, from the molasses. Ethyl acetate is often used when manufacturing adhesives, printing inks, and varnishes.

Ethyl acetate has traditionally been produced from natural gas and petroleum derivatives. Producing ethyl acetate from whey, on the other hand, results in a product that exhibits easy microbial degradability and is independent of the price fluctuations of natural gas and crude oil. Another advantage: the process developed by TU Dresden and Fraunhofer IKTS renders the need for costly disposal of molasses unnecessary. The separated ethyl acetate offers a high purity of 97.5% and, as such, can be used immediately as a raw material without further processing steps.



The Separation Process

In principle, the separation process is straightforward. To begin with, the molasses is fermented in a bioreactor,

After the molasses are fermented in the bioreactor, the resulting gas-vapor mixture is passed through a membrane module and the valuable ethyl acetate is separated.

which is ventilated to allow for aerobic conditions. The reaction forms a gas-vapor mixture that contains ethyl acetate. This is then separated using special composite membranes. "A mixture of gas and water vapor remains as a waste product, which can be released into the environment without issue," said Marcus Weyd, Ph.D., manager of the Membrane Process Technology and Modeling group.

In the development of the membrane, researchers at Fraunhofer IKTS contributed their decades of expertise in the field of materials, particularly membrane technologies. The composite membrane, which was specially developed for the process, consists of a combination of polymers and inorganic particles based on zeolite. "We use liquid silicone rubber as a polymer. This is mixed with zeolite (silicalite-1), applied to a supporting polyester fleece and cured. The membrane is only 10 μ m thick in total and the pore size is 0.5 nm," explained Thomas Hoyer, Ph.D., a specialist in the field of zeolite membranes and nanocomposites.

Even if the membrane is equipped with pores, the actual separation process, in which the ethyl acetate is separated, does not work like a sieve. Instead, the gas separation effect is created by interactions between zeolite and ethyl acetate. "The molecules are adsorbed by the zeolite, slide along the pore surfaces, causing them to diffuse through the composite membrane," explained Hoyer. It is also not necessary to apply high pressure in order to "force" the ethyl acetate through the membrane. "Creating a certain partial pressure difference is sufficient to initiate the chemical reaction and subsequent diffusion."



Scanning electron micrograph of a composite membrane. The ethyl acetate molecules diffuse through the pores of the zeolite layer, which are only 0.5 nm in size, to the other side of the membrane.



Possible Uses for Molasses

The idea arose from an initiative of the TU Dresden, which was looking for ways to use the molasses and turned to Fraunhofer IKTS for help. The TU team dealt with the fermentation process, while the Fraunhofer team was in charge of developing and optimizing the membrane technology.

"We have succeeded in producing a highly advanced membrane with extremely small pores through a relatively simple and cost-efficient process," summarized Weyd. For industrial companies, the fact that the gas separation process consists of only one stage and thus only requires a small number of membrane and control modules is a practical advantage. Once the process parameters for fermentation and gas separation are correctly configured, the separation process runs on its own and in a stable manner.

Next on the researchers' agenda is scaling the size of the membrane modules in order to make the technology available for industrial use. The technology has more applications than just extracting ethyl acetate from molasses: It can be used in any process that requires separating gas mixtures or filtering out volatile components such as hydrocarbons processing. Demonstration plant with a membrane module for separating ethyl acetate from whey molasses.



Article courtesy of Fraunhofer IKTS.

Opening image coutesty of ahavelaar via www.gettyimages.com. Article images courtesy of Fraunhofer IKTS.



CASE STUDY

TARGETED TECH SOLUTIONS HELP MANUFACTURERS TRANSITION FROM PAPER TO AUTOMATION



A company on the leading edge of ester chemistry deployed game-changing

digital solutions to stay ahead of the competition.

By Srinivas Kuppa, Chief Strategy Officer at SymphonyAl Industrial

M anually entering numbers. Stacks of paper in filing cabinets. Workers using clipboards to pass critical information and instructions to one another. These traditional business tools were holding back Hallstar, a Chicago-based chemical manufacturer whose multi-step chemical reactions don't wait for analog communications.

Hallstar leaders knew there were better ways to optimize operations. They also felt that they needed to act. The Hallstar business in sealants and adhesives, shampoo, industrial compounds, and other products was growing. They had to squeeze every ounce of productivity out of their facility as efficiently as possible with the equipment they had.

The company began to investigate software-based manufacturing execution systems (MES), quickly realizing these solutions could collect data from batch manufacturing processes, help analyze that data to identify recipe priorities in mixing chemicals, and achieve greater efficiency through significant increases in throughput.

Many companies grapple with how to change time-consuming, inefficient, sometimes painful processes. Some conclude that transition costs and other headaches outweigh the benefits of cutting-edge, software-based manufacturing execution systems. Hallstar, in contrast, found a partner that offered a MES solution that closely matched its workflows. In fact, the MES seemed like the type of system Hallstar would have chosen to custom develop to best fit its needs.

The new platform offered real-time inventory management, enhanced batch scheduling for recipes, better materials management, and the flexibility to integrate into the facility's existing distributed control system (DCS), which helped operate and oversee its equipment. "It allowed us to build out what we needed rather than try to adapt our needs to existing software," said Hallstar IT Director Chuck Redpath.

Today, Hallstar captures granular-level information from every batch that goes through the plant. That precision is crucial for Hallstar's business.

Follow the Recipe

Making adhesives, sealants, fragrances, and other chemicals requires strictly following a recipe. At Hallstar, operators measure and prepare different chemicals in a pre-mix tank, pour them into a reactor, where the heated mix undergoes a chemical reaction that yields a product. The batch then moves to a finishing tank and then to inventory.

Optimizing those steps is a difficult task. The company has multiple batches reacting simultaneously. Without proper prioritization, one batch might finish too soon or too late, decreasing throughput. The new MES corrected any human errors or oversights that hinder prioritization. In the first years of implementation, the MES delivered a 15% increase in throughput due to better prioritization and has helped boost production growth annually by 5% per year over the last several years. That's in addition to ongoing process variation reduction as priorities and improvements became clearer over time.



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DCS, Meet MES

Recently, Hallstar has been focusing on "true automation" via tight integration between its MES and DCS to use the vast amount of data that the MES generates to identify optimizations and upgrades.

After overhauling a purification process and integrating it into its DCS, for example, the company dramatically accelerated and improved purification, but the new process was much more complicated than the old. The old method used generic "catch all" setpoints, while the new DCS process calculated setpoints based on an array of data about the product, including live and historical information. Personnel simply couldn't supply this data to the DCS in real time on top of their other responsibilities. The MES, however, automatically pulled in the data, calculated the setpoints, and sent them to the DCS directly.

The MES technology turned an incredibly complex operation into a task that today requires almost no human intervention. As a result, the company decreased cycle time by 25%, with highly repeatable quality for a suite of products that make up about 10% of Hallstar's production volume.

Fringe Benefits

On top of faster cycle times and consistent quality, Hallstar has captured additional benefits through the new MES. For example, the MES has improved in-process sampling by prompting employees. Rather than relying on handwritten notes, a supervisor gets an alert to obtain a vessel and send it to the lab, and a chemist is notified to run needed tests. The new process can then modify mixing based on the test results and the recipe.

On the shop floor, operators can use handheld smart devices to receive instructions, standard operating procedures, and other information from the MES workflow system, improving speed and accuracy while reducing errors. The increased efficiency gave operators more time to attend work simulations, safety training, and other programs.

The MES workflow application helped break down silos at Hallstar so people could work better, function as "connected" workers, and work as agile and responsible teams. The MES reduced complexity and made it easier for more people to perform more duties.

Hallstar leaders didn't know for sure that they would realize these benefits. But they were more willing to embrace an advanced MES when they realized that a partner would work with them and understand and target their specific needs rather than impose a new system on them that might disrupt their successful business. The collaboration generated valuable lessons that led to more precise specifications for inbound materials, better direction for capital spending on new equipment and labor, and—vital for a chemicals manufacturer in a competitive industry—better product yields.

Learn more about SymphonyAl Industrial at symphonyindustrial.ai.

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FEATURE

FIRST-EVER ASC SUSTAINABILITY FORUM **TACKLES KEY ISSUES FACING INDUSTRY**



Professionals in the adhesives and sealants industry met in September to discuss the trends, challenges, and opportunities created by the drive for sustainability.

By Karen Parker, Editor-in-Chief of ASI

reveryone is talking about sustainability. It is on the minds of many CEOs, including leaders in the adhesive and L sealant industry. In September, the Adhesive and Sealant Council (ASC) hosted its first Sustainability Forum in Pittsburgh. With sponsorships from Covestro, Arkema, and Kraton, the two-day forum gathered industry professionals to discuss pertinent topics including trends, challenges, opportunities, and market drivers within the framework of sustainability.

Chris Miller, senior global research director at Arkema Coating Resins, kicked off the forum with a keynote address, "Sustainable Development Trends and Outlook for the Adhesive and Sealant Industry." In his address, Miller outlined the key drivers to more sustainable materials: substances of concern, alternative feedstocks, energy intensity, and sustainable performance attributes. Regarding alternative feedstocks, he used examples of how certain products from Arkema fit within the various approaches to bio-based and bio-attributed products. He outlined the elements considered when assessing energy intensity, such as energy within the process, building efficiency, and lightweighting. He then gave examples of areas for innovation that enhance sustainable performance attributes, such as longer service life, compostability, and recyclability. Finally, he gave his view of where the chemical industry is heading in the next five years in regards to sustainability.

One of the tools companies can utilize as they create and quantify their sustainability strategies is the Life Cycle Assessment (LCA). Tad Radzinski, the president of Sustainable Solutions Corp., gave an overview of LCA requirements in his presentation, "Sustainable Product Innovation for Adhesives and Sealants to Meet Market Demands." Sustainable Solutions Corp. advises companies as they change their business operations through sustainability. At the beginning of his presentation. Radzinski pointed out that many employees, suppliers, and specifiers are of the younger generation, and they care about sustainability. He went on to explain that the events of the last year have reinforced the understanding that sustainability risks, particularly risks surrounding the climate, are also investment risks. Radzinski also shared an interesting pie chart of ASC member companies, which showed companies with indepth sustainability reporting compared to those without full sustainability reporting, and companies with sustainability information and companies without this information.

Key Ingredients for the **Adhesive & Sealant Industry**

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- Gum Rosin & Rosin Esters
- Hydrocarbon Resins(C5, C9, C10)
- Hydrogenated Hydrocarbon Resins
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Tim Thiel, Sustainability & Public Affairs North America, Covestro LLC, and Dr. Melissa Bilec, William Kepler Whiteford Professor in Civil & Environmental Engineering and co-director of the Mascaro Center for Sustainable Innovation at the University of Pittsburgh, discussed the launch of the Covestro Circular Economy Program at the university. This program is the first comprehensive academic, research, and innovation Ph.D. program in the United States with a focus and goal of designing for the circular economy. The program aims to create experts in circular economy principles leveraging Covestro's successes in this area.

Covestro's sustainability efforts were highlighted again later that evening when the company welcomed forum attendees to a tour and networking reception/dinner at the company's BrightSpace Center. The building and grounds of this facility is reported to meet the highest standards of sustainability and energy efficiency while also preserving the historic character of the building. On the National Register of Historic Places, the building is also a LEED Platinum designed structure, making it potentially the only LEED designed structure to also quality for Historic Tax Credits.

The next day, John Brandt, technical manager—adhesives and sealants North America Coatings and Adhesives at Covestro, talked about the need for collaboration between raw material suppliers, formulators, product designers, and end users to create products that are truly circular in nature. He offered several examples of this kind of cooperation, including Soft Landing, a mattress-recycling program in Australia supported by Covestro. The program is helping to address what was approximately 1.25 million mattresses that went into landfills in Australia every year. Soft Landing diverts the mattresses from landfills and recovers components to recycle. Covestro is helping to close the loop for polyurethane mattresses with a process for recovering both core raw materials and a new pilot plant for chemical recycling. With these cooperations within the value chain, companies can help to create a more circular



Image courtesy of Adhesive and Sealant Council.

Another conference highlight was a presentation by Gloriamar Gamez, senior sustainability manager North America at Henkel Adhesive Technologies. Gamez gave a very informative review on upcoming legislation and sustainability initiatives in the EU and the United States, and explained how these could potentially affect the industry. EU initiatives that she discussed included: the European Green Deal, which aims to make Europe climate-neutral by 2050; the EU Chemical Strategy for Sustainability, which, among other things, requires more (eco)toxicological data on chemicals, more hazard classes, more substance bans based on intrinsic hazards, and stricter safety assessment methodology for products; and The Classification, Labelling and Packaging, which will create more focus on circularity within the packaging/plastics industry. Gamez also outlined the main objective of the Sustainable Product Initiative (SPI), which includes making products greener through key performance requirements, prevents destruction of unsold goods, and sets mandatory requirements for green procurement. She provided a very useful timeline that outlined the implementation of these and other initiatives in the EU. In relation to the United States, Gamez explained the impacts that the Inflation Reduction Act and the CHIPS and Science Act will have on industry. She also discussed key state legislation regarding packaging, and the SEC's response to climate and ESG risk assessments.

There were many other informative sessions covering topics such as lignin-based PU adhesives, technologies for developing sustainable hot-melt adhesives, trends in sustainability in the hygiene industry, the importance of sustainable packaging across the value chain, the newly formed Sustainability Program from the Adhesion Society, and sustainable solutions within chemical distribution. The most striking thing to me about the forum was the high level of commitment and enthusiasm that both presenters and attendees brought to addressing these issues. It is clear that sustainability is one of the biggest trends within the adhesive and sealant industry, as well as the broader chemical industry and beyond. It is also clear that to solve issues surrounding sustainability, it will take cooperation with all elements of our industry, from raw materials suppliers and formulators, through to end-users.

For more information about the Adhesive and Sealant Council and its programs, visit **ascouncil.org**.

Opening video courtesy of amato1987 via www.gettyimages.com.



ADHESIVES AND SEALANTS PLAY CRUCIAL SUSTAINABILITY ROLE IN THE EU CONSTRUCTION SECTOR AMID ENERGY CRISIS



Adhesives and sealants help to facilitate more energy and material efficiency within the EU construction sector.

By Dimitrios Soutzoukis, Senior Regulatory Affairs Manager at FEICA

S ustainability in the construction sector is receiving substantial attention in the European Union (EU) due to the absolute scale of this sector and its share of materials usage, greenhouse gas emissions in Europe, as well as ongoing geopolitical and energy crises. Recent legislative initiatives, such as the EU Green Deal, cover the construction sector with specific provisions, addressing all levels from entire buildings to construction elements and to the materials used for their production and installation. The environmental performance of adhesives and sealants used in the construction sector is therefore of high interest.

The construction ecosystem comprises all the elements involved in the complete life cycle of buildings—for example, blueprinting, erection of the structure, maintenance of various fixtures and building elements, renovation, and demolition. In the sustainability transition pathway for the construction ecosystem, there are two critical elements: the energy efficiency of buildings and the material efficiency of the installed materials. Adhesives and sealants strongly support both of these elements.

The first critical element in the transition pathway for the construction ecosystem is energy efficiency. Because buildings last a long time, the use phase of these structures has a major effect on the environmental footprint. Since this is the case, the heating and cooling of buildings becomes significant and the efficient use of energy paramount. Moreover, the current energy crisis and the projections for the upcoming winter bring the energy efficiency objective under a new light. Adhesives and sealants play an important role here insofar as the energy efficiency of buildings is augmented by the use of thermal insulation and decarbonized heat sources, which contribute to further reduction of the carbon footprint of buildings in use and ensure less energy consumption within the buildings.

Regarding thermal insulation, adhesives and sealants facilitate insulation systems that are both durable and, very importantly, airtight. This is accomplished, specifically, through the use of adhesively bonded insulation panels, polyurethane foams for filling gaps, adhesive tapes at insulation joints and sealants around door and window openings, and adhesives in the construction of insulated (multipaned) glass units. All these aspects of adhesives and sealants apply not only to new construction of buildings but also to (deep) energy renovation activities. As far as the decarbonization of heat sources is concerned, adhesives and sealants make possible, for example, photovoltaic panels furnishing electricity for heat pumps, as well as batteries holding surplus daytime electrical energy.

Besides promoting energy efficiency during the use phase of buildings, adhesives and sealants play a second key role in terms of promoting material efficiency. Material efficiency concerns the material make-up of the parts of a building, that is, the so-called "embodied carbon" and the circularity of materials. Adhesives and sealants support the reduction of material used (the construction phase), the extension of building life through maintenance and repair (the use phase), and the reuse and recycling of building materials to reduce waste (the end-of-life phase).

Adhesives and sealants can reduce the amount of material used, for instance, by a minimization of the metal elements of window glazing, the adhesion of glass directly to frames, the production of hollow-core doors, and the use of highly insulated glazing on the exteriors of buildings. Furthermore, thanks to adhesives and sealants, renewable construction materials can be used in buildings, for example, engineered wood to replace steel and concrete. This results in a reduction of the carbon footprint of the construction, among other things.

Regarding maintenance and repair, adhesives and sealants can extend a building's life by both averting the need to replace elements and by preventing damage through maintenance and repair. Adhesives and sealants additionally prove to be crucial for repairing and maintaining construction machinery. With respect to reuse and recycling, adhesives and sealants promote approaches towards disposing of materials at a building's end of life.

A summary report of the FEICA report, "Adhesives and sealants' key sustainability role in the transition pathway for the construction ecosystem," is available on the FEICA website at feica.eu. The full report is available for FEICA members via the FEICA Extranet.

Opening image courtesy of Federico Rostagno via www.gettyimages.com







FEATURE

RECYCLING MUST EVOLVE: THE KEY TO TACKLING PACKAGING WASTE



Better recycling programs and government and academic partnerships can help address the problem of plastic packaging waste in the U.S.

By Jorge Izquierdo, VP of Market Development, PMMI

The United States needs to do a much better job at recycling. This is especially true for plastics waste, which at a 5% recycling rate is trailing recycling rates for other packaging and containers: glass (40%), aluminum beverage cans (45%), paper (63%), steel food cans (68%), and corrugated (91%). What will it take to boost recycling rates and achieve the Environmental Protection Agency's goal of a 50% recycling rate by 2030? Action is needed in many areas, but harmonization and regularization of recycling rules and programs is crucial.

Steps for Better Recycling Programs

To start, the United States needs improved data collection, because what's not measured can't be managed. "Stronger data is the necessary first step toward modernizing American recycling infrastructure, strengthening U.S. community recycling programs by determining needs, providing education and access, and ultimately capturing valuable materials for the circular economy," said Dylan de Thomas, vice president of External Affairs at The Recycling Partnership.

Along with more data, regularization of what can and can't be recycled will make the process easier for consumers, thereby driving more material into recycling streams. For example, uniform collection standards can eliminate the variability of what is collected across programs and the confusion consumers experience when one program or municipality collects a material such as polypropylene (PP) or glass and neighboring programs do not. At the same time, clearer labeling of disposal information is important so that consumers know how and where to recycle an empty package. This also minimizes contamination, which can reduce the quality of the recyclate or even render it unusable.

Current Efforts Making a Difference

Many organizations are taking action to eliminate barriers to recycling. As part of its "Blueprint for America's Recycling System," the Recycling Leadership Council (RLC), a group convened in 2020 by the Consumer Brands Association, calls for a national strategy on recycling and policy action, including a plan to standardize the recycling system.

"Besides ... the obvious benefits of a single set of rules to limit consumer confusion, a standardized system across the United States would create scale and efficiency," explained Meghan Stasz, senior director, Sustainability, at the Consumer Brands Association, in a recent blog post. She added, "Currently, each program collects different combinations of materials. With a standardized system, programs can collect more volume, which allows for more and different types of materials to be collected and processed for post-consumer recycled content, keeping recyclable waste out of landfills and waterways."

The American Beverage Association is also undertaking efforts to spur more recycling. The goals of its Every Bottle Back program are to improve recycling infrastructure, measure the industry's plastic footprint, make 100% recyclable bottles, add recycling-promoting messaging on packaging, raise awareness, and inspire action. Similarly, the Can Manufacturers Institute is working to retrieve the 25% of aluminum cans currently missorted and lost at material recovery facilities. Toward that end, it has established a grant program to help install eddy current equipment and quality-control robots that can identify and capture the cans that otherwise would be overlooked.

Recycling technology is evolving too. To maximize the yield of post-consumer recycled plastics, The Wolfson Centre for Materials Processing, Brunel University London, developed PRISM (Plastic Packaging Recycling using Intelligent Separation technologies). Now known as polyPRISM, the technology invisibly tags plastic containers for sorting into food-grade and non-food-grade streams for recycling. Coded mixtures of invisible phosphor inks are applied to labels and identify the plastic regardless of color as well as the contents of the container. To sort the marked containers, recyclers only need to add a low-cost ultraviolet light source to their near-infrared sorting systems, which can be programmed to read the phosphor codes.

A multi-client project called NEXTLOOPP, led by Nextek, a consultancy specializing in the design, optimization, processing, and recycling of plastic materials, is developing polyPRISM technology to sort and wash PP containers to establish closed-loop recycling for food-grade PP. Separation rates exceeded 99% in full-scale trials. Next steps include a commercial-scale test and food-grade accreditation. Consumer packaged goods companies (CPGs) that are members of NEXTLOOPP and that wish to adopt polyPRISM coding technology may have packaging evaluated and labels printed to the required standard. Eventually, procedures will be established to broaden access to the technology. Recyclers may license the polyPRISM technology from NEXTLOOPP.

Government and Academic Partners Play a Role

CPGs must commit to using recycled content to develop a circular economy, but better sorting technologies, cutting-edge materials science, and a collaborative approach with all stakeholders is necessary to address the scale of the plastics waste issue.

At the federal level, the U.S. Department of Energy is funding seven research and development projects to convert plastic films into more valuable materials and design new plastics that are more recyclable and biodegradable. "Single-use plastics generate large amounts of carbon pollution when produced, are hard to recycle, and dirty our nation's beaches, parks, and neighborhoods," said Secretary of Energy Jennifer M. Granholm. Three projects are of particular interest to packagers. Michigan State University will create a redesign for inherently recyclable plastics. The University of Massachusetts – Lowell will integrate delamination and carbonization processes for the upcycling of single-use, multilayer plastic films, and West Virginia University Research Corp. will develop process-intensified modular upcycling of plastic films to monomers by microwave catalysis.

Lastly, educating consumers can't be forgotten. CPGs are helping consumers recycle correctly by adopting the How2Recycle label, which provides information about local recycling programs. Established in 2012 by the Sustainable Packaging Coalition, the program seeks to standardize recycling labeling, divert recyclables from landfills, and teach consumers more about recycling.

To make a real difference in recycling rates and tackle the persistent problem of plastic waste, it will take commercial, governmental, and academic partners working together along with end users and consumers. East what about with appmany stakeholders focused on improving recycling, progress is being made and this momentum can be continued going forward. Opening images courtesy of piotr_malczyk via www.gettyimages.com.



FREEWEBINAR

November 15, 2022 at 2 PM EST

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Join us to learn where and how adhesive tapes are used and what solutions Mactac can offer.

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Learning Objectives:

- Types of pressure-sensitive adhesive tapes and how they can be used in building and construction applications
- The differences between structural adhesives and pressure-sensitive adhesives
- Mactac Engineered Adhesives offering and capabilities for the building and construction market



SPEAKER:



Steve Schroff Senior Technical Marketing Engineer Mactac



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2023 BUYERS' GUIDE

elcome to ASI's annual Buyers' Guide, a purchasing and applications resource for raw materials, equipment, and services used to manufacture adhesives and sealants, pressure sensitives, and related products such as tapes and labels. The Buyers' Guide also includes supplier details for finished adhesives and sealants.

We invite you to reference the supplier* logos below, and click or tap them to learn more about each company's offerings. Plus, be sure to visit (and bookmark!) our easy-to-use online directory at www.adhesivesmag.com/buyersguide.

The online Buyers' Guide is organized into three main sections: Associations, Distributors, and Supplier/Manufacturer Products. The Products Listings are further divided into nine major categories: Additives and Chemical Specialties; Containers, Packaging and Material Handling; Equipment; Finished Adhesives and Sealants; Oils and Fatty Acids; Pigments and Dyes, Dry/Dispersions; Resins and Base Polymers; Services; and Solvents.

The online guide is also fully searchable by product or company; company listings provide contact details as well as information regarding the products and services offered.



*Supplier logos represent paid advertising. If you are a supplier and would like to receive information regarding your company's inclusion, contact Stacey Hurley, Directory Enhancement Sales, at 248/786.1662 or hurleys@bnpmedia.com.

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TAPE TALK

Kape industry Industry

Pressure-sensitive adhesive tape manufacturers and suppliers are working through industry challenges together at this annual event.

A fter the success of its inaugural Tape Week, the Pressure Sensitive Tape Council (PSTC) is gathering in person once again for its annual Fall Member Business Meeting. At this unique, more boutique event, PSTC members participate in open dialogue and explore solutions to issues currently facing the tape industry. The members-only education and networking event, themed "Involve, Solve and Evolve," includes a variety of opportunities for strategic discussion and collaboration.

Involve

This year's Fall Member Business Meeting features an inaugural Industry Leader Panel, where senior leaders from PSTC member companies share their professional and personal visions on the economy, regulations, labor, and other critical factors impacting the current and future landscape of the tape industry. Panelists include American Biltrite Inc. President and COO Richard Marcus; IPG President and CEO Gregory A.C. Yull; Shurtape Technologies, LLC, CEO Vuk Trivanovic; and tesa tape, Inc., President and Regional Manager Daniel Germain.

Attendees are encouraged to engage in discourse through a question-and-answer segment—and continue their dialogue in the subsequent Innovative Roundtable Discussion, an interactive forum for attendees to exchange insights on what they've heard so far.

Solve

Setting the stage for these discussions is a keynote by ITR Economics CEO and Chief Economist Brian Beaulieu, who researches the use of business cycle analysis and economic forecasting as tools for improving profitability. He is coauthor of "Prosperity in the Age of Decline," a powerful look at how to make the most of the U.S. and global trends over the next 20 years, as well as "Make Your Move," a practical and insightful guide to increasing profits through inevitable business cycle changes.

PSTC supplier partners are also sharing their outlooks on current market trends. In a series of 30-minute presentations, speakers from Bostik, Mativ, and Ahlstrom Munksjo discuss the challenges their companies are facing as well as successes and opportunities for growth.

Evolve

The path forward may not be the same for everyone—but by pooling our knowledge and recognizing different perspectives, we can gain a better sense of how to navigate it to the benefit of both ourselves and those around us.

The PSTC Fall Member Business Meeting is taking place in person November 7–9, 2022, at the PGA National Resort Palm Beach Gardens in Palm Beach Gardens, Florida. PSTC holds two Member Business Meetings every year: one in the fall and one in the spring. The next member business meeting will take place at Tape Week 2023 at the Hilton Orlando on Destination Parkway in Orlando, Florida.

Joe Tocci is president of the Pressure Sensitive Tape Council (PSTC) and senior vice president of global sourcing and supply chain at Intertape Polymer Group. For more information on PSTC, visit **pstc.org**.

For additional information about the Fall Member Business Meeting, visit pstc.org/2022-fall-member-meeting-programming.

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SUPPLY CHAIN STRATEGIES



Successful companies are increasing efforts in sustainability with environment-friendly manufacturing processes that minimize waste and maximize efficiency.

By Lisa Anderson, Founder and President, LMA Consulting Group

W ith the increase in interest in sustainable materials and manufacturing, there will be a significant opportunity for U.S. manufacturers that use common sense, good manufacturing practices. In fact, because manufacturers have realized that it is far less environmentally friendly and energy efficient to produce in Asia, India, and the like, as sustainability increases in popularity and end-to-end supply chain carbon footprints are evaluated, U.S. manufacturing will soar. Technological advances and innovation drive successful sustainability in manufacturing, and, according to the World Economic Forum, the United States is one of the top countries in innovation.

Are you focusing on sustainable manufacturing? Successful companies are stepping up their efforts in sustainability. There are countless ways to improve sustainability while following common sense manufacturing practices. For example, manufacturers have rolled out lean initiatives, maintenance improvements, and machinery and equipment upgrades that have reduced the waste of materials. There has also been significant focus on rolling out improvements to reduce energy, material, and water waste. Additionally, companies have started using cleaner energy such as natural gas and renewable sources.

Pertinent Examples

According to Siemens, Coca-Cola HBC Australia has a priority to be as environmentally friendly and carbon efficient as possible in manufacturing. It has invested in a high-speed line that is not only one of the fastest in the world, but also energy efficient and water efficient. Additionally, 100% of the electricity comes from renewable sources, and Coca-Cola HBC Australia has put metrics and reporting in place to measure energy and water consumption.

Similarly, an absorbent products manufacturer focused on how to reduce materials, packaging, waste, and transportation costs to achieve the win-win of margin improvement and carbon-footprint reduction. Since pulp is one of the most water-intensive manufacturing processes, the manufacturer focused attention on updating and maintaining equipment, waste reduction and recycling, and auditing water usage. In the converting process, there was an intense focus on reducing waste and scrap by working with equipment suppliers, engineering, and operations resources, and by partnering with suppliers on material development. The company partnered with several suppliers to adjust material compositions and to jointly develop materials to run more efficiently on the lines with 20%+ less scrap and to reduce material composition without impacting product quality.

From a transportation standpoint, the R&D engineers and the packaging engineers redesigned the products, packaging, and manufacturing process to compress the product as much as possible without impacting quality. They also reduced the packaging materials and designed the product to maximize the pallets that would fit on a truck. Additionally, the logistics professionals implemented a transportation management system (TMS) to analyze transportation routes, carriers, and how to maximize the number of boxes on a truck. The system put together multiple-stop truckloads for shipping lanes to minimize transportation expenses as well as the carbon footprint. The bottom line equated to a 20-40% advantage.

A building products manufacturer focused attention on electricity costs and usage. It pursued several improvements to become more energy efficient. In addition to partnering with the local electric company and hiring an energy expert, the company conducted an energy audit and put together energy plans. It incented its people to work in nonpeak hours to strategically schedule downtime during peak hours. The company also retrofitted and upgraded equipment, optimized air compressors, and improved its industrial furnace energy efficiency.

Resilient and successful organizations are partnering with suppliers on material formulation and adjustments, partnering with equipment manufacturers to optimize the use of the equipment to minimize waste and maximize efficiency, and are innovating within their organization to find ways to reduce energy, water, and material usage. Sustainability will not occur without internal and external focus. The most successful companies are focusing on win-win strategies to impact people, profit, and the planet. As sustainability gains momentum and end-to-end

supply chain visibility is achieved, there is an opportunity for a U.S. manufacturing renaissance to follow.

For more information, contact the author at landerson@lma-consultinggroup.com or visit lma-consultinggroup.com.

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