ASI ADHESIVES & SEALANTS INDUSTRY

2022 Dahlquist Award-Winning Paper

Raw Materials and Chemicals Overview

Form-in-Place Gasket Sealing

ASI ADHESIVES & SEALANTS INDUSTRY
VOLUME 29, ISSUE 8

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FROM THE EDITOR

>> Susan Sutton, editor-in-chief

MOVING ON

The adhesives and sealants industry is vibrant and dynamic, supporting myriad vital end-use sectors, and I'll miss sharing the latest advancements and technologies with you all.

Before sharing some of this issue's highlights with you, I'd like to relate a bit of personal news. After more than two decades with BNP Media, **ASI**'s parent company, I've decided to step away in order to pursue new opportunities. Though I'm excited about what's to come for me, this is a bittersweet moment.

I've enjoyed working with so many of you over the years! The adhesives and sealants industry is vibrant and dynamic, supporting myriad vital end-use sectors, and I'll miss sharing the latest advancements and technologies with you all.

I'm thrilled to share that Karen Parker will be the new editor of **ASI**. Karen has been an invaluable help with our news coverage and eNewsletters over the past year or so, and she's handled a number of editorial duties for *Paint & Coatings Industry* for nearly 15 years.

Please don't hesitate to reach out to Karen at parkerk@bnpmedia.com with any content-related questions or suggestions you may have. Though I'm sentimental about my departure, I'm excited to see what Karen will bring to **ASI** and the industry.

But enough about me! We've got lots of great content lined up for you in this issue, including the 2022 Carl Dahlquist Award-winning paper. Lead author Joseph D. Binder, Ph.D., of Dow presented "Designed Polymer Particle Architectures for Waterborne Acrylic Pressure-Sensitive Adhesives" at the Pressure Sensitive Tape Council's 2022 Tape Week this past May.

"In this work, an alternative particle architecture was investigated for enhanced PSA properties," Binder and the team write in the paper. "A pre-strained interpenetrating network was designed into each particle through a multistage polymerization process… The PSA properties and polymer rheology of films made from these designed polymer particles were investigated to identify opportunities to improve the adhesion/cohesion balance of waterborne PSAs."

"Part 1: Introduction and Experimental" appears in this issue of **ASI**. The conclusion, "Part 2: Results and Discussion," will be featured in next month's edition.

Be sure to dig in to the annual "Raw Materials and Chemicals Overview" feature in this issue as well. Authored by Michael Rezai of The ChemQuest Group, this always-popular piece provides historical and present-day context on key materials and chemicals-related issues influencing the industry, as well as outlooks for the future.

We're also highlighting transportation-related end-use applications in this issue. For example, form-in-place gaskets (FIPGs) are evolving to meet the changing needs of the automotive industry. ThreeBond International's Thomas Jones shares details in "Process and Design Decisions for Successful Form-in-Place Gasket Sealing."

Susan Sutton served as Editor-in-Chief, Integrated Media, of ASI magazine for many years. If you wish to send a letter to the editor, please contact Tom Fowler at fowlert@bnpmedia.com. Letters may be edited for space and clarity.

GLOBAL ADHESIVES & SEALANTS DIRECTORY

Image courtesy of Bill Oxford via www.gettyimages.com.

Welcome to the *Global Adhesives & Sealants Directory*, a comprehensive buyers' guide and resource for finished adhesives and sealants, adhesives and sealants products, and equipment and packaging related to the use of finished adhesives and sealants. This directory is designed to be the single best purchasing reference for engineers, designers, managers, and purchasing agents to specify and purchase finished adhesives and sealants and related products.

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FEATURE

DESIGNED POLYMER PARTICLE ARCHITECTURES FOR WATERBORNE ACRYLIC PRESSURE-SENSITIVE ADHESIVES

PART 1: INTRODUCTION AND EXPERIMENTAL

This paper received the 2022 Carl Dahlquist Award at the Pressure Sensitive Tape Council's 2022 Tape Week.

By Joseph B. Binder, Ph.D., Research Scientist; Graham Abramo, Ph.D., Senior Research Scientist; William DenBleyker, R&D Technician; Melinda Einsla, Ph.D., Senior Research Scientist; Catheryn Jackson, Ph.D., Research Scientist; Alan Nakatani, Ph.D., Senior Research Scientist; and Saswati Pujari, Ph.D., Research Scientist (current affiliation: Unilever), Dow, Inc.

Waterborne pressure-sensitive adhesives (PSAs) are the largest class of PSAs by production volume, and most waterborne PSAs comprise polymer dispersions in water. Typically, the major component of a PSA dispersion is a hydrophobic copolymer of acrylic, styrenic, or other vinyl monomers made by emulsion polymerization.

The emulsion polymerization process utilizes hydrophilic components such as water-soluble monomers, water-soluble initiators, surfactants, rheology modifiers, and salts that remain in the final PSA dispersion either associated with the polymer particles or free in the aqueous phase.[1] Water-soluble monomers such as acrylic acid (AA) or 2-hydroxyethyl acrylate may copolymerize with more hydrophobic monomers so that the resulting polymer is amphiphilic, displaying hydrophilic groups on the polymer particle surface, or they may form hydrophilic polymers that remain dissolved in the aqueous phase.

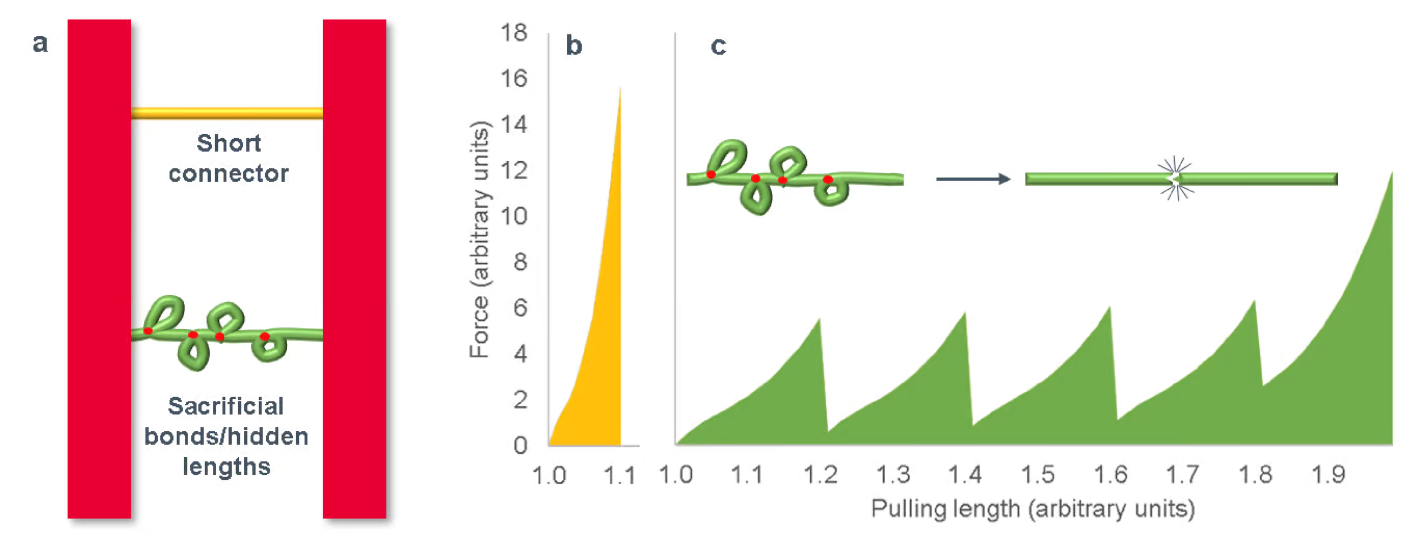
Common initiators such as persulfate salts form sulfate polymer end-groups that also occupy the polymer–water interface. Surfactants that are added to PSA dispersions not only to aid polymerization but also to improve dispersion stability and coatability are present both at particle surfaces and in the aqueous phase. Salts, such as buffers or polymerization byproducts, and rheology modifiers, which are often hydrophilic polymers, are further components of the aqueous phase of a typical PSA dispersion. The aqueous phase surrounds the polymer particles, and the charged and hydrophilic components on the particles provide electrostatic and steric barriers to particle coalescence.

As this dispersion is applied and dried to create a PSA tape, label, or other article, the evaporation of water diminishes the aqueous phase and brings the particles closer together.[2] Eventually, the particles deform to create a void-free film with interdiffusion of polymer chains across the particle interfaces.

Nonetheless, aqueous phase components such as surfactants, water-soluble polymer, and salts remain in the interstices between particles,[3] while hydrophilic functional groups on the polymer surface can form membranes between polymer particles in the ultimate film.[2] These hydrophilic domains create weak boundary layers between polymer particles that are thought to decrease adhesion, cohesion, and water resistance.[4,5] Moreover, polymer particles of waterborne PSAs derived by random emulsion polymerization generally lack defined internal structures.

In contrast, studies of biological materials reveal diverse hierarchical structures that often impart superior mechanical performance.[6] As shown below (a), two of these structural motifs built up in growing biomaterials are sacrificial bonds and hidden lengths.

a: Diagram of bonds by a short connector (yellow) and by a connector (green) comprising sacrificial bonds (red) and hidden lengths (loops); b: Schematic of force vs. pulling length for a short connector stretched to failure; c: Schematic of force vs. pulling length as a connector comprising sacrificial bonds and hidden lengths is stretched to failure. Energy is dissipated by the scission of each of the sacrificial bonds, the unfolding of the hidden lengths, and the rupture of the entire chain. The total energy required to break the connector is much greater than that of the short connector.



Two surfaces joined by a short connector may require high force to separate them by breaking the bonds of the connector, but the total energy required to separate them is relatively low due to the short extension (b). In contrast, separation of two surfaces joined by a connector containing sacrificial bonds and hidden lengths requires multiple bond-breaking and extension steps, making the material very tough (c).

Sacrificial bonds break early in the deformation process, enabling hidden lengths in the backbone polymer to unfold prior to the ultimate rupture of the backbone. Both of these processes dissipate tremendous energy, and such sacrificial bonds/hidden lengths motifs are found in many biomaterials, including collagen, titin, tendon, and silk.[6]

Although the pioneering work on artificial sacrificial bond networks was performed using hydrogels,[7] Ducrot *et al.* more recently demonstrated a tough elastomeric network employing sacrificial bonds.[8] To create the sacrificial bonds, a first network comprising 6-10 wt% of the final material was polymerized from ethyl acrylate crosslinked with butanediol diacrylate (1.45-2.81 mol%) in solvent. The dried first network was then swollen to equilibrium with methyl acrylate and butanediol diacrylate (0.01 mol%), which were copolymerized *in situ* with UV initiation to create a double network.

Finally, the swelling and polymerization process was repeated to create a triple network in which the first network contains pre-stretched chains that can cleave at sacrificial bonds to dissipate energy as the material is deformed. This hierarchical structure incorporating sacrificial bonds dramatically increased the toughness of the triple network material to the range of that of natural rubber, which benefits from the mechanism of strain-induced crystallization.[9]

Inspired by these examples of hierarchical structures improving the properties of soft materials, we have explored methods to apply these concepts to waterborne acrylic PSAs made by emulsion polymerization. In this work, we attempted to build a sacrificial bond network into a PSA through multistage emulsion polymerization.

Experimental

Preparation of PSA Dispersions by Multistage Emulsion Polymerization

The pressure-sensitive adhesive dispersions were prepared by a multistage emulsion polymerization process in a parallel automated reactor. The principal monomer composition was 97% butyl acrylate (BA), 2% styrene, and 1% acrylic acid (AA). Varying low levels of allyl methacrylate (ALMA) or divinylbenzene (DVB) crosslinkers were incorporated in some stages.

Comprising 40% of the total monomer by weight, the first stage was polymerized by gradual addition of monomer with a persulfate initiator. After the first stage was complete, the latex was cooled and 30% of the total monomer was added in one portion for the second stage of polymerization, which employed redox initiation. After the second stage was complete, the latex was cooled and 30% of the total monomer was added in one portion for the third stage of polymerization, which employed redox initiation.

Laminate Preparation from PSA Dispersions Prepared by Multistage Emulsion Polymerization

All samples were direct coated on a 2-mil polyethylene terephthalate (PET) film and closed with silicone release liner. The wet drawdowns were dried in a convection oven at 80˚C for 5 min. The samples were coated at a coat weight of 20 gsm. The samples were conditioned in a controlled temperature and humidity room (23˚C, 50% humidity) overnight prior to applications testing.

Peel Adhesion (PSTC Test Method 101)

Peel adhesion is the measure of the adhesive strength of the adhesive to the substrate. The peel adhesion is tested by applying a 1-in.-wide strip to a chosen substrate—typically stainless steel (SS) or high-density polyethylene (HDPE) panels—using a roller (4.5-lb roller moving at 24 in./min).

The adhesive is allowed to dwell on the panel for a set time (typically 20 min or 24 hr) and then peeled from the panel at a 90˚ or 180˚ angle at 12 in./min using a universal testing system. The average force is reported, along with the failure mode.

Loop Tack (PSTC Test Method 16)

The loop tack test measures the initial or instant adhesion when the adhesive comes in contact with the substrate. A 1-in. strip is cut and folded over to form a loop, exposing the adhesive side. It is then placed in between the jaws of the Instron and lowered at a rate of 12 in./min to the substrate such that a 1 x 1-in. area of the adhesive comes in contact with the substrate for 1 sec. Then the adhesive is pulled away and the peak force to pull the adhesive away from the substrate is recorded, along with the failure mode.

Shear (PSTC Test Method 107)

Shear is a measure of the cohesive strength of the adhesive. A 1 x 1-in. sample is applied to a stainless steel panel and laminated using a roller (4.5-lb roller moving at 24 in./min). The panels are mounted vertically on the shear tester at an angle of 2˚. A 1-kg weight is hung to the bottom of the sample.

The time to failure is recorded as the shear (in hours), along with the failure modes. Typically, the failure mode is cohesive, thus directly correlated with the internal strength of the adhesive.

Failure Modes

Failure modes are abbreviated as follows:

- A—Adhesive
- C—Cohesive
- AFB—Adhesive failure from backing

Part 2 of this paper, featuring Results and Discussion, will appear in the September 2022 issue of **ASI**.

For additional information, contact the lead author at jbbinder@dow.com or visit www.dow.com. Learn more about Tape Week at https://pstc.org.

Acknowledgements: The authors would like to thank the Dow Adhesives team for their support of this work.

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POST-CURE ADVANTAGES FOR SILICONE ELASTOMERS AND ADHESIVES

Whether using a silicone adhesive in an aerospace assembly or manufacturing silicone bakeware, post-cure for silicone is not a process that belongs in the past.

By Alexander Santayana, Senior Application Engineer, NuSil®, a brand of Avantor®

Using post-cure for silicone rubbers is a process of the past, right? Not necessarily. Original equipment manufacturers (OEMs) may find that post-curing can bring value to certain applications. To determine if post-cure is the best option, it's important to better understand what is happening during the process, the advantages it offers, and key best practices.

OEMs designing with silicones today often see products marketed as "no post-cure required" solutions. However, that can create the misconception that there is no value in the post-cure process—when in fact there are numerous reasons why an OEM may want to incorporate a post-cure.

Understanding Curing

Catalysts are used to vulcanize silicones. This process creates a network of crosslinks between the polymers, thereby curing the material and building the elastic response for which silicone is known.

Historically, silicone vulcanizing agents (e.g., peroxides) or condensation catalysts (e.g., acetoxy, alkoxy, or oxime) were used with some types of silicone to cure the material. This process leaves residual byproducts that must be evaporated off. Today's technology includes addition-cured silicone solutions that rely on two-part platinum chemistry, offering an alternative that doesn't produce significant curing byproducts.

The Post-Cure Difference

In a typical post-cure process, the temperature is controlled to a point between 150-200°C for a period of two to six hours. The time and temperature vary depending on the application.

During the post-cure process for two-part platinum-cured silicones, the elastomer's reactive chemistry is driven to completion. Any uncrosslinked vinyl remaining in the elastomer reacts with residual hydrides, changing the crosslinking network. The added energy from heat changes the elastomer quickly, which can cause post-cured material to exhibit a range of changes. In addition, regardless of the cure mechanism, articles subject to post-cure may result in some reduction in mass.

After the post-cure, the components must be cooled. This can be accomplished by laying them out on trays or hanging them to allow air to circulate around them.

Though post-curing can often be misconstrued as a non-value-added process, an OEM may want to incorporate post-cure for a number of reasons.

Why Choose Post-Cure?

The post-cure process offers numerous advantages for various applications.

Change Material Properties

A post-cure step is often used to change specific material properties, such as:

Modulus—This is one of the most common reasons to use the post-cure process, particularly for articles that will be sterilized. Heat and gamma sterilization can alter a finished piece's stiffness, which can impact quality. A post-cure step can create that change ahead of sterilization.

Compression set—When post-curing drives a chemistry to completion, it can improve resistance to permanent deformation. For example, post-cure can improve sealing performance in gaskets. The same post-cure chemical stability that improves compression set can also allow a product such as a medical balloon to inflate with precise pressures and return to its original shape.

Shrinkage—The factors that contribute to shrinkage in silicones are complex and are often linked to processing variables. One way to control shrinkage is with a post-cure.

Chemical stability—Post-cure silicones resist reversion better and can often perform more reliably in challenging environments, like those subject to pressure and steam. This quality is also true of silicone-based adhesives.

Adhesive performance—Though it can be difficult to predict, both silicone substrates and assemblies bonded using silicone adhesives can be impacted by post-cure. As always, but especially after post-cure, silicone substrates should be cleaned before bonding.

Remove Byproducts and Prevent Outgassing

When a polymer is formulated, the intention is to create a certain molecular weight. Since this is not a precisely controlled process, however, some of the lower molecular weight polymers remain and can create concerns. Similarly, acetoxy curing produces acetic acid, a corrosive substance that can damage electronics (especially in a contained space).

From household goods to sensitive electronics, OEMs have several reasons they may need to eliminate these curing byproducts. For example, impurities may need to be removed to comply with regulations focused on the impact of chemical substances on human health and the environment.

In addition to curing byproducts, many silicones (regardless of cure method) have the potential to contain low-molecular-weight volatile species. Silicone volatiles can evaporate or leech, known as outgassing. Outgassing is a significant concern for aerospace applications. In the harsh space environment, volatiles can evaporate and condense on lenses, sensors, optics, paints, or coatings, causing failures in mission-critical components.

To protect the usability of this equipment in space, as well as the safety of the astronauts who rely on it, the volatile chemicals must be eliminated. Ultra-high-purity silicones can be used in applications where outgassing is a concern. These materials are highly purified to remove low-molecular-weight volatiles.

When ultra-high-purity silicones are used, manufacturers can avoid the additional processing steps required to remove the undesirable volatiles from silicones. Likewise, post-cure can reduce unwanted extractables and leachables from medical device components and from components used in ultra-high-purity systems for the biopharmaceutical industry.

Reduce Molding Cycle Time

Another advantage to post-cure is that it allows parts to be ejected from a mold before they are completely cured but while they are still strong enough for handling. This saves cycle time, which is a primary contributor to the cost, while increasing the machine's capacity to make more parts per hour.

Post-Cure Challenges

Although the process can provide benefits in some applications, post-cure can be wasteful or even harmful in others. For example, from an application standpoint, post-cure is typically not a good fit for thermally sensitive components (e.g., electronics) in assemblies with multiple materials. Likewise, the process can cause discoloration, which can impact final articles that require a well-defined color or clarity.

Post-cure can impact costs as well. For example, the process increases manufacturing time, which can slow time to market. Even though that time is measured in hours rather than days, the additional time might not outweigh the benefits, especially in fast-turnaround or high-throughput situations.

In addition, the use of ovens—including the space, energy, and labor it takes to operate them—can be an important consideration. For example, unless a manufacturer implements an automated process, it takes time and labor to prepare, lay out, and remove pieces. Ovens need to be cleaned regularly, too, which can add to costs.

The post-cure process involves a safety element as well. During the post-cure process, volatiles can build up in the oven, creating a potential flammability hazard. To mitigate that risk, it is important to follow all best practices for oven loading and fresh air circulation. This also makes it essential to work with an experienced silicone supplier that is able to work through a post-cure setup.

Best Post-Cure Practices

Once post-cure is identified as a feasible process for an application, several factors can help contribute to success.

Account for Post-Curing Early in the Development Process

The process produces changes that can impact manufacturing downstream. A common mistake is to design, develop, and test the part without a post-cure—only to discover the process impacts color once post-cure is incorporated during manufacturing or introduces the potential for adhesion to a silicone substrate after post-cure.

Test, Test, and Test Again

There is no cookie-cutter answer to find the right time and temperature before developing the post-cure process for a specific component. Instead, use experiments that vary time and temperature to find the combination that produces the desired outcome.

Spread the Components Out

The components' geometry can impact the length of the post-cure, with thin parts typically needing less time than thicker, bulky pieces. Instead of stacking the parts, spread them out so air flows around them.

Plan for Fresh Air

During post-cure, all parts must be exposed to well-circulated, clean, dry air to help prevent a concentrated buildup of volatiles. Use vented or porous racks rather than solid sheets to help circulation.

Clean the Oven Regularly

Over time, contaminants or volatile components crystalize in the oven, creating a safety hazard. Regular cleaning keeps the facility safer and the manufacturing line running.

Log Data

Data loggers that record thermal history can be critical for OEMs because they enable the identification of oven problems and sources of quality issues.

Understand Where Silicone Articles are Sourced

If an application requires post-curing, it's important to understand whether the quoted price includes post-cure and, if so, what the specific quoted post-cure conditions are. This can help avoid surprises that increase time and costs later in the manufacturing process.

Adding Real Value

Whether using a silicone adhesive in an aerospace assembly or manufacturing silicone bakeware, post-cure for silicone is not a process that belongs in the past. By considering post-cure early in the design stage and working with an experienced silicone manufacturer, you can determine if it has the potential to add real value to your specific manufacturing process or end-use application.

For more information, visit www.avantorsciences.com/pages/en/nusil.

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FEATURE

2022 Raw Materials and Chemicals Overview

As COVID recovery continues, manufacturers must strategize and optimize to mitigate ongoing supply chain issues and soaring costs.

By Michael Rezai, Senior Consultant, The ChemQuest Group

As the world emerges from the impacts of the COVID-19 pandemic, the global economy is seeing some positive indicators for growth, with sustained high demand. The recovery gained traction in 2021 following the introduction of vaccines and reduced protocols related to COVID-19. Strong increases in new orders for all major subsectors indicate that growth will continue in 2022, after industrial production and capacity utilization surpassed pre-pandemic levels in the middle of 2021.

However, market optimism is hampered by major challenges on an unprecedented scale: inconsistent supply, logistics and production bottlenecks, war in Ukraine, fuel prices spiking, and labor shortages. Central banks throughout the world recently announced a wide breadth of policy changes to attempt to curtail the impacts of inflation.

While manufacturers strive to keep pace with demand, these challenges have placed a damper on operational efficiency and margins, as many announce price increases to mitigate impacts of surging costs and work to improve supply chains with localized or secondary supply. Price increases and supply chain volatility are expected to continue but are difficult to predict, as evidenced by the uncertain impacts unfolding from external, uncontrollable factors such as global health, the Russia-Ukraine conflict, and severe weather events.

End Market Outlook

U.S. construction data has stabilized. The residential side of spending has led much of the growth, climbing as demand soared for housing inventory. ABC's Construction Backlog Indicator and Confidence Index suggest that growth in U.S. construction is likely to continue, with the largest recent increase in backlog in the industrial segment, as companies look to increase domestic supply chain capacity.

Automotive production has been severely impacted by supply chain constraints and shortages impacting production, particularly semiconductors. North American light vehicle production experienced the biggest dip in the second quarter of 2020 as the pandemic spread. North America-based manufacturers worked to quickly catch up, ramping up production to meet consumer demand for vehicles as shutdowns eased. Production is expected to steadily recover through 2022.

Global Economic Outlook

Significant contractions in Russia and mainland China have weighed down the overall potential for global growth. With the exception of the initial COVID outbreak, Russian output has dropped the most of any region this year, as the invasion of Ukraine escalated, Western countries imposed a series of sanctions, and many companies announced restrictions for doing business in the country.

Following the beginning of the invasion at the end of February, the manufacturing Purchasing Managers' Index (PMI) for Russia began to contract, falling to 44.1 in March, as reported by S&P Global. The PMI rebounded slightly in May to 50.8, but output levels remained in contraction, pointing to a slowing but still overall trend of decline.

China's manufacturing and service production both fell as the country saw new pandemic lockdowns amidst its zero-COVID policy. The PMI showed contraction for three straight months, falling from 50.2 in February to a low of 47.4 in April, before rebounding slightly to 49.6 in May, as reported by the National Bureau of Statistics of China.

Factors influencing regional GDP growth in the 2022 first quarter include:

U.S.: -1.5% GDP growth rate

- In the first three months of 2022, the U.S. economy shrank by an annualized 1.5%, somewhat more than original predictions of a 1.4% contraction.
- Imports increased more than expected (18.3% vs. 17.7% in the advance estimate), led by nonfood and nonautomotive consumer goods, while exports fell slightly less (down by 5.4% vs 5.9%).
- Consumer expenditure, on the other hand, increased more (3.1% vs. 2.7%), with housing and utilities, as well as motor vehicles and components, leading the way; spending on gasoline and other energy goods declined.

Euro Area: 0.3% GDP growth rate

- In the first three months of 2022, the Euro Area economy grew by 0.3% quarter on quarter, somewhat higher than original projections of 0.2% and in line with the previous quarter's growth.
- Germany grew by 0.2% and Spain by 0.3%, while France's GDP stagnated and Italy shrank by 0.2%.
- In comparison to the previous year, GDP increased by 5.1%, which was also higher than the early estimate of 5% and 4.7% in the 2021 fourth quarter.

China: 1.3% GDP growth rate

- In the three months to March 2022, the Chinese economy grew by a seasonally adjusted 1.3% quarter on quarter, beating market expectations of 0.6% and following a marginally corrected 1.5% increase the previous quarter.
- Despite several headwinds at home and abroad, China's statistics bureau said in an online statement that the economy continued to recover, adding that overall activities were within a reasonable range.

Conflict in Ukraine

On February 24, 2022, Russia launched a full-scale invasion of the Ukrainian mainland across a broad front, forcing Ukraine to dissolve all formal diplomatic connections with Russia. The war's consequences are becoming more apparent as energy and raw material costs continue to rise. Naturally, this has a significant impact on the world economy, with the chemical industry possibly suffering the most.

Gas

- Europe depends on Russia for 40% of its gas.
- Gas storage is low in Europe, and winter demand is 30% higher than the rest of year.
- Record volumes of liquefied natural gas (LNG) have been shipped to Europe so far in 2022.
- LNG could ease Europe shortages if Russian supplies are cut.
- Russia insists that payments for gas are in Russian rubles and threatens to cut supply. Poland and Bulgaria reject.
- Europe LNG processing is operating at full capacity.

Oil

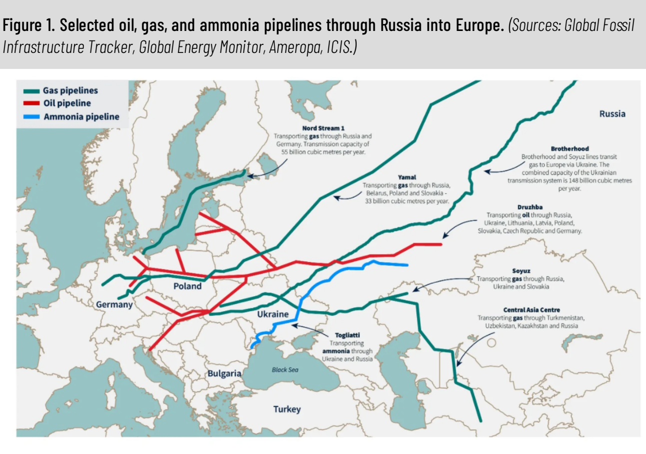
- The Druzhba Pipeline (also known as the Friendship Pipeline) flows through Ukraine.
- Russian oil feeds account for around a quarter of total Europe demand.
- Oil prices could spike to triple digits in a wider conflict.
- The European Union (EU) is implementing a (partial) oil ban against Russia.

Chemicals

- High Europe gas and electricity prices force energy surcharges.
- Soaring oil prices dent chemical producer margins.
- Elevated oil prices depress consumer confidence and demand.

Nearly 40% of Europe's annual gas consumption is imported from Russia via four routes: Ukraine, Belarus-Poland, and the Nord Stream 1 and TurkStream pipelines, which connect Russia to Germany and Turkey via the Baltic and Black Seas, respectively (see Figure 1).

Figure 1. Selected oil, gas, and ammonia pipelines through Russia into Europe. *(Sources: Global Fossil Infrastructure Tracker, Global Energy Monitor, Ameropa, ICIS.)*



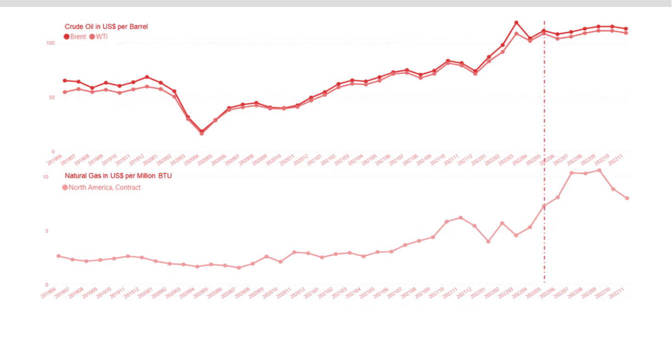
Overall, Russian pipeline supplies were constrained in 2021. Producer Gazprom has only sent one-third of the gas that it was due to send to European consumers via Ukraine as part of a five-year transit arrangement since the beginning of this year.

Feedstock Analysis

Consumers will be relieved to see oil prices soften following the recent drop. However, it will be some time before this translates to cheaper gas costs. The issue of demand destruction has reappeared following the U.S. Federal Reserve's 75-basis-point hike in interest rates in recent weeks to rein in surging inflation.

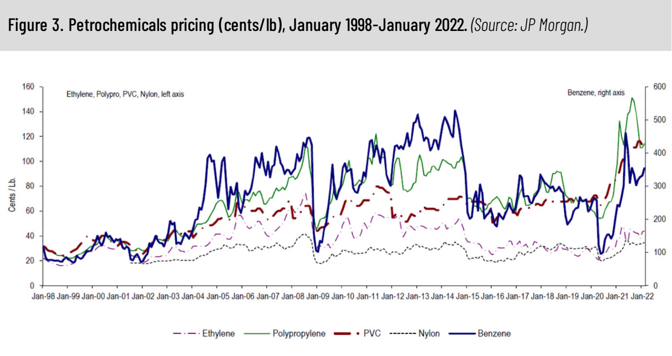
Persistently high oil prices have threatened to reduce aggregate consumption of the commodity as individuals and corporations tighten their wallets and reduce fuel purchases. Sanctions placed by the EU on Russian oil shipments have aggravated the situation, which was already stressed. Considering that the Organization of the Petroleum Exporting Countries (OPEC) has been unable to reach previous production objectives, the organization's dwindling spare capacity puts even more upward pressure on prices.

Figure 2. Crude oil and natural gas price outlook. *(Source: ICIS.)*



In its oil market report for June 2022, the International Energy Agency (IEA) predicts that following a brief dip, demand will build up in 2023 to surpass pre-pandemic levels of 101.6 million barrels per day (bpd). A return to Chinese economic development is expected to support demand recovery, balancing weaker demand from Organization for Economic Cooperation and Development (OECD) countries.

Figure 3. Petrochemicals pricing (cents/lb), January 1998-January 2022. *(Source: JP Morgan.)*



The developing global energy shortfall, which could quickly escalate into a catastrophe by winter, threatens to drive up chemical and polymer costs, or at the very least maintain them well into 2022 and perhaps beyond. 2021 saw wave after wave of global supply disruptions, ranging from the Delta variant's rolling COVID restrictions to the U.S. deep freeze in February and Hurricane Ida in August, as well as container shortages and logistics constraints causing extended lead times. These disruptions led to shortages in basic commodities all the way down the supply chain to semiconductors and finished goods, such as appliances.

The chemical sector is experiencing record high pricing because of the worldwide energy crisis—from oil to natural gas—and spikes in chemical prices (see Figure 3). Benzene, nylon, and PVC rose 8%, 8%, and 1%, respectively, while ethylene and polypropylene fell 7% and 1%, respectively. On a year-over-year basis, benzene, nylon, PVC, and polypropylene rose 36%, 23%, 11%, and 9%, respectively, while ethylene fell 19%.

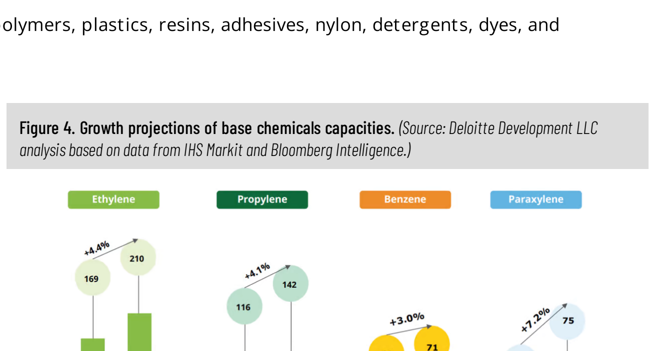
These petrochemicals are derived from refined petroleum and are used as feedstocks for a wide range of important goods and materials. For example:

- Ethylene is used as an input to various plastics/resins and PVC.
- Polypropylene is used both as a structural plastic and a fiber for carpets.
- PVC is a plastic used in pipes and tubes.
- Nylon fiber is a primary component of carpets.
- Benzene is used in the production of polymers, plastics, resins, adhesives, nylon, detergents, dyes, and lubricants.

Global Base Chemicals Outlook

Growth projections of base chemicals capacities, such as ethylene, propylene, and paraxylene, are more than 4% per year through 2022 (see Figure 4). These projections anticipate robust end-market demand, which would allow the major petrochemical companies to continue developing and ramping up capacity.

Figure 4. Growth projections of base chemicals capacities. *(Source: Deloitte Development LLC analysis based on data from IHS Markit and Bloomberg Intelligence.)*



In recent weeks, the U.S. spot market for ethylene and propylene was particularly active, with trades totaling 113 million pounds at the Texas and Louisiana hubs.

Overall, ethylene prices were range-bound, with May delivery settling at 28.50-30.50 cents per pound (cpp) and June delivery at 28.50-29.75 cpp. The 45-day weighted-average price of ethylene in the U.S. Gulf Coast (USGC) in May was 29.85 cpp, up 3.30 cpp from April.

U.S. polymer-grade propylene (PGP) spot prices in the U.S. fell, with agreements for May delivery concluded in the region of 53.50-55.25 cents per pound (cpp). In recent weeks, the spot market was busy, with 38.5 million pounds traded for May delivery. The 45-day weighted-average price for USGC PGP in May was 55.78 cpp, down 10.21 cpp from the April 45-day weighted-average price.

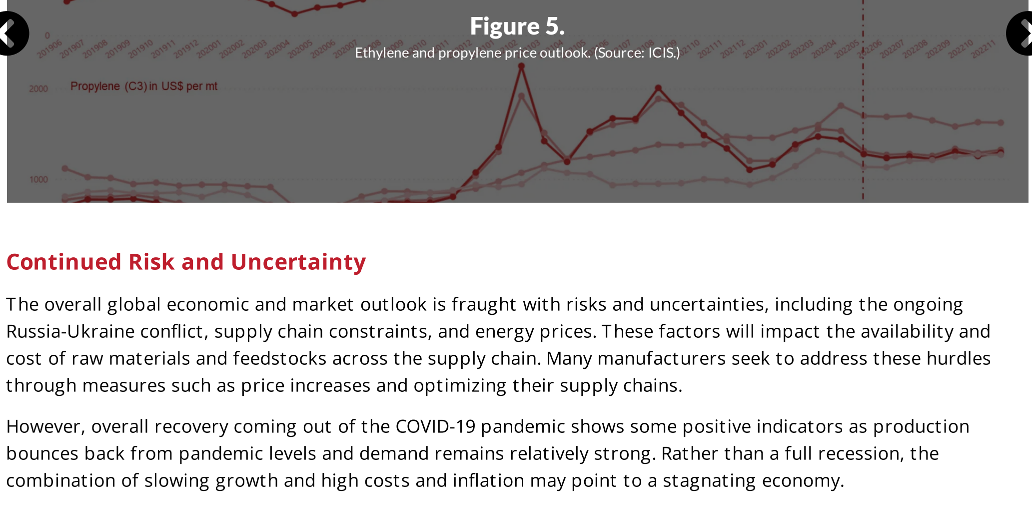


Figure 5.
Ethylene and propylene price outlook. (Source: ICIS.)

Continued Risk and Uncertainty

The overall global economic and market outlook is fraught with risks and uncertainties, including the ongoing Russia-Ukraine conflict, supply chain constraints, and energy prices. These factors will impact the availability and cost of raw materials and feedstocks across the supply chain. Many manufacturers seek to address these hurdles through measures such as price increases and optimizing their supply chains.

However, overall recovery coming out of the COVID-19 pandemic shows some positive indicators as production bounces back from pandemic levels and demand remains relatively strong. Rather than a full recession, the combination of slowing growth and high costs and inflation may point to a stagnating economy.

For more information, email info@chemquest.com or visit www.chemquest.com.

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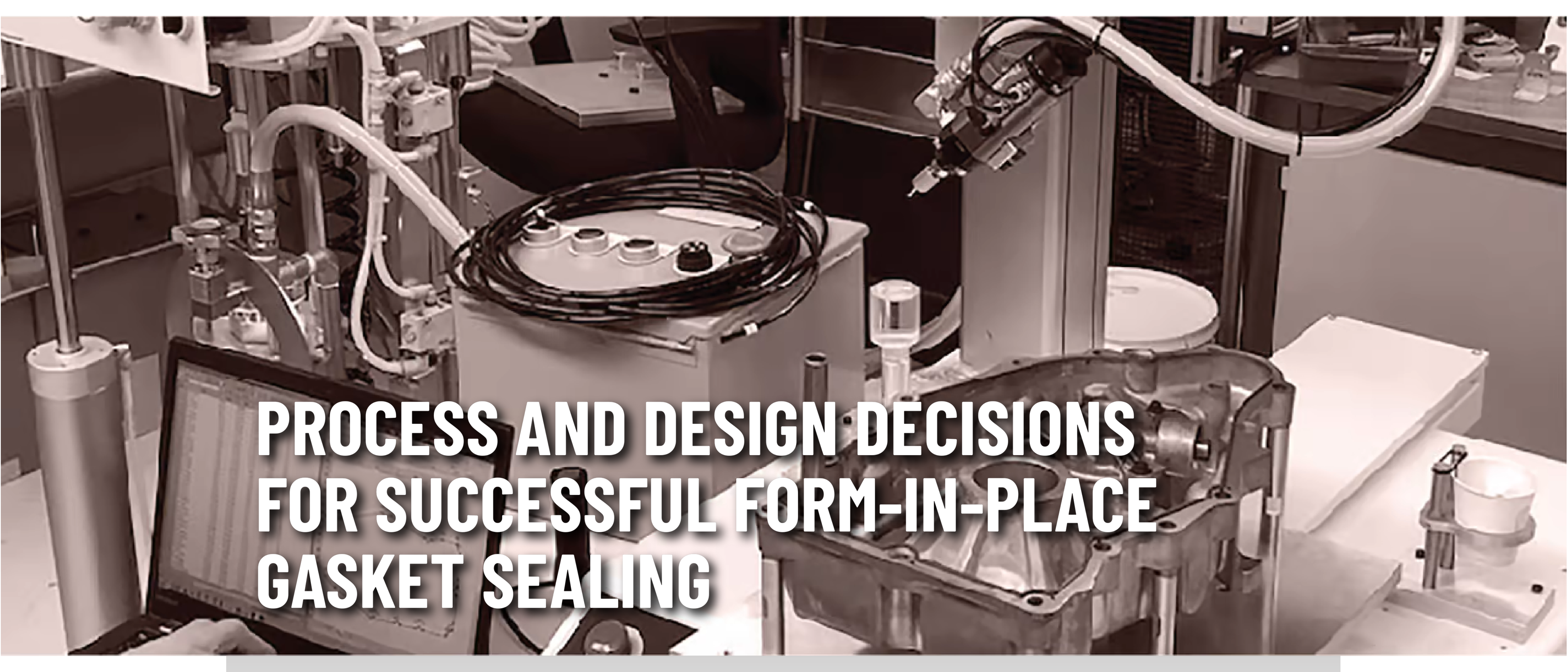


PROCESS AND DESIGN DECISIONS FOR SUCCESSFUL FORM-IN-PLACE GASKET SEALING

Innovations in automotive design have led to substantial changes in how form-in-place gaskets (FIPGs) are used today.

By Thomas Jones, Marketing, Industrial Distribution, and Consumer Sales Manager, ThreeBond International, Inc.

Form-in-place gasket (FIPG) sealants are well-established in the automotive sector for seal applications such as oil pans, drive trains, and cooling systems. However, innovations in automotive design have led to substantial changes in how FIPGs are used today. Heuristics established for previous generations of designs and materials are no longer applicable.

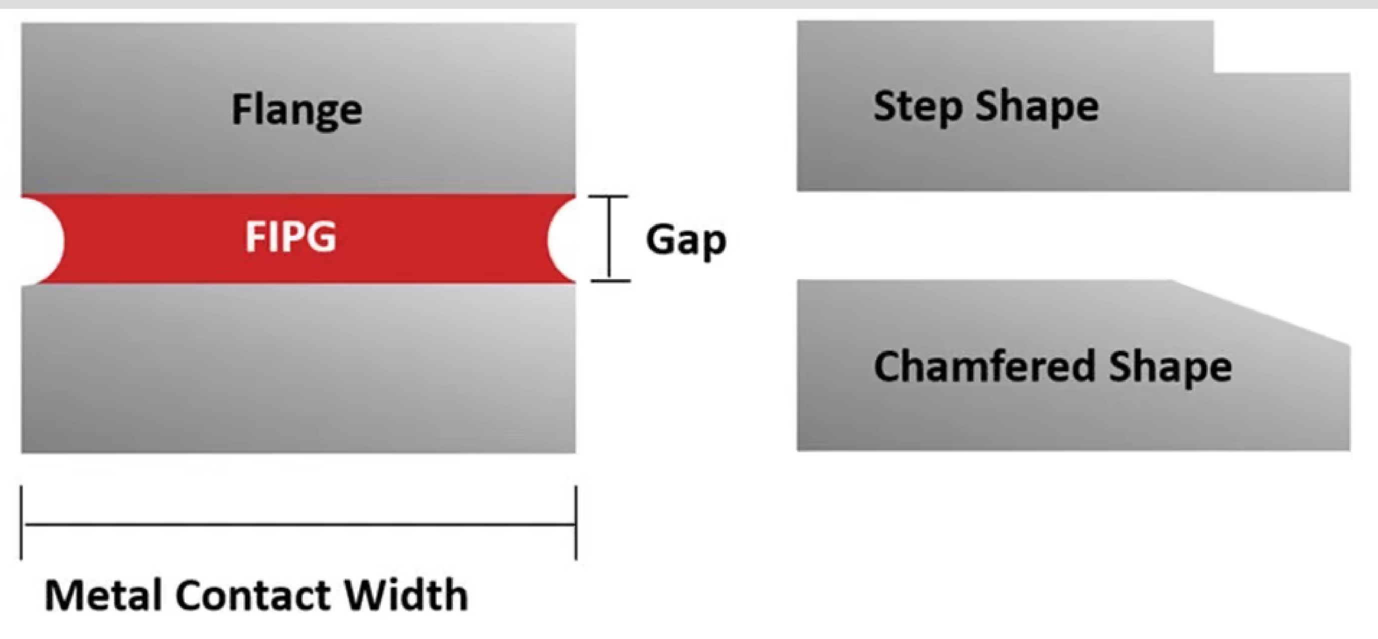
Joint Design

Liquid gasket design is simpler than solid gasket design because liquid gaskets are more forgiving, but essential design considerations must still be employed to achieve good sealing. The geometry of the flange is critical to how the sealant will perform. It is important to consider the balance of metal contact width, as well as the FIPG's thickness volume, initial hardenability, and elongation rates (see Figure 1).

The most common mistake in liquid gasket design is failing to design a proper flange for the sealant. Tiny flanges do not allow the sealant bead to have sufficient thickness for a robust seal. When you put the sealant on a tightrope, there is much more scope for the development of leak paths.

Increasing the metal contact width also increases initial pressure resistance, which is important because many manufacturing processes include an in-line pressure test to evaluate the sealing capability of partially cured FIPG material. Excessive pressure applied to partially cured material will damage the seal, but a wider metal contact width will better protect the FIPG while it cures.

Figure 1. Flange geometry is critical in how the sealant will perform.



The FIPG thickness volume is controlled by the gap size and metal contact width. Increasing the FIPG thickness volume increases sealability under vibration. More sealant volume means more ability to stretch before breaking but reduces both initial pressure resistance and sealant strength.

Chamfer and step flange designs are used to provide better initial sealing and a thicker bead to allow movement in the flange. Flange chamfer width and angle must be set by considering the balance of initial pressure resistance and compliance with movement. It is important to avoid groove designs because they have poor moisture migration into the bulk, causing them to cure slowly. Additionally, grooves provide less ability for the sealant to deform and comply with the substrate to achieve a good seal. In general, wider flanges are better for sealing, and small gaps are better for initial testing.

Properly designing and supporting the joint is becoming increasingly important with the trend toward making cars out of plastics, lightweight composites, and thin sheets of stamped metal. These newer materials tend to have a lot of flex, which means that joints are exposed to twists, tension, compression, shear stresses, and other movements.

FIPGs were originally designed for bolted metal joints. Accordingly, the low strength of traditional FIPGs was not a problem because they could function solely as sealants without taking on a structural role. Any displacement in the joint assembly or operation will compromise the seal.

Mechanical fastener spacing and location are crucial for stabilizing joints. The maximum acceptable spacing between mechanical fasteners depends on the flexibility of the joint materials, as well as the width of the flange. Positioning a mechanical fastener at each corner is the most secure design, but other considerations often lead the designer to prefer to position the fastener along the side near the corner instead. Even if the fastener spacing is sufficient, however, a non-corner fastener placement can allow a corner leak path because of the way stresses propagate along the design.

It is also important to avoid high-pressure ports. Surround these locations with a press-in-place or edge-bonded carrier gasket, with a room-temperature vulcanizing (RTV) silicone-based FIPG as the secondary sealant using concentric or semi-circular grooves.

Another concern with the new generation of vehicular materials is the coefficient of thermal expansion (CTE). CTE mismatch and creep with plastic substrates can pop joints, so any joints subject to temperature changes may require stiffening structures.

The new materials require a fresh focus on surface properties as well. Many new-generation materials have low surface energy, which makes them difficult to bond, so it is necessary to optimize the bonding conditions for each material depending on the specific surface chemistries.

These materials may initially have a surface energy of about 30 dynes but can be treated to increase the surface energy to 40-60 dynes, which improves the ability of sealants to wet onto the surface and achieve a secure, leak-proof seal. The old roughness standard for FIPG substrates was 0.8-3 Ra, but a new roughness standard of 6-25 Rz should be established to better account for a variety of peak and valley shapes.

Substrate cleanliness also important. To achieve a good seal, the surfaces should not be greasy, dusty, wet, or have been washed in a basic solution (pH).

In addition to modeling, it is particularly important to investigate surface pressures on the actual part in the design stage. Modeling still cannot replace rigorous testing. It also is necessary to design for the product. Never use RTV sealant on a joint originally intended for another material unless the joint requirements for FIPG are satisfied in the joint design.

Selection Criteria

Since RTVs are silicone-based, they tend to have good overall chemical and temperature resistance properties. RTVs have been developed to perform better against specific chemicals such as engine oil, long-life coolant (LLC), automatic transmission fluid (ATF), differential oil, and others.*

It is important to identify any specific requirements when selecting an RTV for an FIPG. Most silicone RTVs have an operating temperature range of -40 to 250˚C. While this range covers most applications, RTV types that are resistant to higher temperatures are also available for high-heat applications.

Several design requirements are key when selecting the best RTV for an FIPG application. It is important to determine the requirements for the project and share this information with the RTV supplier:

- Viscosity/sag
- Skin over time
- Time to full cure
- Adhesive strength to various surfaces
- Color
- Outgas (electronics)
- Elongation
- Compatibility with substrate (not promote corrosion)
- Thermal conductivity
- Flame resistance
- Compatibility with fluids
- Pressure resistance

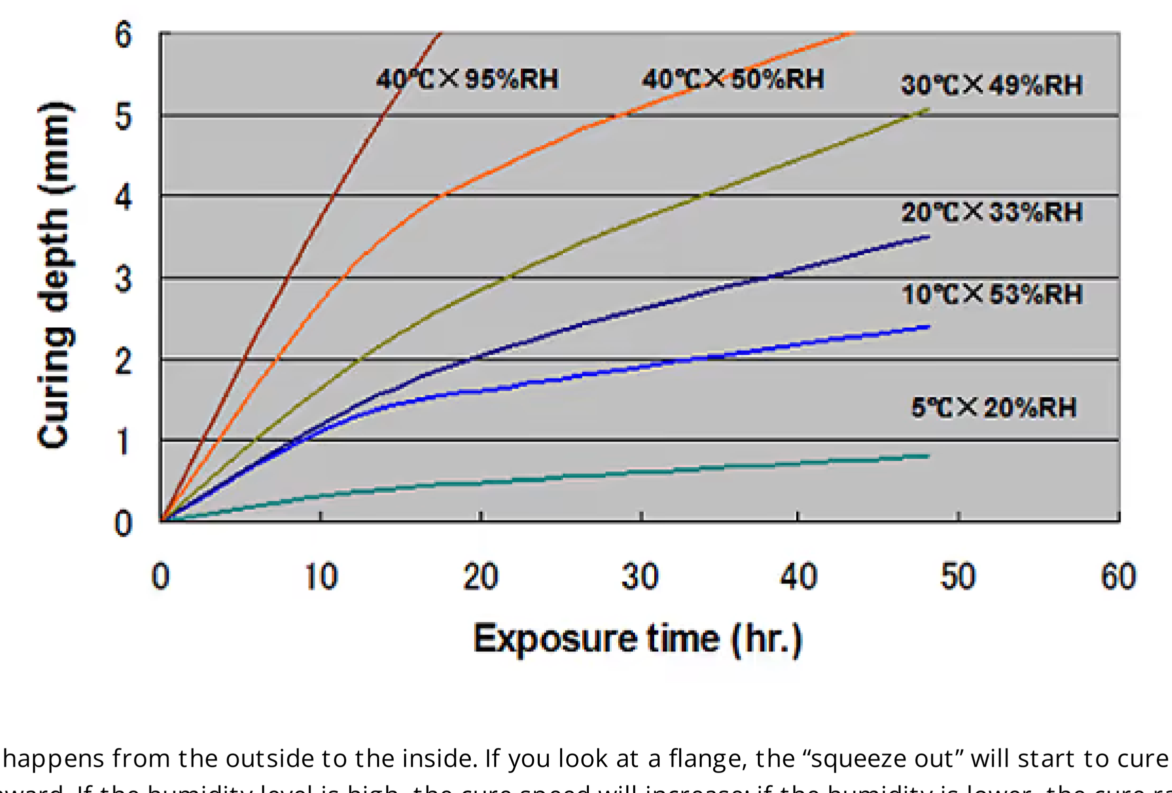
Processing

All RTVs start as a liquid. When choosing to use this type of material for an FIPG, designing to the end result—a solid gasket—can cause problems. Since every manufacturing process has steps and takes time to fully assemble, this dwell time is key when using RTV.

The "liquid" sealant behaves as a "steady flow of viscous fluid between two parallel planes" when it is in the flange of components being mated. Even though the material is a liquid, it can still withstand pressures and maintain the seal. The viscosity of the material, the flange width, and the distance between the mating faces (gap) are key to a good seal until the material has cured thoroughly.

RTV cures by the reaction of humidity in the air. This reaction creates a polymer chain and continues until the material is fully cured. Most one-part, moisture-cure RTV cures at seven days, 55% relative humidity.

Figure 2. Effect of temperature and humidity on the curing of form-in-place gaskets. In general, FIPG cures about 2-3 mm at 20˚C and 50% humidity.



Curing happens from the outside to the inside. If you look at a flange, the "squeeze out" will start to cure and then work inward. If the humidity level is high, the cure speed will increase; if the humidity is lower, the cure rate will decrease. Typically, RTV cures faster in the warmer months and more slowly in the winter.

After applying the liquid gasket, assembly must take place quickly to ensure the material does not "skin" over, reducing the adhesion to the substrate. Dispensing the sealant onto a part and then allowing it to sit out too long, such as during a production break, can cause reduced adhesion and sealant failure.

In addition, the dispensing process must be designed to be completed before the sealant starts to skin over; this can be a challenge on a large part or a slow dispense. Timers and sensors need to ensure the parts are assembled quickly or not used if the recommended time is exceeded. Once the parts are assembled, they need to be fastened quickly to ensure the bond is not jeopardized if not completed.

When dealing with a solid gasket, the key to sealing is compression. A leak will occur when the mating parts are slightly out of spec. When using an RTV-based FIPG, the material can fill these voids and still provide great sealing performance. RTV does not use compression. Instead, seal integrity is determined by adhesion to the substrates and strength of the RTV.

Dispensing RTV Sealant

With today's technology in robotics, dispensing RTV sealant can be an easy process. Depending on the RTV bead specifications, several options can ensure that the proper shape and size of the bead is applied to the flange. Dispensing systems typically include the following:

- Pump and hoses—move the sealant to the dispensing valve
- Regulators—maintain constant material pressure
- Dispensing valve—regulate material (pneumatic, servo, gear)
- Dispensing nozzle—control the size of the bead dispensed
- Robot—programmable; apply bead pattern onto the flange
- Machine base/part fixture—hold the part in place during RTV dispensing
- High-definition multimedia interface (HDMI)—control center for system

Automation enables easy and efficient sealant dispensing.

Due to design changes in the mating substrates, working with RTV and dispensing with a robotic system allows for easy adjustments of FIPGs. Instead of tooling change costs, longer lead times for changes, and possible manufacturing equipment costs, the program can simply be changed to adapt to the new design.

Sealing the Future

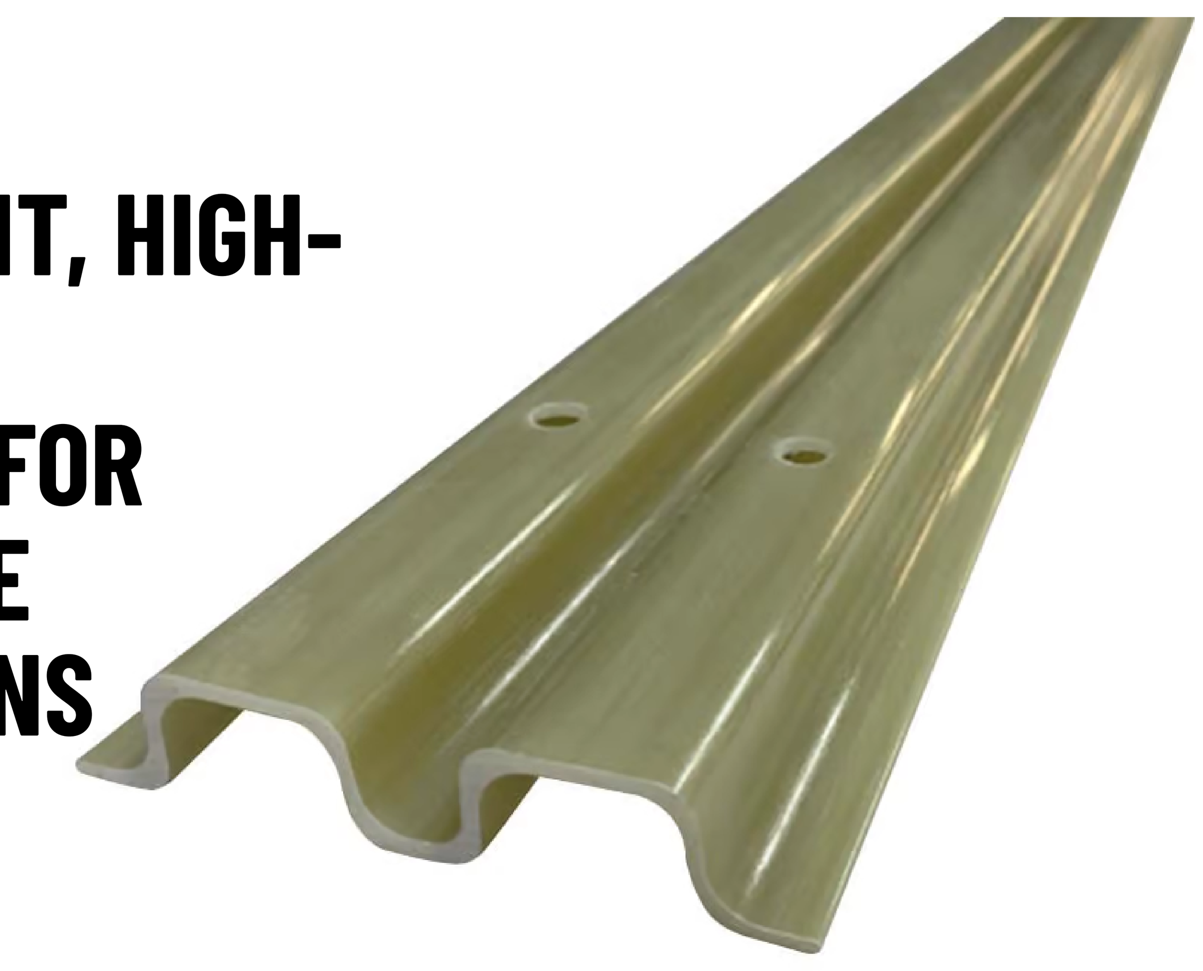
It has been over 40 years since RTV silicone was adopted widely by the automotive market, and numerous products and applications have evolved to meet the ever-changing market. While RTV silicone is a mainstay in the sealing of engines, the electric vehicle industry is adopting this technology for sealing battery enclosures and various access panels. As we move away from the combustible engine, RTV-based FIPGs playing a vital role in the future of the automotive market.

For more information, contact the author at tjones@threebond.com or visit https://threebond.com.

**Developed by ThreeBond International, Inc.*

Note: Images courtesy of ThreeBond International, Inc.

LIGHTWEIGHT, HIGH-STRENGTH SOLUTIONS FOR AUTOMOTIVE APPLICATIONS



A pultruded profile beam for the new Toyota Tundra seat prior to overmolding.

When combined with structural adhesives or overmolded thermoplastics, composite pultrusion systems* help deliver high-strength, lightweight macrostructures that can help automotive manufacturers meet efficiency goals while optimizing costs.

By Hank Richardson, Product Engineering Manager, L&L Products

Make it lighter. Make it stronger. Manufacturers in automotive and other industries are no strangers to these initiatives. How can companies meet these objectives when they seem to pull engineering teams in opposite directions?

Composite pultrusion systems* can help achieve ultra-strong and lightweight structures at cost-competitive rates. This technology represents an alternative (or addition) to traditional steel or aluminum structures, which can be heavier, weaker, and more expensive than composite technology, especially when factoring in the tooling costs.

Pultruded composites are continuous fiber-reinforced materials that can be used as a main structure and, when combined with sealants or structural adhesives, create a unified macrostructure. This constant cross-section pultrudate is designed to provide strength, stiffness, and rigidity to a lightweight structure; when combined with injection molding, the resulting three-dimensional shape can be adapted to fit many applications.

The technology is currently used to strengthen and reinforce crossmembers, composite tunnel reinforcements, and seatbacks. Additional applications in the automotive industry and beyond are also being explored.

Strength, Weight, and Cost Optimization

Composites can handle large loads and capture significant energy during safety events. When bonded to steel or aluminum structures, composites enable a cost-effective reinforcement solution that is 75% lighter than steel and 30% lighter than aluminum. Compared to high-strength steel, composite pultrusion systems* can deliver equal flexural strength at a fraction of the weight by themselves.

A process developed by L&L Products enables the manufacture of straight parts with constant cross-sections, delivering consistent, high-strength components. The process enables the higher processing speeds that are necessary to improve the value proposition and maximum capital utilization. In addition, multiple outputs can be accommodated, with one machine feeding more than one die.

High throughput rates can be achieved with the combination of low line rates and inexpensive die costs, resulting in a cost-competitive solution with value that exceeds the alternatives. The technology applies adhesives to parts in a continuous process, reducing manufacturing costs and time to delivery. In addition, state-of-the-art manufacturing equipment is capable of capturing data to regulate quality, apply adhesives, and then robotically transfer parts to packaging or post-processing in a seamless, cost-efficient process.

The redesigned crossmember in the 2022 Ford F-150 Lightning provides the same strength as a full-size crossmember.

Ford F-150 Lightning Crossmember Reinforcement

BASF and L&L Products joined forces to develop a battery protection solution for the 2022 Ford® F-150 Lightning™ pickup, which was the company's first electric F-Series truck. To accommodate the battery enclosure, which needed extra room, the objective was to provide a smaller crossmember while providing the same strength as a full-size crossmember. The crossmember is a structural section designed to withstand high loads to keep the battery and occupants safe in the vehicle.

This application brought three "firsts" for composite pultrusion systems: the first closed-section pultruded tubular part, the first body-in-white application, and the first use on an electric vehicle. The pultruded composite crossmember was also the first application for BASF's new polyurethane pultrusion system to be implemented prior to the e-coat process.

Jeep Grand Cherokee Composite Tunnel Reinforcement

While researching opportunities to reduce mass and improve durability without compromising safety performance, the Jeep® Grand Cherokee's transmission mounting system (TMS) was one area of focus. The composite tunnel reinforcement (CTR) is located on the underside of the vehicle and is part of the overall TMS. In the event that a vehicle collides slightly off-center with an opposing vehicle, for example, the CTR transfers the energy load from the outer rail to the transmission mount crossmember, improving performance in A-side pole impact or in the Insurance Institute for Highway Safety's (IIHS) small offset rigid barrier test.

The use of the L&L composite pultrusion system along with polyurethane chemistry from BASF were key factors in the success of the CTR, enabling Stellantis to realize a new design that reduces space along with mass and uses the surrounding environment on the vehicle to help transition loads to the CTR. The system was designed to carry a 70-kN (15,700-lb) load cross-car in a shallow offset crash event.

This was also the first application for L&L Products' composite pultrusion system and BASF's new polyurethane pultrusion system. "Our polyurethane chemistry coupled with continuous glass fiber has a superior strength-to-weight ratio compared to ultra-high-strength steel when used in these kinds of applications," said Chris Korson, Chassis Market Segment manager, Performance Materials, BASF Corp.

The new composite tunnel reinforcement (CTR) design of the Jeep Grand Cherokee reduces space along with mass and uses the surrounding environment on the vehicle to help transition loads to the CTR.

For this application, BASF, L&L Products, and Stellantis were recognized for lightweighting success on the composite tunnel reinforcement, winning the Altair Enlighten Award for achievements in vehicle weight savings of 4.6 lb over the traditional steel clamshell design. In addition, the assembly process was improved with the use of molded-in clips, compression limiters, and threaded studs. Finally, technology improvements enabled the team to achieve an industry first in processing speeds, doubling the typical profile pultrusion output.

Toyota Tundra Seat Structure

In an interior example, Toyota needed a strong, lightweight solution for the rear seat frames on its Tundra. The previous generation of this vehicle had seat frames that were constructed from over 60 steel components, resulting in high manufacturing costs, numerous weld points, high scrap rates, and a more complicated quality inspection process.

L&L again partnered with BASF, along with Flex-N-Gate and Toyota, to develop an all-new composite resin seat frame for the 2022 Tundra. Constructed with an overmolded pultruded crossmember in the seat back, this seat frame is strong and lightweight, with the 60+ steel components reduced to only four molded parts. The need for fewer parts results in less scrap and reduced manufacturing costs.

The composite resin seat frame in the Toyota Tundra is strong and lightweight, with the 60+ steel components reduced to only four molded parts.

Quality inspections are significantly easier with the composite seat assembly, with no more need to sort and scrap assemblies due to bad welds. Quality evaluation of composite parts is now fully automated and accomplished through sensors and software that monitors the molding process.

In the end, cost and mass were decreased by 20%. As an added benefit, fold-down seats and under-seat stowage became a new feature that was made possible by the new composite seat design. Plus, the seat frame is now shared between the double cab and crew/max cab vehicles, where unique steel structures had previously been needed for both.

Computer-Aided Engineering

Engineering expertise and computer-aided engineering (CAE) modeling capabilities are a critical aspect of composite pultrusion systems for producing and optimizing unusual part designs, enabling parts to be validated even before they are created. Conventional computer methodologies break down at the initial point of failure with composites. These methods cannot reconcile the behavior of one component of the composite system failing while the other remains intact. This leads to catastrophic failure in the model and ignores the massive post-failure energy absorption in the actual part.

Through a rigorous testing plan and thousands of hours of simulation time, this shortcoming has been addressed to simulate the continuous fiber composite behavior in these types of applications. Material cards for the pultruded material have been developed that allow for accurate performance prediction, stiffness, and crash events while capturing the additional load after failure that a composite provides.

For more information, visit www.llproducts.com.

**Continuous Composites System™ (CCS™)*

Images courtesy of L&L Products.

PRODUCT PROFILE

MIXED, NOT STIRRED: ACHIEVING BUBBLE-FREE ADHESIVES AND SEALANTS

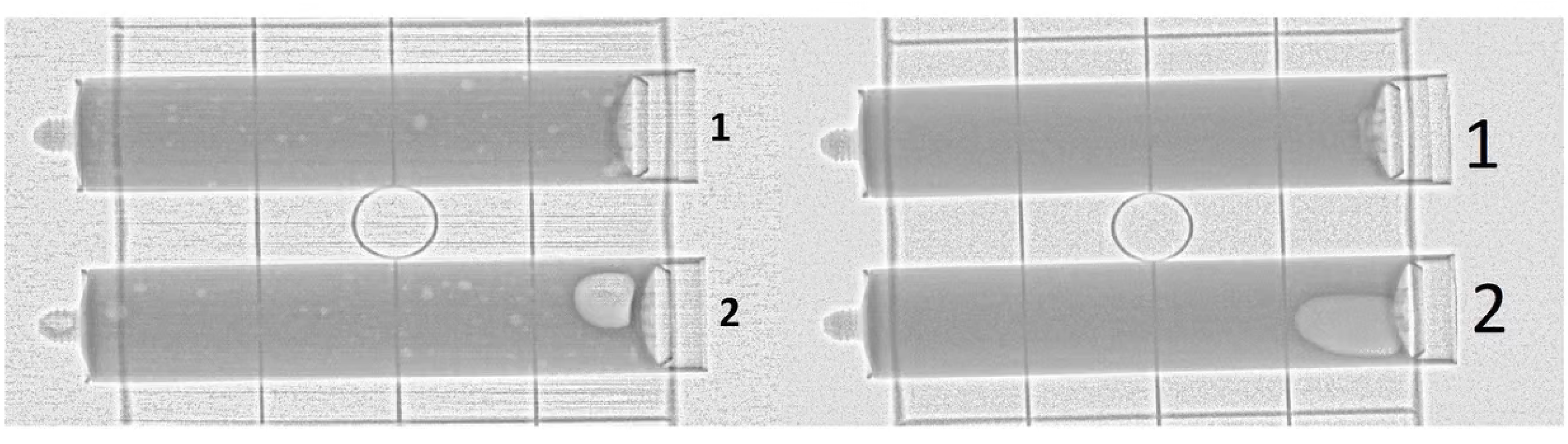
When mixing adhesives and sealants, it is important to work as homogeneously as possible and without bubbles to ensure optimum adhesion and a full seal.

Hauschild Engineering reports that its SpeedMixer® has the ability to mix multi-material compounds in just a few minutes and without any air bubbles. Materials created with this mixer are used in almost all industries, including rubbers, paints, plastics, batteries, and—last but not least—adhesives and sealants. Inadequate mixing is particularly critical with adhesives and sealants, because air does not stick or seal.

The use of adhesives and sealants is increasingly replacing conventional joining techniques. When mixing, it is important to work as homogeneously as possible and without bubbles to ensure optimum adhesion and a full seal.

Air bubbles form when stirring tools are used. The tools must also be cleaned extensively after each batch to prevent contamination. In addition, the mixing process often takes a long time and thus ties up unnecessary capacities. Professional centrifugal mixers deliver air-bubble-free, homogeneous, reproducible results completely without stirring tools.

Figure 1. Silicone adhesive before (left) and after the mixing process. *(Image courtesy of Lohnpack GmbH, www.lohnpack.info.)*



Use of Centrifugal Forces

The key to success is dual asymmetric centrifuge (DAC) technology. The special feature of this mixing principle is the double rotation of the mixing cup. The combination of centrifugal forces acting in different planes enables an extremely efficient mixing process, which is characterized by a homogeneous result without the use of stirring tools.

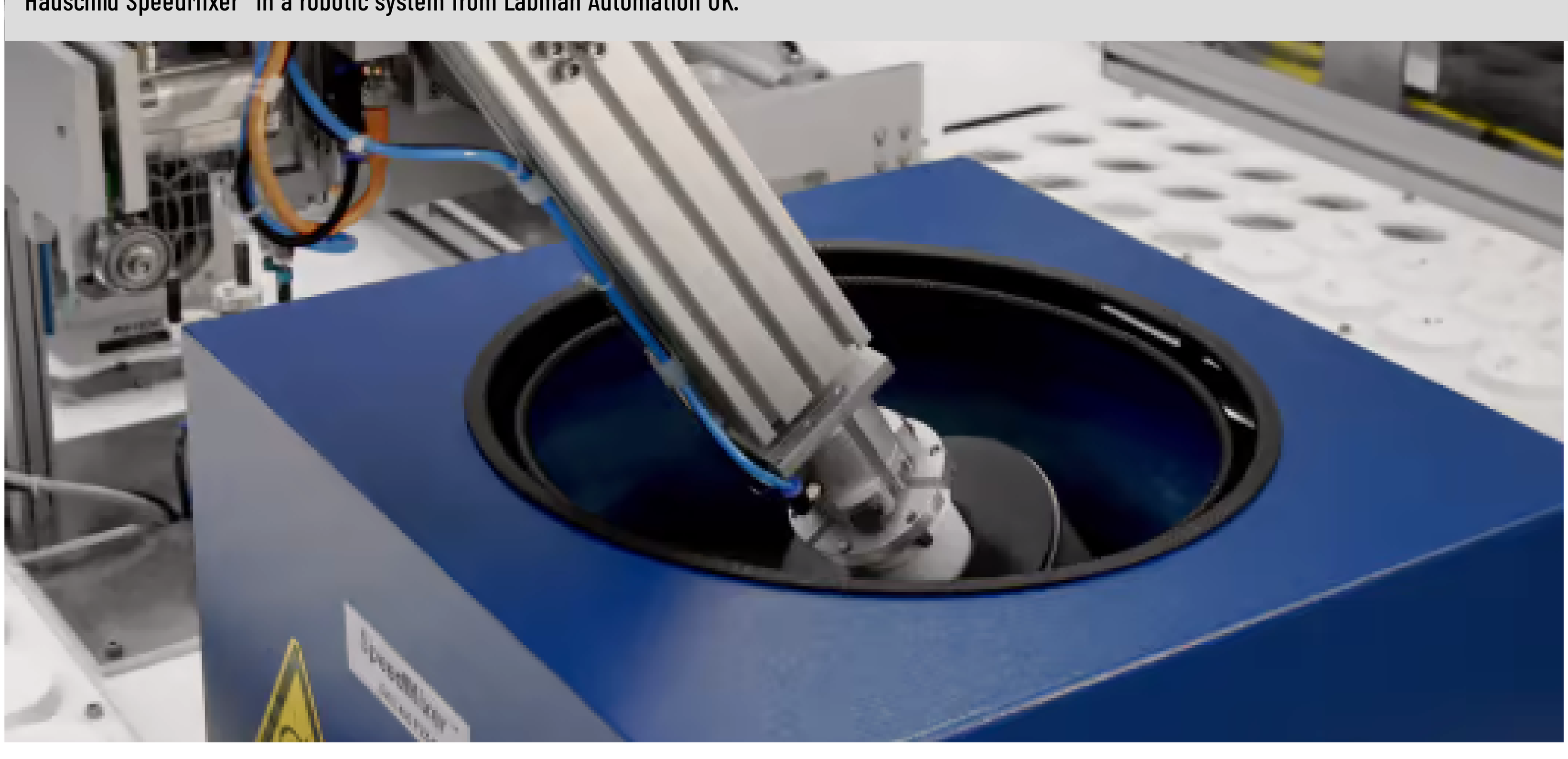
Almost 100% degassing is carried out during the mixing process. Even the smallest micro-bubbles are removed, and there is no need for an additional degassing cycle.

For complete degassing, the Hauschild SpeedMixer® is available with vacuum technology. Programmable cycles ensure identical, reproducible mixing of each batch and lead to a considerable acceleration of the development process.

The Hauschild SpeedMixer® mixes without stirring tools in disposable cups, which eliminates the need for cleaning and the additional use of chemicals. The dimensions of the mixing cups and mixing buckets range from a few grams to 10 kg and a few milliliters to 16 liters of nominal capacity, depending on the size of the batch.

The applications of this centrifugal mixer are as diverse as the product world. It is possible to mix different liquids and pastes, pastes with powders, powders with powders, and other combinations of liquids and powders. Materials with different chemical and physical properties can also be mixed to form new sealants and adhesives, rubbers, plastics, and other products.

Hauschild SpeedMixer® in a robotic system from Labman Automation UK.



Data Exchange and Robotics

If the laboratory mixing device is to be integrated into an automated process, Hauschild Engineering designs suitable robotic devices in close customer dialog. Accessories such as mixing bowls, holders, cartridges, or the LeverPress filling system are also supplied according to customer specifications and applications.

Process automation is supported in various ways. The new SMART DAC generation offers the possibility of integrating various sensors such as temperature and humidity, smoke, fire detection, and dissolved gases, optimizing safety when mixing hazardous materials.

Work in larger laboratories with many employees is supported by the multi-user function with different access rights.

Full Integration

The mixers are programmable; up to 500 programs/recipes can be executed automatically, and up to 12 steps/programs and multi-program sequence functions can be selected. Acceleration and deceleration of the mixing vessel is also separately programmable for each step. Work in larger laboratories with many employees is supported by the multi-user function with different access rights.

For further processing of the mixing material in robotic systems, it is also important that the mixing container comes to a standstill at exactly the same point at the end of the mixing process (e.g., so that a robot gripper arm can remove it). According to Hauschild, the robotic version vacuum of the SpeedMixer® SMART DAC is the first of its kind worldwide that reliably achieves this.

For more information, visit www.hauschild-speedmixer.com.

Photos courtesy of Hauschild Engineering, unless otherwise noted.

>> By Joe Tocci, President, Pressure Sensitive Tape Council

BRINGING TAPE EDUCATION TO A WIDER AUDIENCE AT TAPE WEEK 2022

Tape Week 2022 detailed cutting-edge research and market-related developments for pressure-sensitive adhesive (PSA) tape professionals and end users alike.

After two years of postponement due to the COVID-19 pandemic, 437 people gathered May 2-5, 2022, in Lake Buena Vista, Fla., for the Pressure Sensitive Tape Council's (PSTC) inaugural Tape Week. With 21 technical speakers presenting advances in our understanding of pressure-sensitive adhesive (PSA) tape's scientific properties, as well as 46 exhibitors showcasing the latest innovations in the PSA tape industry, Tape Week 2022 provided the cutting-edge research developments that PSA tape professionals have come to expect from PSTC's conferences.

For example, PSTC's annual Carl Dahlquist Award went to Joseph Binder, Ph.D., polymer synthesis chemist with Dow Adhesives. His paper identified opportunities to improve the adhesion/cohesion balance of waterborne PSAs.

Markets and Applications

Tape Week isn't just for tape experts, though. After the success of PSTC's first Markets and Applications track in 2019, which covered PSA tape solutions for building and construction professionals, we decided to add new educational opportunities for a wider variety of end users. Tape Week 2022's expanded Markets and Applications track featured 14 speakers exploring PSA tape's uses not only in building and construction but also transportation, automotive, and other emerging markets.

The expanded Markets and Applications track featured 14 speakers exploring PSA tape's uses in building and construction, transportation, automotive, and other emerging markets.

Bob Galyen, owner of Galyen Energy LLC and one of the top executives in battery energy storage, discussed the importance of PSA tape to the manufacturing of batteries used in electric vehicles. Electric vehicles are just one example of how digitalization trends are driving new tape applications, according to Tom Sicilian, who works in business development for Henkel's Printed Electronics group.

Experts across industries emphasized the role that PSA tape can play in sustainability efforts. Jay Bolus, vice president of Sustainability for Intertape Polymer Group Inc. and the creator of the Cradle to Cradle Certified™ Products Program, explained how manufacturers can develop and implement responsible corporate sustainability strategies. Kyle Rhodes, North America president of Circular Economy for Labels (CELAB), shared how the global consortium is promoting the recycling of paper and filmic liners and working to reduce matrix waste during converting and slitting operations.

Companies throughout the supply chain came to Tape Week to better understand the complex interconnections in our industry and work together to address common challenges. To facilitate this important conversation, PSTC organized a Supply Chain Panel with: Elodie Picard, Henkel global market strategy head for tapes and labels; Dan Jeffery, Momentive Performance Products global PSA marketing manager; and Todd Schweigert, Channeled Resources Group Release Liner Division general manager.

The Markets and Applications Track also highlighted the unique role of converters with "Converting Concepts into Reality." Here, Todd Wright, JBC Technologies CEO, and Kate Gluck, JBC's vice president of Business Development, provided a look at PSAs through the eyes of the converter and shared what their team needs from PSA tape manufacturers.

Tape Week 2022's Markets and Applications track also included a variety of professional perspectives, from Sam Richter, SBR Worldwide/Know More founder and CEO and a prominent speaker and bestselling author, to Robert Dietz, Ph.D., who worked for the Congressional Joint Committee on Taxation before becoming the chief economist for the National Association of Home Builders (NAHB). Richter shared insights for sales professionals in the tape industry with "The Sales YES Begins With a Know," while Dietz analyzed the potential impact of the current housing market on building and construction trends.

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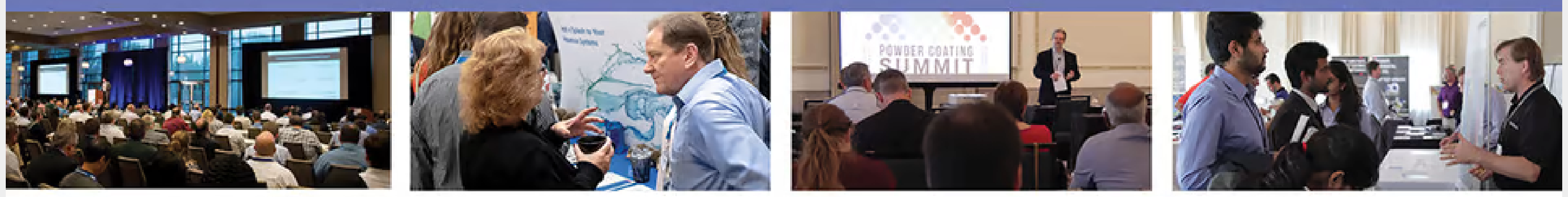

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