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FEATURES





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Adhesives provide a strong bond during electronics assembly while protecting components against potential damage.

Structural Adhesive Pushes Performance Boundaries for Composite Armor Systems

A new high-strength and highly ductile adhesive offers performance benefits in the harshest operating environments.



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FROM THE EDITOR

>> Susan Sutton, editor-in-chief

EXPLORING ASSEMBLY APPLICATIONS

From automotive and construction to general industrial applications, the use of adhesives and sealants is expanding in assembly operations around the world.

We're focusing on adhesives in assembly applications in this issue of **ASI**, and it's always exciting to see the industry's development of new technologies in this sector, as well as the increasing willingness of OEMs and others to accept them. From automotive and construction to general industrial applications, the use of adhesives and sealants is expanding in assembly operations around the world.

Our cover story this month details the various ways that adhesives are used in electronics assembly. "Adhesives provide a strong bond while protecting components against the damaging effects of excessive vibration, heat, moisture, corrosion, mechanical shock, and extreme environmental conditions," writes Hernon Manufacturing's Simla Ay. "They also offer thermal and electrically conductive properties, as well as UV curing abilities."

How are adhesives replacing traditional electronics assembly methods? Which adhesive chemistries work best in various electronics applications? Ay shares answers to these questions, and more, in "Adhesives for Electronics Assembly."

In addition to bonding two substrates together, structural adhesives are tasked with load-bearing responsibilities. PPG has worked with U.S. Army Combat Capabilities Development Command (DEVCOM) Army Research Laboratory (ARL) to develop a new adhesive technology to address critical requirements in armor assemblies.

"Designed to meet or exceed MIL-PRF-32662, this one-component, epoxy-based thermoset technology is expected to enable the development and manufacturing of personal, vehicle, and aircraft composite armor systems with unparalleled performance in the harshest operating environments," write Brian Rearick and Marvin Pollum in this issue. "Through innovative materials design, PPG researchers were able to push performance boundaries to achieve high adhesive ductility without sacrificing overall adhesive strength, maximizing the material's toughness."

Learn more about this award-winning development in "Structural Adhesive Pushes Performance Boundaries for Composite Armor Systems."

How is your company working to advance adhesives in assembly operations? I'd love to hear from you! Please contact me at (248) 786-1704 or suttons@bnpmedia.com to share your story.

Susan Sutton is Editor-in-Chief, Integrated Media, of ASI magazine. If you wish to send a letter to the editor, please email suttons@bnpmedia.com. Letters must include the sender's address, phone number, and email address, when possible. Letters may be edited for space and clarity.





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FEATURE



ADHESIVES FOR ELECTRONICS ASSEMBLY

Adhesives provide a strong bond during electronics assembly while protecting components against potential damage.

By Simla Ay, Technical Writer, Hernon Manufacturing, Inc.

Recent innovations in the electronics industry, such as hybrid vehicles, mobile electronic devices, medical applications, digital cameras, computers, defense telecommunications, and augmented reality headsets, touch nearly every part of our lives. Electronics adhesives are a crucial part of assembling these components, with a range of different adhesive technologies available to address specific application needs.

Adhesives provide a strong bond while protecting components against the damaging effects of excessive vibration, heat, moisture, corrosion, mechanical shock, and extreme environmental conditions. They also offer thermal and electrically conductive properties, as well as UV curing abilities.

As a result, electronics adhesives have successfully replaced many traditional soldering systems. Typical applications where these adhesives can be used in electronics assembly include masking before conformal coating, heat sinks, electric motor applications, potting fiber optic cable connections, and encapsulation.

MASKING BEFORE CONFORMAL COATING

Conformal coating is a polymeric film technology applied to a sensitive printed circuit board (PCB) to protect its components against vibration, corrosion, moisture, dust, chemicals, and environmental stresses, as these external factors can decrease the performance of the electronic components. Every type of coating (e.g., acrylic, polyurethane, water-based, and UV-cure) acts according to its specific properties in the different environments in which the PCB operates. Therefore, it is important to select the best coating material for the required protection.

Masking is a process applied before conformal coating that protects specified regions of PCBs from being coated, including sensitive components, LED surfaces, connectors, pins, and test sites where electrical continuity must be maintained. These must remain uncoated in order to carry out their functions. Peelable masks provide excellent protection of the restricted areas by preventing invasion of conformal coatings into these areas.

The masking process comprises four steps: application, curing, inspection, and removal. After applying a UV-curable masking product on the required components, it cures completely in seconds following exposure to UV visible light. The fast cure allows circuit boards to be processed immediately. After dipping, spraying, or hand application of the conformal coating, the mask is peeled off, leaving a residue- and contaminant-free surface. Masking can successfully replace traditional time-consuming methods.

The masking application method is extremely important. If the product is applied poorly, even if it is the best-fit choice, it will not provide adequate protection. Before the application, it is necessary to clean the surfaces to avoid outside contaminants and preplan which areas of the board require masking. Sensitive areas that do not need coating must be masked. Masking products are available in high-visibility colors such as pink, blue, amber, and green.

Manual or automated dispensing is ideal for the masking application. If hand coating, the mask should not be applied too thickly. Likewise, over-applying is a potential risk when brush coating. When the application ends, regardless of the application method, the masking should be removed once the board is dried.

HEAT SINK ATTACHMENT

As electronic devices become smaller, the power and correlated heat they consume becomes more concentrated and must be dissipated, making heat transfer more valuable. A heat sink is a heat dissipation device that consists of a base and fins. When a chip heats up, the heat sink disperses the heat to keep the chip at a proper temperature. Without a heat sink, chips would overheat and destroy the entire system.

Heat sink adhesives have been designed for bonding heat sinks to electrical components and circuit boards to dissipate heat. This process requires high thermal conductivity and strong structural bonds, and these adhesives rapidly and effectively transfer heat away from power components to the heat sink. Heat sink bonding applications are common in computers, electric vehicles, refrigerators, LED lights, mobile phones, and memory devices.

Heat sink adhesives can be easily applied with syringes or dispensing machines. Before the application, the component's surface must be cleaned thoroughly and properly with a clean cloth and an appropriate solvent. During application, the adhesive should fill the component surface entirely, leaving no air gap, which leads to a heat dissipation within the enclosure. This process protects electronic circuits from overheating, maximizes efficiency, minimizes cost, and improves product reliability.

MAGNET BONDING IN ELECTRIC MOTORS

Electric motors play a key role in our daily life, finding use in electric vehicles (e.g., automobiles, buses, trains, watercrafts, aircrafts, and subway systems), dishwashers, electric toothbrushes, computer printers, vacuum cleaners, and more. Due to the strong trend toward electric vehicles in the transportation industry, most of the modern discussion in that sector involves the concept of replacing the main gas-powered engine with an electric version.

Even in vehicles with combustion engines, dozens of electric motors are at work, enabling everything from windshield wipers to electric locks and heater fans. Adhesives and sealants find many uses throughout electric motors in these components, primarily in magnet bonding, retaining bearings, creating gaskets, and threadlocking engine mounting bolts.

Magnets are bonded in place with adhesives for several reasons. First, the structure of a magnet is brittle and subject to cracking under pressure. Using clips or metal fasteners is discouraged because these methods focus stress into points on the magnet. In contrast, adhesives disperse bonding stresses much more evenly across the



POTTING AND ENCAPSULATION

Potting is the process of filling an electronic component with a liquid resin such as epoxy, silicone, or polyurethane. This process protects sensitive electronic devices like printed sensors, power supplies, connectors, switches, circuit boards, junction boxes, and power electronics against potential environmental threats, including: chemical attacks; pressure differentials that may occur in spacecraft or aircraft; thermal and physical shocks; or conditions like vibration, moisture, and humidity. These threats can all severely damage and destroy these types of sensitive electronics.

Once the resin is applied, dried, and cured, the covered components are secured. However, if air gets trapped in the potting compound, it produces air bubbles that result in performance issues in the finished component.

In encapsulation, the component and hardened resin are removed from the pot and placed in an assembly. As electronic devices continue shrinking, encapsulation becomes more necessary to make the internal elements durable and hold them in position.

While deciding what potting compound is ideal for an application, as well as which elements must be protected, it also is important to consider the components' operating temperatures, production conditions, cure times, property changes, and mechanical stresses. There are three major types of potting compounds: epoxies, urethanes, and silicones. Epoxies offer excellent strength and versatility with superb chemical and temperature resistance, while urethanes are more flexible than epoxies with less resistance to chemicals and high temperatures. Silicones also are resistant to many chemicals, and they offer good flexibility. The main drawback to silicone resins, however, is cost. They are the most expensive option.

Sealing electronic boards with potting adhesives.



POTTING FIBER OPTIC CABLE CONNECTIONS

When bonding fiber optic cable connections, it is important to choose an adhesive that improves the assembly's performance and stability while decreasing cost. Though traditional methods like welding and soldering lead to unwanted heat, adhesives perform much better by protecting the internal components from extreme heat, moisture, and chemicals.

Epoxy adhesives and UV-cure systems are used in potting fiber optic cable connections. These products offer superior bond strength, excellent optical clarity, and high resistance to corrosion and harsh environmental conditions. Common applications include sealing fibers into ferrules, bonding fiber optic bundles into ferrules or connectors, and potting fiber optic bundles.

EXPANDING APPLICATIONS

Adhesives have found ever-expanding use in electronics assembly in recent years. The type of adhesive, the method of application, and the amount of the adhesive applied are the most important factors to achieving reliable performance in electronics components. While adhesives play a key role in joining electronic assemblies, there remains work to do since adhesives are expected in the near future to offer higher mechanical and thermal properties that will increasingly replace traditional soldering systems.

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ADVANCING ADHESIVES

STRUCTURAL ADHESIVE PUSHES PERFORMANCE BOUNDARIES FOR COMPOSITE ARMOR SYSTEMS

A new high-strength and highly ductile adhesive offers performance benefits in the harshest operating environments.

>> By Brian Rearick, Research Manager, Material Science and Engineering, PPG; and Marvin Pollum, Senior Research Chemist, Adhesives and Sealants, PPG



As part of a collaborative project focusing on coatings and joining systems for lightweight materials, the U.S. Army Combat Capabilities Development Command (DEVCOM) Army Research Laboratory (ARL) tasked PPG to develop a high-strength, highly ductile structural adhesive to meet the requirements of the U.S. Department of Defense's (DoD) test method standard MIL-PRF-32662, Tier I-III specification. MIL-PRF-32662 incorporates a decade of rigorous research efforts to statistically correlate the complex ballistic response of adhesively bonded armor assemblies to universally translatable and commercially relevant quasi-static mechanical properties.¹

Designed to meet or exceed MIL-PRF-32662, this one-component, epoxy-based thermoset technology is expected to enable the development and manufacturing of personal, vehicle, and aircraft composite armor systems with unparalleled performance in the harshest operating environments. Through innovative materials design, PPG researchers were able to push performance boundaries to achieve high adhesive ductility without sacrificing overall adhesive strength, maximizing the material's toughness.

STRENGTH AND DUCTILITY

Development began with benchmarking a series of PPG commercial adhesive and sealant technologies. In general, single-lap joint performance was similar to competitive technologies: high strength or high elongation was achieved, with the combination of both properties remaining elusive. Modifications to conventional toughened epoxy adhesives eventually produced an extremely homogenous nanoscale toughening phase within an optimized epoxybased matrix.

Single-lap joint testing indicated a stronger, more flexible material had been developed, producing a 150% increase in strain to break and a 50% increase in breaking strength, as compared to conventional toughened epoxy adhesives (see Figure 1). Thus, a formulation platform was developed for epoxy-based structural adhesives meeting Group I performance of MIL-PRF-32662.

Figure 1. Single-lap joint benchmarking results for commercial adhesive and sealant formulations against MIL-PRF-32662. The red data point demonstrates the lap shear performance of a conventional structural adhesive formulation, falling into the Group II specification range. The blue data point shows the lap shear performance of the developed Group I adhesive platform. Single-lap joint images to the right compare the deformation of the aluminum substrate during testing for these two groups of adhesives.







The significant deformation of the aluminum substrate observed during single-lap joint testing shown in Figure 1 raised the question as to whether the observed high displacement values were due to deformation of the adhesive or yielding of the aluminum substrate under high shear stresses. To minimize any substrate deformation effects, a thick adherend shear test (TAST) was employed.

This test utilizes thicker aluminum substrates and a shorter overlap length to minimize or eliminate any yielding of the aluminum substrate during testing. TAST testing also uses a digital extensometer positioned around the bondline to measure and correct for any minor yielding of the aluminum during testing.

The results of the TAST testing are shown in Figure 2. In comparison with a conventional structural adhesive, the new adhesive platform displays a higher shear strength and a much greater shear strain before failure.

Figure 2. Bulk shear properties of adhesives measured by thick adherend shear test (TAST) ISO 11003-2. Shear strain of the adhesive was measured independent of substrate deformation using a digital averaging extensometer. The area under the shear stress-strain curve represents the strain energy density of the adhesive (i.e., the total energy absorbed by the adhesive prior to failure).



Shear Strain (%)

The observed shear yielding of the adhesive material and high degree of strain before failure demonstrates significant ductility within the bulk adhesive layer at high stress levels and explains the observation of both higher shear stress and greater displacement to failure in the single-lap joint testing discussed previously. The area under this shear stress-strain curve represents the total energy absorbed by the adhesive before failure, which was measured to be 2.5-fold greater for the Group I adhesive platform as compared to a conventional epoxy-based structural adhesive.

In addition to single-lap joint strength and displacement (Tier I), MIL-PRF-32662 specifies single-lap joint performance under elevated temperatures and after hot-wet conditioning (Tier II), as well as resistance to crack propagation (Tier III). Validation data from ARL testing is presented in Table 1 and Figure 3. To date, this technology is the only material approved to all three tiers of the specification.

Figure 3. Validation photographs (provided courtesy of ARL).



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EXPANDING BEYOND DEFENSE APPLICATIONS

Following the MIL-PRF-32662 qualifications and the initial testing phase, PPG became interested in expanding the structural adhesive's applications to additional market segments. In markets such as aerospace, automotive, and industrial, adhesives are required to meet many additional criteria and performance properties, in addition to those that were included in the MIL-PRF-32662 specification and in initial formulations of PPG PR-2930[™]. Such performance properties include broader cure conditions (time and temperature), specific viscosity and rheology, adhesion to a variety of substrates, environmental resistance, fatigue and high-speed impact resistance, product shelf stability, and numerous industry-specific mechanical tests.

Many of these market-specific properties were eventually included into the final PR-2930 product. Some properties, such as a wide range of operating temperatures and water/corrosion resistance, were inherent to the product due to the polymer chemistry. Other properties, such as improved cure speed and cure over a broad range of temperatures, had to be built into the formulation (see Figure 4).





Figure 5 compares the performance of the initial prototype and the final PR-2930 product for one specific market segment. Despite the formulation changes to meet these additional requirements, lap shear performance (MIL-PRF-32662 Tier I-III) remained nearly identical compared to the initial prototype.

Figure 5. Adhesive properties beyond MIL-PRF-32662 that were built into PR-2930 to meet a broader range of market applications.



Finally, all of the tests specified in MIL-PRF-32662 are quasi-static. However, polymeric materials are viscoelastic, with mechanical properties highly dependent on test rate and temperature. PR-2930 was also evaluated in a series of high-strain rate tests conducted at the City College of New York (CCNY). Both the high strength and high ductility was maintained in high-strain rate shear and bending tests over a wide temperature range (-50°C to 63°C).

WINNING INNOVATION

In November 2020, PPG PR-2930 structural adhesive received the 2020 Innovation Award from The Adhesive and Sealant Council (ASC). The annual ASC Innovation Awards Program recognizes innovation in adhesive and sealant product developments. The awards identify significant impact chemistries that contribute to downstream industries' unmet needs and advancements in technology. The award is intended to foster and encourage innovation across the adhesive and sealant industry and academia.

For PPG, the award validates the company's ability to provide cutting-edge innovations and technologies. The greatest achievement for PPG, however, is knowing that its people and products play a vital role in the protection of the men and women of the U.S. armed forces globally.

For more information, visit www.ppg.com.

Reference **1. MIL-PRF-32662 "Performance Specification, Adhesive, High-Loading Rate, for Structural and Armor Applications," 2020.**

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Geographic Scope: The current marketplace in volume and value, and forecasts growth over a three-year period (2020-2023). The full report includes a global size of the Adhesives and Sealants market and a macro assessment of Western Europe, the Far East, Latin America and the rest of world.

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- Global Market Size and Volume & Global Market Dynamics
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- NEW! Flexible Packaging Chapter
- Assembly Operations & Key Sub-segments
- NEW! Learn how 3D printed rough surfaces affect adhesives end users' approach to bonding, the adhesive forms that are most compatible with industrialized additive manufacturing (AM) methods, and product application factors that determine success for adhesive use in assembly operations (with charts).
- Building & Construction & Key Sub-segments
- NEW! Composites use in construction, including applications such as structural strengthening, composite rebar, composite bridge, composite wind towers, and subsea components.
- Woodworking & Joinery & key sub segments
- A section dedicated to sealants and chemistry types
- DIY/Retail, e-commerce (including new COVID-19 buying trends such as social commerce) and distribution
- Regulatory outlook

This report features Deep-dive Qualitative Interviews with Key End Users including the following job titles: VP Marketing Adhesives, R&D Manager-DIY Adhesives Formulator, Adhesives formulator, R&D Manager, VP Marketing and many, many more.

The report also includes an outlook on raw materials; quantitative data for Hot Melt, Solvent Borne, Reactive, Pressure Sensitive, and Water Soluble adhesives; overview of top regulatory issues through 2020; channels to market for seven key distribution markets; e-commerce with an analysis on trends and market drivers; matrix of manufacturers.

View the Table of Contents online for full details.



AN OUNCE OF PREVENTION LEADS TO EFFICIENT ADHESIVE ASSEMBLY OPERATIONS

Environmentally friendly cleaning and preventative maintenance can pay dividends in terms of efficient operation and a safer manufacturing environment.

By Susan Sutton, Editor-in-Chief

Have you ever run your hot-melt tank above the adhesive manufacturer's recommended operating temperature? Did someone on the line ever forget to turn the equipment off at the end of the day? What about drips on the tank lid, or that one spot on the nozzle that always seems to collect buildup? It's quite possible that you've run into all of these issues (and others), as well as the char that resulted.

"Char is literally just burnt glue," says Frank Cavallo, president and CEO of GlueGuard Inc. "When you put hot melt in a tank and you melt it, it generally looks clear. Maybe a slightly cloudy look, but relatively clear. Glue is like any other material. If you leave it on heat for long enough without it moving or circulating, it's going to burn. Char is literally just black chunks of burnt glue."

Char in the tank is bad enough, to be sure, but it doesn't stay in the tank. Smaller pieces flow along with the hot melt through the system's hoses, guns, and nozzles, causing multiple problems. Issues of concern include clogged equipment and misfires that ultimately result in rejected product, which, in turn, necessitates shutting down the line to either clean or replace the affected parts. It's a double-whammy of lost production and increased costs for replacement parts and man-hours.

These issues are compounded if you're using a polyurethane (PUR). "Polyurethanes have a whole other set of issues to contend with, because when a PUR sets, it is set. That is it. You're done," Cavallo explains. "There have been instances where PUR will set in a hose or a tank, or on something where maybe it shouldn't have been. A lot of times, that piece of equipment would be garbage, and they're not inexpensive pieces of equipment. We've even heard of companies using blowtorches to try to clean PUR off of their equipment."

While not as immediately dangerous as blowtorches, potentially harmful solvents and citrus-based products have traditionally been used for cleaning in manufacturing environments. In addition, paraffin waxes are often used when trying to clean non-PUR hot-melt tanks, but they struggle with char and don't provide a deep clean. As Cavallo explains, plants are looking for alternatives.

"The thinking has just been, 'Hey, something's dirty. How fast can I get it off?' So you use something like harsh solvents or citrus that just dissolve and eat away anything, including the paint off the machines eventually," he says. "Well, that comes with consequences."

EASY CLEANING

Environmentally friendly options exist that are formulated to address specific needs (e.g., general hot melt, liquid adhesive, or PUR).* The non-solvent, non-citrus products are free of volatile organic compounds (VOCs) and are safe to use in food-related applications; the majority of the products are certified by NSF International in the U.S., as well as the Canadian Food Inspection Agency (CFIA).

These products work by reversing the effect of the adhesive, essentially changing the dried adhesive back to a liquid state for easier removal. To clean a general hot-melt tank, the user would drain the tank (leaving the temperature set at the hot melt's normal operating temperature), fill the tank approximately half full with the cleaning product, and then let it heat up.

If the tank is quite dirty or hasn't been cleaned in a long time, the process may require more product. Similarly, the amount of time needed for cleaning depends on the thickness of the char; it could take as few as 15 min or up to several hours for a really dirty tank. (Cleaning PUR generally entails a longer timeframe than a general hot melt.)

The majority of the char will fall off as the adhesive is reversed. Once that happens, the user should let the tank cool and drain it, and then use a soft bristle brush on any remaining char.

Char falls off as the adhesive reverses. A soft bristle brush can be used for any remaining char after the tank cools and drains.





Hoses can also be cleaned in a similar way, though Cavallo offers words of caution here. "You can't see what's inside a hose, so you never know for sure if it's completely clean," he explains. "If you've only partially cleaned it and then go back to full production, you can have some of that leftover char go through, clogging guns and nozzles."

Though not a guaranteed solution, one option is to disconnect the nozzle from the hose and point the hose back into the tank through a strainer. The strainer will catch the char as the cleaner runs though, making it easier for the user to see when the process is complete.

The non-corrosive cleaning products can also be used to safely clean nozzles. Instead of trying to gouge the char out or simply replacing the nozzle, users can place the nozzle and cleaner in a pot on a hot plate and let the nozzle soak until the char is removed.

STRAIGHTFORWARD PREVENTION

Buildup and char are inevitable to a certain degree in assembly operations that use hot-melt and liquid adhesives.

While simple cleaning options are necessary in any manufacturing environment, it can be much more efficient for the overall process to prevent excessive buildup in the first place.

As Cavallo explains, buildup has a tendency to occur in specific areas. "Sometimes it's from glue splashing or parts rubbing against the machine where they're not supposed to," he says. "Whatever the reason, if you're getting glue buildup, chances are it's continually building up in that same place. So let's focus on that spot."

A simple and safe option is to coat the affected area with a solvent-, citrus-, and VOC-free preventative product.* Let's take nozzles as an example; overspray is a prevalent issue, and the resulting char can cause problems during adhesive application. After applying a thin coating of the preventative product to the impacted nozzle, users can run the system for each shift as they normally would. No action is needed at the end of the shift, other than turning off the equipment and letting it cool. The next morning, the user can simply peel the cooled buildup off of the nozzle and discard it.

"Your daily process changes slightly, but every day you're starting with a fresh, clean machine, so your odds of going down for some kind of glue-related issue become astronomically less," Cavallo says.

As long as the coating isn't wiped off prematurely, these preventative products typically last for several months, helping to ensure cost-effective and efficient production speeds. Spot touch-ups can be done as needed, though adding a full wipe and reapplication to the monthly preventative maintenance schedule is recommended.

PERSONNEL BENEFITS

The positive employee impacts that can be achieved through the use of simpler and safer cleaning options could arguably be more important than the production-related benefits. Traditional solvent-based products are often dangerous to worker health, causing respiratory issues and even cancer. In addition, they can be flammable and must be stored in special lockers. Eliminating the need for solvents in the workplace helps ensure worker safety.

Worker injuries are reduced when all systems are able to run in good working order. When a piece of equipment fails, workers need to take the equipment apart and rebuild it, which introduces the possibility for accidents in the workplace.

"You don't have to spend time—or the extra elbow grease—trying to clean equipment, and there's less chance of random injuries from just trying to clean something that's almost impossible to clean," Cavallo says. "So it's the safety of the actual product itself, plus making jobs easier, with less physical labor to do the same work."

Speaking of accidental injuries, some employees might also go to extreme lengths to clean the char and get their line **For there information, wisign Let/Scavoid the** blowtorches, shall we?

*Specific product details are available from GlueGuard.

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FEATURE

FORCE MEASUREMENT TO THE RESCUE

Recent advancements in force measurement can help adhesives manufacturers keep up with changing customer demands.

By Mark Fridman, President, Mark-10 Corporation



The global pandemic has accelerated demand for manufactured goods of many types, as consumers stay home and manufacturers continue to operate as essential businesses. Adhesives of all stripes make it possible to join parts together, seal shipping cartons, secure packaging, and much more. Force measurement increases adhesives manufacturers' confidence by providing the data to determine whether their products are acceptable or might cause issues down the road.

WHAT IS FORCE MEASUREMENT?

Force measurement is the measure of a push (compression) or pull (tension) against an object. The term is often used interchangeably with materials testing and tensile testing, but important distinctions abound.

Materials testing is the scientific analysis of materials such as metals, elastomers, and textiles, usually requiring the determination of stress, strain, modulus of elasticity, elongation, and other calculations. While important to the manufacturers of materials, and sometimes to the users of such materials, many day-to-day applications can be achieved with force measurement equipment, which is generally simpler and less expensive to operate.

Force measurement equipment is commonly employed to test components and assemblies, such as the adhesive strength of tape or the pull-off strength of two joined components. Adhesives manufacturers measure force to ensure end user safety and compliance, assist with product design and improvement, and validate quality.

Compliance is an ever-increasing burden on industry, as the web of local, national, and international standards and regulations expands.

End User Safety

Manufacturers keep end users in mind, as their reputation and legal responsibility are on the line. High/low acceptance criteria or minimum force requirements are used to mitigate risk and predict successful performance in the field.

Compliance

Compliance is an ever-increasing burden on industry, as the web of local, national, and international standards and regulations expands. In certain sensitive industries, such as medical device and aerospace, adhesives and sealant strength must satisfy norms to avoid penalties or restricted market access.

While ensuring compliance can be burdensome, much of the work has already been done via the multitude of force measurement standards and methods prescribing how to accomplish particular objectives. Depending on the particular product, industry, and customer base, the manufacturer may follow ISO, ASTM, DIN, or other industry-specific standards. Test methods define test equipment, sample preparation, and how to interpret results.

Established standards sometimes don't meet a manufacturer's particular needs. In these cases, companies also develop their own internal test methods to ensure baseline quality metrics.

Product Design and Improvement

The oft-used expression "innovate or die" applies now more than ever. Data obtained through force measurement can help inform product designers, giving them empirical evidence to recommend new products for production.

Quality Validation

The role of a quality department is to make sure that a product is manufactured in conformance to agreed-upon standards. Force measurement data helps isolate problematic individual products, lots, or batches. Armed with this data, quality control and engineering professionals can determine the source of the problem, whether it's a design issue, material defect, production problem, or other cause.

EXAMPLE APPLICATIONS

Adhesive manufacturers conduct force measurements in different ways, depending on the product in question and the end-use application. The ubiquitous T-peel test measures the separation force of adhesive labels against their backing. The expectation is that the bond strength between the label and the backing is sufficient to prevent premature separation while still being easy enough to remove. In addition, removal force should be consistent from batch to batch to prevent downstream issues with label application on packaging lines.

To test, a length of the roll is cut and then separated just enough to allow grips to secure the two loose ends. The sample is pulled apart, and the force is measured. The maximum force may be considered most important by some users, while others require a graph of force vs. distance or force vs. time.

A 90° peel test can be used to simulate real-world applications. Here, tape may be peeled at a consistent 90° or other angle via specialized fixtures. Tape is applied to the surface of the fixture, and the loose end is then secured by a grip. As the grip pulls upward, the fixture moves horizontally, maintaining the desired angle for the duration of the test.

Another type of peel testing is the loop tack test. This approach involves forming a loop with the adhesive side out, lowering the loop to a surface, and then pulling up at the loose ends to measure the maximum force.



In a loop tack test, a loop with the adhesive side out is lowered to a surface and then pulled up at the loose ends to measure the maximum force.



In these applications, the average force may be interesting to many companies to ensure that the adhesive is applied evenly to a given length of tape. Unevenly applied adhesive could cause issues with insufficient or excessive adhesive strength.

Coefficient of friction testing is often used for coatings applications. Coatings are an important part of many products, from packaging materials to bearings to tile flooring. Whether to protect the item or to provide the desired sliding resistance or tactile feel, the frictional properties of coatings should be quantified to ensure manufacturing consistency.

In coefficient of friction (COF) testing of films and paper, a sample is wrapped around a sled of a given weight (e.g., 200 g). Another piece of the same material is clamped to a surface. As the wrapped sled is pulled across the clamped material, the ratio of the downward force to the resistive force is calculated as the COF. COF testers calculate both the static COF (maximum force) and dynamic COF (average force over the course of the test).



TEST EQUIPMENT

The above application examples touch upon the physical motions and measurements that are required to perform the test. An equipment selection can be made after defining the test objective, estimating the expected maximum force, determining the sample size, and estimating how much the sample will deform or deflect. Force measurement equipment generally consists of a test frame of suitable force capacity (motorized or manually driven), a force sensor of suitable force capacity, grips and fixtures, and data collection software.

Test Frame

A test frame uses an actuator to produce compression and tension forces. Its speed can be regulated to ensure that tests are being performed repeatably and according to the test method.

Test frames are available in a range of force capacities. For longer or wider samples, single- and double-column

extensions increase the working height and depth. Some test frames feature modular designs that allow for custom mounting to the edge of a workbench or to other surfaces.

Force Sensor

Force sensors (also referred to as load cells) measure tension and compression forces. They are offered in many force capacities, typically from as low as 50 gF (gram-force) full scale to thousands of lbF (pound-force). In the U.S., the most common unit of measurement is lbF, while N (Newtons), kN (Kilinewtons), and kgF (kilogram-force) prevail in other countries. Force measurement systems have selectable units of measurement to accommodate local preferences.

Choosing an appropriate capacity is one of the most important considerations in selecting a sensor. As a general rule, a sensor should be used at no less than approximately 5-10% of its range. For example, an application requiring 8 lbF is best served by a 10 lbF-capacity model. A 1,000 lbF-capacity sensor would yield lower accuracy and coarser data resolution.

Grips and Fixtures

The above application examples highlight three grip and fixture types commonly used in the adhesives and sealants industry. Globally, there are many more examples of force measurement applications.

Fortunately, force measurement manufacturers have developed an extensive library of generalized and applicationspecific grips and fixtures. In cases where a standard solution is not available, manufacturers have fabricated their own. The advent of 3D printing has made custom fixturing much easier, especially in lower force applications.

Recent innovations in force measurement software have increased testing efficiency and sophistication.

Software

Recent innovations in force measurement software have increased testing efficiency and sophistication. Traditional force measurement equipment, such as test stands, force gauges, and standalone software, offer universality for many uses, but extracting, presenting, and analyzing data can be more challenging.

Newer force measurement systems integrate the force sensor and software into one system, governed by a single software application. Such applications display the basics (force, distance, and time) while also providing a user interface to design the test, analyze results, export data, and generate a report. For complex applications requiring cyclical testing or custom combinations of push and pull sequences, multi-step scripting allows the user to customize a test without any programming knowledge.

Results are displayed on a graph. It may be considered important for average force tests and dynamic COF testing to visualize problematic areas of the sample. For maximum force tests, the results table may be of more use. Pass/fail indicators and tabulated results make it easy to determine the status of a run or batch and to generate a report or data export.

LOOKING FORWARD

The universality of today's force measurement technology allows adhesives manufacturers to stay ahead of rapidly changing global market disruptions and dynamic customer needs. By accurately and repeatably testing products according to proven test methods and procedures, manufacturers can be more confident in the quality and performance of their products.

For additional information, contact the author at (631) 842-9200 or mf@mark-10.com, or visit www.mark-10.com.

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EXPLORING A HIGH-PERFORMANCE, BIO-BASED FEEDSTOCK

Safe and produced from an annually renewable feedstock, isosorbide has a combination of properties that offers excellent potential for a range of CASE applications.

By Jiae Kim, Global Market Manager, Performance Materials, Roquette

Better resistance to UV, abrasion, scratching, and impact. Better adhesion and improved properties for water-based

formulation. The demands on today's coatings, adhesives, sealants, and elastomers (CASE) create a long list of desirable properties for feedstocks. Safe and produced from an annually renewable feedstock, isosorbide features a combination of properties that offers excellent potential for a range of CASE applications.

KEY PROPERTIES

Isosorbide is a plant starch-derived bicyclic diol with rich functionality for a range of applications in the packaging, CASE, and automotive sectors. Starch from annually renewable feedstocks is hydrolyzed to produce glucose, which is then converted to sorbitol and on to isosorbide by hydrogenation.

As a plant-based, sustainable feedstock with a carbon footprint of just 0.09 kg CO₂/kg of product, isosorbide is a substitute for monomers such as bisphenol A, which has a carbon footprint around 60 times higher. In addition, isosorbide is non-toxic, non-carcinogenic, a non-endocrine disruptor, REACH compliant, and suitable for food contact and for the manufacture of cosmetics and pharmaceuticals. These attributes make the performance benefits of isosorbide of interest and value in a diverse range of applications.

Isosorbide can reduce the environmental burden associated with the use of existing materials.

Isosorbide can be incorporated alongside other monomers to modify the properties of, for example, polyethylene terephthalate (PET), polycarbonates (PC), polyurethanes (PU), and epoxy resins. When used in this way, it can enhance:

- Thermal properties (e.g., increasing the glass transition temperature, Tg)
- Chemical resistance to both water and organic solvents such as acetones and esters
- Optical performance (transparency and birefringence)
- UV resistance (reduced yellowing upon exposure to the sun)
- Mechanical properties (e.g., scratch, impact, and bending resistance)
- Adhesion
- Appearance (e.g., imparting high gloss)

Isosorbide can reduce the environmental burden associated with the use of existing materials. At the same time, it enables producers to maintain performance or even provide the potential for new performance profiles to meet the exacting requirements of different markets.

INDUSTRIAL APPLICATIONS

The CASE market is characterized by diversity, with products formulated specifically to meet precisely defined, sometimes unique applications. However, certain trends prevail across the industry, including the move away from petroleum-derived ingredients and the increasing use of water-based formulations to reduce volatile organic compound (VOC) emissions. Isosorbide combines sustainability with technical performance, with specific advantages depending on the application of interest.

Polyurethane Coatings

Polyurethanes (PUs) are made by reacting alcohols with two or more reactive hydroxyl groups per molecule (i.e., diols, triols, or polyols). 1, 4 butanediol (BDO) is one such alcohol that is routinely used as a chain extender to increase the molecular weight of the PU. Substituting BDO with isosorbide creates coatings with higher heat resistance, better adhesion, and improved impact and abrasion resistance. Switching from BDO to isosorbide increases the Tg of PUs made by reaction with isophorone diisocyanate (IPDI), thereby improving heat resistance. Impact resistance is also significantly improved.

Epoxy Resins

The most common commercial epoxy resins are made by reacting epichlorohydrin and bisphenol A to form diglycidyl ether (bisphenol A digylcidyl ether, BADGE), which is then reacted with an amine to form the resin. Isosorbide can be directly substituted for bisphenol A to make isosorbide-based digylcidyl ether to reduce toxicity and improve the quality of the finished product.

Isosorbide-based epoxies deliver an improved aspect, with a shiny gloss and better UV resistance than aromaticbased BADGE analogs. Appearance is further enhanced by the absence of the white haze that can appear with BADGE/amine systems in the presence of water; isosorbide-based epoxies are less sensitive to the classic amine carbonation phenomenon that produces this effect. Isosorbide epoxy derivatives can, in fact, be miscible and soluble with water. Just as with PUs, impact resistance is also improved, and isosorbide-based epoxy exhibits superior adhesion and deformation properties.

Displacing bisphenol A with isosorbide results in an epoxy resin with improved deformation properties. The superior adhesive properties of the isosorbide-based epoxy have also been demonstrated by comparative cross-cutter testing.

Displacing bisphenol A with isosorbide results in an epoxy resin with improved deformation properties.

LOOKING AHEAD

Isosorbide is a plant-based, sustainable monomer with a low carbon footprint and significant potential for a wide range of applications. Substituting isosorbide for existing petrochemical ingredients not only lightens the environmental impact of industrial polymers, it also drives up performance.

Advancements include new types of aerosol packaging, touchscreens with enhanced clarity and scratch resistance, and better adhesives with improved UV and impact resistance. These are just some of the products that isosorbide is already beginning to deliver as polymer chemists and formulators learn exactly what it can do.



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SOCMA FOCUSES ON THE FUTURE AS IT REACHES A MAJOR MILESTONE

The Society of Chemical Manufacturers & Affiliates (SOCMA) is turning 100 this year, but it's not resting on any laurels.

The Society of Chemical Manufacturers & Affiliates (SOCMA) is celebrating its 100th anniversary in 2021. While the official festivities will be held during SOCMA Week 2021, scheduled to take place October 20-22 at the Royal Sonesta in New Orleans, La., the association is also focusing on many additional initiatives throughout the year.

Last fall, SOCMA announced that it had purchased the Specialty & Custom Chemicals Show. "As a galvanizing force for the specialty and custom chemical community, it is SOCMA's role and responsibility to connect the supply chain," said Jennifer Abril, SOCMA's president and CEO, at the time. "When we sold InformEx in 2005, it left a void. Our industry thrives on face-to-face, intimate interactions to solidify business partnerships and fulfill supply chain needs, and without InformEx that unique space for connecting was severed for SOCMA. Returning to the trade show space underpins our strategic focus to offer commercial growth opportunities for our members and the industry, alongside our year-round trove of tools and resources."

SOCMA had planned to hold the Specialty & Custom Chemicals Show first in February 2021 and then in April. However, ongoing concerns related to COVID-19 and company travel restrictions prompted the association to postpone the event to February 2022. In the meantime, SOCMA provides opportunities that promote connections and business growth beyond the show floor with commercial services such as Lead Sheets, an industry matchmaking service, and Manufacturing Solutions Platform, a 24/7 searchable database that maps SOCMA member company capabilities.

SAFETY FIRST

Of course, safety has long been one of SOCMA's primary concerns. The association offers multiple resources to help its members understand and comply with the myriad regulations and legislative concerns surrounding the chemical industry. Indeed, its emphasis on safety education was the primary reason that Mike Ott, president and CEO of Polysciences, Inc. and newly elected chairman of the SOCMA board of governors, originally decided to join the association.

"Our company did not have formalized safety programs that had external verification," Ott explains. "I'm a chemical guy, and safety is first on every priority list. I knew I needed to have that for my own company, and SOCMA was and is a wonderful resource."

It could be argued that safety has never been more important, as COVID-19 has been a huge concern across all global industries over the past year. As essential businesses, specialty chemicals producers were not typically forced to shut down due to the outbreak. While this continued production of vital materials worked to assist with various aspects of the pandemic, the unprecedented situation posed many serious questions and challenges for producers.



Mike Ott, president and CEO of Polysciences, Inc., serves as chairman of the SOCMA board of governors. (Photo courtesy of Polysciences, Inc.)

SOCMA responded and helped educate its members by developing a forum and multiple webinars, as well as an online resources page. "SOCMA leaped upon the issue quickly and immediately had forums for the members to gather together, on a computer-based video meeting, and had many presentations and lots of resources for people to be aware of," says Ott. "The specialty chemicals industry was out ahead of most companies or most industries in addressing the pandemic."

SOCMA also continues to help government agencies such as the U.S. Departments of Homeland Security, Commerce, and Labor understand how the pandemic is impacting the specialty chemical industry. SOCMA collaborated on a guidance document with Homeland Security for "Essential Industries" in the early days of the outbreak, as well as another document that was recently released by the Occupational Safety and Health Administration (OSHA).

ADVOCACY EFFORTS

SOCMA's government-related efforts are certainly not limited to those involving COVID-19. The association has long represented the interests of the specialty chemicals industry by educating regulators and advocating for sensible policy change.

"SOCMA is taking a multifaceted approach with the Biden Administration, which includes educating the new administration, developing a virtual policy summit and strengthening our existing relationships in federal agencies," says Ott. "Understanding that COVID-19 recovery is the top priority, SOCMA will continue to work with the Biden Administration and its Task Force on efforts to eradicate the pandemic."

Examples of economic and policy efforts include advocating to reopen the exclusion process for China 301 tariffs and requesting more transparency in the exclusion review process, a resolution to correct a policy change on enforcement of the Resource Conservation and Recovery Act (RCRA) Manufacturing Process Unit Exclusion, and improvements to the Toxic Substances Control Act (TSCA) program.

Specific work in terms of TSCA will focus on the importance of meeting deadlines for the review of new chemicals. "Adhering to these deadlines is critical for specialty chemical manufacturers that are developing new, cutting-edge products and are looking to get them to market in a timely manner," Ott explains. "The slowdown in the review process, in conjunction with the advent of the fees program, has caused a sharp decline in pre-manufacture notice PMN (new chemical) submissions."

"I am particularly excited to lead SOCMA into 2021," Mike Ott said upon his election as chairman of SOCMA's board of governors.

ADDITIONAL ACTIVITIES

SOCMA also continues to develop new resources for its membership. This year will bring the next version of the Chemical Operations Training Tool, a multi-module course that features interactive 3D animations of process equipment and self-guided assessment exercises. In addition, a new Manufacturing Solutions Day will be launched this year to virtually showcase SOCMA members' capabilities.

"I am particularly excited to lead SOCMA into 2021," Ott said upon his election. "I especially look forward to working with my new board colleagues who bring fresh energy and enthusiasm to our leadership team. Their creativity and know-how will be instrumental in helping build upon the solid foundation set before us, making the organization stronger and more sustainable for years to come."

Opening image courtesy of Image Source via DigitalVision / Getty Images Plus





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With vaccine distribution well underway and many states beginning to reopen this spring, our conference may be among the first opportunities to network this fall so you can meet like-minded professionals and form lasting professional partnerships!

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For more information: www.coatingsconference.com



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>> By Sapna Blackburn, Ph.D., Director of Intellectual Property, The ChemQuest Group

PATENTING CONSIDERATIONS FOR COMPOSITION INVENTIONS IN THE ADHESIVES AND SEALANTS INDUSTRY

Incorporating compositions into process or assembly/device claims, although restrictive, can afford some protection. But is it enough?

The global adhesives and sealants market grew from approximately \$45 billion in 2010 to around \$63 billion last year, according to The Adhesive and Sealant Council's recently released "2020-2023 North American Market Report for Adhesives and Sealants, with a Global Overview." During this period, over 200 patent applications (simple family groups) in the technical fields of adhesives and sealants were filed across the five major IP jurisdictions (US, EU, CN, JP, KR).

Interestingly, composition of matter (or chemical composition) claims constituted approximately 50% of the granted patents and at least 65% of the inactive (i.e., lapsed, withdrawn, or rejected) patent applications, the balance being process and assembly/device patents. A closer analysis of the granted process patents, especially in the field of adhesives, showed 65% of these to be fundamentally compositions claimed as methods or processes.

Adhesives Sealants - Granted Patent - Abandoned/ Ceased Patent - Pending - Dending - Ceased Patent - Pending - Ceased Patent - Ceased

Figure 1. Breakdown of adhesives and sealants IP5 patent applications filed 2010-2020. (Source: Patent Search and Analysis conducted by The ChemQuest Group using Patsnap.com patent search platform.)



 Lapsed/ Withdrawn/ Rejected



COMPOSITION CLAIMS

The difficulty in securing composition claims is indicative of the challenge of inventing in a mature, crowded compositional space. Incorporating compositions into process or assembly/device claims, although restrictive, can afford some protection. But is it enough?

The answer to that question depends on the benefit of the patent to the assignee (i.e., the adhesive or sealant manufacturer). Does the manufacturer intend to:

- Commercialize or license the patented technology to generate a revenue stream
- Build an extensive patent portfolio to impress customers, shareholders, and competitors as a technology leader in the field
- Utilize patents as a reward/retention tool for its product developers and scientists

The purpose of patenting is usually some combination of the three to varying degrees based on company size, finances, and business model. However, if the predominant purpose of securing patent protection is the first point, then an assessment of the following factors can aid in deciding whether to seek patent protection or maintain the composition as a trade secret.

Novelty of Chemistry

Is the invention a new molecule (i.e., new chemistry) or a new combination of existing chemistries? New molecules offer opportunities for broad patent claims, and thus a stronger patent.

Detectability of Invention

Can the invention be easily detected in the final commercial article? If so, infringing the patent is more difficult (i.e., the patent is easier to enforce).

Enforceability of Invention Claims

This is impacted by detectability of the invention and patent jurisdiction. If the prevailing laws of a geographic region of commercial interest do not adequately support prosecution of patent infringement, filing a patent may invite copycat competitive products.

Ease of Workaround

How easily can a competitor use the teachings of the patent to develop an alternative solution that is outside the patent claims? Generally, the narrower or more restricted the claims, the easier they are to work around. As a result, if a composition is highly nuanced or if it is combined with process restrictions, the protection afforded by the patent is diminished and, in some cases, may even be detrimental competitively.

Freedom to Practice Trade Secret

How likely is a competitor to file a patent on the invention in jurisdiction(s) of interest in the event the invention is maintained as a trade secret, thereby potentially preventing you from manufacturing, selling, or using your own invention?

The decision to file ultimately depends on the manufacturer's business goals and the competitive environment. However, an objective patent risk-benefit analysis can not only align IP strategy and cost with business development needs but also serve as a critical component of multi-generation product development and sales cycle planning based on availability and need for IP protection, as well as how quickly and easily the innovation can be copied or substituted.

GAINING PERSPECTIVE

Another critical consideration for an innovator to develop competitive differentiated solutions is the need for definitive unbiased answers to questions such as:

- What value is the market willing to pay to use the new technology?
- What are the unmet market needs?
- How will my adhesives/sealant product perform when it leaves my laboratory?

A manufacturer developing technology solely within its own laboratory does so wearing blinders of ingrained norms, assumptions, and problem-solving approaches. Consider engaging a credible external partner to remove these blinders and augment internal resources with:

- A broader knowledge of unmet user needs across the specialty chemicals value chain
- A clearer vision of potential applications to allow for proper screening and prioritization of market opportunities
- An enhanced capability to redesign, synthesize, formulate, apply, and cure adhesives and sealants, with third-party validation of test data benchmarked against customer requirements
- Access to a real-world manufacturing and material testing facility for pilot runs and final testing of your products prior to implementation on your customer's production line

Utilizing the right market knowledge, the right IP strategy, and the right execution partner can accelerate new Same Blackby the Chills server as director as intellective of the Chem Quest Gyour a Forence intermetion, cell (533) 469 7555, grain the composition of the compositio



FORGING A NEW PATH

The Pressure Sensitive Tape Council plans to provide its members with new opportunities to network and continue refining their skills.



In the last Pressure Sensitive Tape Council (PSTC) "Tape Talk" column and recent **ASI** Insider video, we discussed a number of topics, including our plans for Tape Week 2021, our adjusted strategy in light of the ongoing public health emergency, and the results of our record-attended Fall Member Business Meeting. Suffice to say, a lot has changed since then.

At the end of January, PSTC leadership made the decision to again postpone our inaugural Tape Week event. This decision was not made lightly.

After taking into consideration our member companies' travel restrictions, COVID-19 case number projections, and the slower-than-expected rate of vaccination, we made the strategic call to move Tape Week to next year. Although we were looking forward to finally meeting in person, our utmost priority is the health, safety, and overall wellbeing of our leadership, staff, and members, and we responded accordingly.

In the meantime, however, we have some exciting events and activities planned throughout 2021. While nothing can truly replace the benefits of having a large-scale gathering, especially given the nature of our industry, our reformatted plan for the year will give our members new opportunities to network and continue refining their skills.

We have some exciting events and activities planned throughout 2021.

CONNECTING WITH OUR MEMBERS

As a way to keep our members engaged and reach new individuals from their companies, we introduced a series of webinars. Hosted by our committees, the webinars feature keynote speakers and presentations on a variety of industry-related topics.

Our first webinar, "The Economic Recovery Continues in 2021," was held on March 10 with broad member attendance

joining in to hear from speaker Robert Dietz, Ph.D., chief economist and senior vice president for economics and housing policy for the National Association of Home Builders (NAHB). Our second webinar, set for May 12, will feature keynote speaker Catherine Putney from economic research and consulting firm ITR Economics.

A HOPEFUL REUNION

By November, we expect that enough of the general population will be vaccinated to deem it safe to gather in person once again. We are therefore busy planning the details of our Fall Member Business Meeting, which will be held November 9-11 at the Hyatt Regency Coconut Point in Bonita Springs, Fla.

Positioned as the more strategic of the two Member Business Meetings that PSTC holds yearly and building on our most successful Fall Member Business Meeting to date last year, we look forward to meeting with member company representatives for the first time in person since the public health emergency began to review the pandemic's effects on our business, discuss plans for moving forward, and more. Registration will be opening soon, and further details will be posted on our website.

MAKING IT STICK

A cornerstone of PSTC's member benefits is its series of unique and powerful educational classes covering all aspects of pressure-sensitive adhesive (PSA) tape design and manufacture. Traditionally, courses have only been offered in person, but the onset of the pandemic necessitated new ways of delivering our expert education.

Last December, we officially launched the first 10 modules of our new on-demand and online PSTC Tape Academy. Providing an ideal introduction to the industry with less technical content than our other educational offerings, our first course—Fundamentals of PSA Tape—covers a basic overview of all the key technology areas of PSA tape in a virtual classroom setting.

As we work to make Tape Academy the leading venue for PSA tape education, we are eager to add even more courses in the future. We encourage our member companies to direct their employees to these courses to assist them in professional development and upward mobility.

The Fundamentals of PSA Tape course covers a basic overview of all the key technology areas of PSA tape in a virtual classroom setting.

ONGOING EXPANSION (VERTICAL EXPLORATION)

While the past year has presented us as an organization and our members with unexpected challenges, it hasn't stopped us from continuing our efforts to grow the global usage of PSA tape products. Following the release of exclusive research study results on PSA tape use in the automotive industry, we introduced new materials to help promote tape's use in the automotive vertical, specifically among key target audiences.

Since then, we have launched a digital campaign on behalf of our members with the goal of informing these audiences about the key benefits of this type of bonding method over competitors and securing conversions. Automotive vertical education will be introduced at Tape Week 2022, and we will be working on expanding into other verticals this year and next.

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, visit pstc.org.



Opening image courtesy of nipastock via iStock / Getty Images Plus

WHAT'S NEW

Be sure you're up to date on all of the latest products and technologies in the industry. Visit www.adhesivesmag.com/whatsnew.

CHARLES ROSS & SON CO.

Granulating and Drying in Double-Planetary Mixers Charles Ross & Son Co. reports that the double-planetary mixer is ideal for highprecision mixing, granulation, and vacuum drying all in a single vessel. Powders and granules are gently blended by two rectangular planetary blades that rotate on their own axes while orbiting the mixing zone on a common axis.

Atomizing spray nozzles enable controlled and spill-free addition of liquid raw materials as the mixing blades continuously ensure uniform composition and temperature throughout the batch. As a result, granulation and drying procedures can be completed in significantly shorter times compared to conventional, non-vacuum granulators and dryers.

FLEXCON

Polypropylene Films for Labeling Applications FLEXcon® NEXgen™ polypropylene films are reportedly sustainable "greener" non-vinyl alternatives for durable labeling applications. FLEXcon NEXgen polypropylene is designed for consumer durables, electronics, industrial, and transportation applications, including compliance labels, brand identity labels, and warning and instructional labels. FLEXcon NEXgen polypropylenes are UL/cUL-recognized (CSA pending).

"As many segments of this industry are trending away from vinyl, converters have been hard-pressed to find an alternative robust enough to meet the demands of durable labeling at a comparable price," said Ross Hodnett, FLEXcon product manager. We worked with one of our supplier-partners to develop a unique polypropylene film which is a true alternative to flexible vinyl for durable labels."

AVERY DENNISON PERFORMANCE TAPES

Heat-Activated Acrylic Foam Tapes

The acrylic foam bonding (AFB[™]) portfolio has expanded with the release of the 94 Series product line. The new 94 Series AFB heat-activated tapes are reportedly engineered to deliver the high holding power required for rubber extrusion bonding in industrial applications. The new line also features an easy release liner to aid in removal during application. These products are offered in full web, spool wound, or level wound formats to increase flexibility for converters and their customers.

"Rubber extruders and OEMs are actively seeking alternatives to their current bonding solutions for extruded rubber applications," said Scott Krusinski, application engineer at Avery Dennison Performance Tapes. "With this new high-performance tape product, we are delivering on their needs by offering a lower cost option without compromising performance. We are pleased with performance data on the 94 Series AFB tape."

http://tapes.averydennison.com

CHROMAFLO TECHNOLOGIES

New App

A streamlined app reportedly features multiple options for users to quickly access the Chromaflo website and information about the company, download product data, view the company's social wall, and stay updated on company news and events. The app also includes a colorful, free-to-play puzzle game entitled Color Match.

"We're thrilled to introduce our first-generation app to our valued customers and other interested users," said Steve Riccardi, director of Global Marketing & Business Development. "The app's seamless user interface allows customers to quickly gain access to much of what Chromaflo has to offer and help us to more efficiently connect with them. The simple navigation and clean design makes it easy for the users. Plus, the Color Match game offers some color-related fun, while learning more about us."

www.chromaflo.com

ADHESIVES TECHNOLOGY CORP.

Bonding Agents for Concrete Repair and Restoration

The CRACKBOND® concrete repair and restoration product line has been updated. As bonding agents for concrete repairs, coating and sealing interior and exterior slabs, and crack injection applications, CRACKBOND products were reportedly engineered with industry-leading formulations that provide fast and simple solutions to the end user.

"Concrete repair and restoration materials have been an area of increasing focus for ATC over the last 8-10 years, both in terms of launching innovative new formulations and adding new approvals and certifications to the existing product range," said T. J. Bland, president of ATC. "The product range marketed under the CRACKBOND name gives contractors, engineers and distributors the benefits of world-class products and approvals, coupled with personalized expert service levels that have long been the trademark of ATC."

www.atcepoxy.com

MASTER BOND

Silver Conductive Silicone Adhesive Master Bond MasterSil 151S is an addition-curing, two-part silicone system that can be used as an adhesive, sealant, coating, or form-in-place gasketing material. Despite its silicone chemistry, it passes NASA low-outgassing specifications. In addition, it purportedly retains superior electrical conductivity with a volume resistivity of 0.004 ohm-cm at 75°F.

"This silicone is ideal for applications where low stress is required, since it is highly flexible across a wide service temperature range. It is capable of resisting aggressive thermal cycles and shocks," said Rohit Ramnath, senior product engineer.

The mix ratio of MasterSil 151S is 100:5 by weight, and it cures with the addition of heat. Upon mixing, it reportedly retains its smooth, paste consistency and has a long working life of 6-12 hrs for a 50-g mass.

www.masterbond.com

CONSULTING BY "DR. DAVE"

Adhesives and Sealants–Technology, Applications and Markets

Dr. Dave Dunn writes the monthly "Ask Dr. Dave" column in Adhesives & Sealants Industry magazine, and is a unique source of both technical and management consulting for the adhesives and sealants industry.	Technology Focus • anaerobics • cyanoacrylates • reactive acrylics • epoxies • bot melts	About the principal Dr. Dave Dunn is President of F.L.D. Enterprises, which is located near Akron, Ohio, USA. He is a former Vice President and Director of Loctite Corporation and has consulted
Tarkeled Consulting	 gasketing 	for many adhesives and sealants
 formulation advice sourcing information new developments application development application troubleshooting problem solving 	Market Focus • industrial • automotive OEM and aftermarket • medical • construction	manufacturers and users in both North America and Europe. He is the author of several books and many articles, including Adhesives and Sealants-Technology, Applications and Markets, published by Rapra Technology, Itd
Market Research • opportunity analysis • customer surveys • mergers and acquisitions • new developments • market analysis • industry structure • competitive intelligence • key trends	Management Consulting Innovation can be planned and managed to meet the strategic goals of a company. We have concentrated on integrating the R&D functions of companies into their strategic plans and putting systems in place to continuously measure the effectiveness of investments in R&D.	F.L.D. Enterprises Inc. 242 Trails End Aurora, OH 44202 330-562-2930 DrDave242@windstream.net

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Chromaflo image courtesy of PeopleImages iStock / Getty Images Plus

ASK DR. DAVE

SUPERGLUES VS. POLYURETHANE GLUES

Should I use superglue or one of the new polyurethane glues for general-purpose assembly and home repairs?

I have worked with companies that manufacture superglue and polyurethane glue, both of which are singlecomponent, no-mix adhesives. Superglue, which is the common term for cyanoacrylate adhesive, has been around for about 60 years. In contrast, the polyurethanes are about 20 years old in the retail market and somewhat older in professional woodworking. I admit to using both types of adhesive regularly.

Cyanoacrylates are particularly good for virtually instant repairs on a wide range of materials, as long as the parts are close fitting (curing is initiated from traces of moisture on the surfaces). Polyurethane glues cure much more slowly, often taking 24 hrs for maximum strength. They depend on atmospheric moisture diffusing in from the outside of the bond, although cure can be speeded up by dampening the part surfaces. Clamping is often required during curing. Polyurethanes are particularly good for bonding porous surfaces like wood, and that is where I use them most often.

Cured polyurethanes are extremely resistant to water and all solvents, and any excess must be removed mechanically by sanding, scraping, or cutting.

Both types of adhesive have some negatives and cautions during use. Cyanoacrylates bond skin in seconds, and bonded fingers need to be soaked in warm water before being peeled apart. Polyurethanes remain liquid on skin for some time and can be wiped off or washed with soapy water.

Cured polyurethanes are extremely resistant to water and all solvents, and any excess must be removed mechanically by sanding, scraping, or cutting. Frequent users of polyurethanes learn not to apply excess adhesive to the parts because the adhesive expands during curing and can leave a messy extrusion of cured glue on the outside of the bondline. Both adhesives perform poorly on some plastics (e.g., polyethylene or polypropylene), although special surface primers are available for the cyanoacrylates.

Dr. Dave is a former vice president and director of Loctite Corp. (now Henkel) and has spent many years in troubleshooting adhesive and sealant problems in the adhesives, sealants, specialty rubbers, and plastics fields. Questions for publication should be directed to him at 242 Trails End, Aurora OH 44202; phone (440) 477-5164; or email DrDave242@windstream.net.

Any views or opinions expressed in this column are those of the author and do not represent those of ASI, its staff, Editorial Advisory Board or BNP Media.

www.adhesivesmag.com

WEB HIGHLIGHTS

PODCAST: How Are Adhesives and Sealants Used in Electric Vehicle Batteries?

Tune in as Chemence's Michael Pomykala outlines the various types of electric vehicles and their associated battery assemblies, as well as the role that adhesives, sealants, and thermal materials play in the success of these technologies.

VIDEO: Adhesive and Sealant Council: 2021 Events and Initiatives

Bill Allmond, president of the Adhesive and Sealant Council (ASC), highlights upcoming ASC events, as well as additional initiatives and activities for 2021.

DIRECTORY: 2021 Raw Materials, Chemicals, Polymers, and Additives Handbook

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