ASI ADHESIVES & SEALANTS INDUSTRY

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Supply Chain Challenges

Light Stabilizers in Transparent Sealants

Formulating Software Considerations

Dispensing Advances

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ASI ADHESIVES & SEALANTS INDUSTRY

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FEATURES

Ongoing Supply Chain Challenges

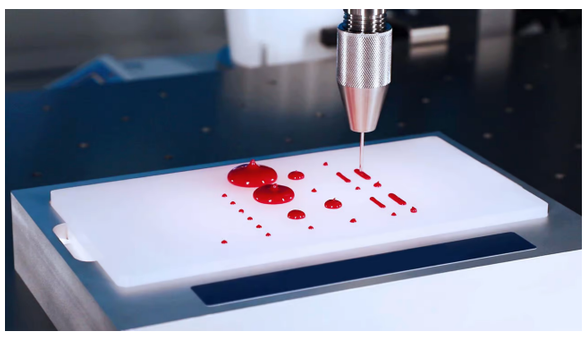
What supply chain issues are still in play, and how are key industry players mitigating the various challenges?

Low-Reactivity Liquid Light Stabilizer in Transparent Modified Silane Sealants

A recently developed liquid light stabilizer technology can alleviate unwanted coloring issues in modified silane sealants.

Choosing the Right Formulation Software

Electronic laboratory notebook software enables users to store raw materials, formulas, protocols, notes, and more.



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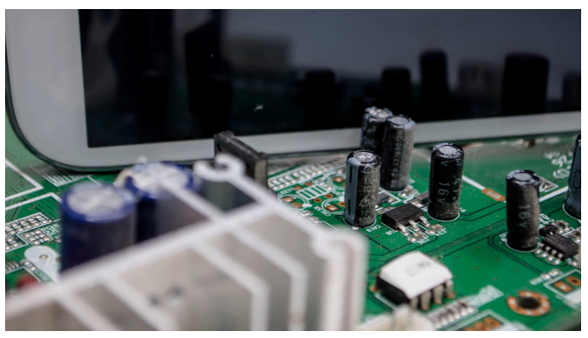

Electronics Industry to Gather at IPC APEX EXPO 2022

IPC APEX EXPO returns as an in-person event January 22-27 in San Diego, Calif.

Pressure-Sensitive Tapes on the Rise

Pressure-sensitive tape manufacturers are tapping into the packaging, medical, and transportation sectors to gain ground.

DEPARTMENTS

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FROM THE EDITOR

>> Susan Sutton, editor-in-chief

RESOLVING SUPPLY CHAIN ISSUES

Participants in this issue's supply chain roundtable discuss current challenges, specific materials that are experiencing supply shortages, end-use sector considerations, and projections for the future.

We can thank the ancient Babylonians for the annual tradition of making New Year's resolutions.[1] For 4,000 years, people have seen the turn of the year as an opportunity to evaluate themselves and their lives, finding areas for improvement and resolving to be better.

Sadly, however, we in America aren't great at keeping these resolutions. A 2020 survey shows that, on average, we abandon them by February 1.[2] But I appreciate the introspection and optimism involved, nevertheless.

The past year has brought an unprecedented combination of factors that have worked together to impact the supply chain, in some cases severely. The industry's sustained resolve in navigating this onslaught of material shortages, logistics challenges, and other issues has been impressive. It is unfortunately looking like all of that determination, ingenuity, and flexibility will be required well into 2022.

I recently reached out to key players in the adhesive and sealant industry to get their take on the current supply chain situation. Participants in this issue's roundtable discuss current challenges, specific materials that are experiencing supply shortages, end-use sector considerations, and projections for the future.

Like most others in our global economy, these industry professionals are all actively working to mitigate the supply chain challenges and are finding some cause for some optimism. However, the overall future outlook remains a bit grim. Be sure to check out "Ongoing Supply Chain Challenges" to help further understand all of the dynamic issues at play.

Do you make New Year's resolutions and, if so, do you keep them? What are your thoughts on the supply chain issues shared by our roundtable participants? All of your comments are welcome. Please contact me to share your experiences and observations.

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

ONGOING SUPPLY CHAIN CHALLENGES

I recently reached out to key players in the industry to find out what supply chain issues are still in play and how companies are mitigating the various challenges, as well as their projections for the future.

By Susan Sutton, Editor-in-Chief, Integrated Media

The supply chain has seen several major disruptions over the last 20 months or so. As a result of various issues arising from the beginning of the COVID-19 outbreak and the pandemic's extended impact to natural disasters and more, the adhesive and sealant industry has been dealing with lack of supply, supply and demand disparities, and logistics complications, to name just a few.

I reached out to key players in the industry to find out what issues are still in play and how companies are mitigating the various challenges, as well as their projections for the future.

What major supply chain challenges continue to impact the adhesives and sealants industry?

Dietmar Dengler

Dietmar Dengler, Ph.D., Head of Chemistry and Risk Management, DELO: The availability of raw materials is certainly the main concern. Logistics is also extremely important and directly connected to raw materials. Since the start of the pandemic, freight capacity and freight rates have become an issue. Shipping has become expensive, but even more, it has become very unpredictable. The effects of port and airport closures due to COVID cases should not be underestimated.

Apart from these closures, there is a supply shortage of ship containers. Air cargo capacity is still limited due to the reduced number of intercontinental flights. While logistics experts know how much cargo passenger flights can transport, this is a fairly new insight for the general public.

When looking at logistics from a global perspective, we see that the capacity in the U.S. is higher than in Europe. The U.S. pays higher prices, with routes from Asia to Europe being redirected to America. This creates a bigger logistical issue in Europe than it does in the U.S.

Rob Hubbard

Rob Hubbard, Vice President, Global Strategic Sourcing, H.B. Fuller: The two major challenges to receiving desired amounts of goods on time currently are: logistics challenges and high demand outpacing supply. In the first half of 2020, demand dropped dramatically, and many production assets were throttled down or shut down because of COVID-19. This major disruption to the world's normal flow of goods caused shipping containers and shipping vessels to become imbalanced.

In the second half of 2020, consumer demand surged at an unexpected rate to very high levels. As a result of this fast rise in demand, supply was initially caught off guard. Demand continued to outpace supply into 2021, and then the cold weather event that struck Texas and Louisiana further constrained supply. As of today, supply has not caught up with the ever-increasing demand in the petrochemical space. Most markets remain short, which is continuing to push prices to record levels.

The lingering logistics challenges mean lead times are much longer and delivery times are unreliable. This is especially true for goods shipped transoceanic. Nearly 40% of the world's chemicals are sourced from China, and most companies in the adhesives and sealants industry are being impacted to some degree. And, limited domestic supply of some materials, like MDI in the U.S., has caused us to increase supply from offshore production sites. This has involved incrementally higher transportation costs, longer lead times, and unreliable delivery dates.

Unreliable deliveries also are forcing many companies to increase normal inventory levels where possible, negatively impacting working capital and increasing costs.

Bjorn Kirchner

Björn Neal Kirchner, Corporate Vice President Global Supply Chain, Henkel Adhesive Technologies: Like many other companies, we are currently experiencing significant pressures in the global supply chain, which are due to a combination of various factors. These still include well-known impacts from the COVID-19 pandemic and the extreme winter weather conditions in North America at the beginning of the year, which have been hitting the U.S. petrochemical production center, massively disrupting production and logistics in an already tight market. Global supply chains were also affected by logistical issues, for example in the context of the Suez Canal blockage.

In addition, a strong recovery in multiple industrial segments and continued high demand in consumer goods markets is meeting relatively short supply capacities. These two factors caused an all-time high in force majeure situations and supply disruptions globally, and as a consequence sharp increases of direct material prices and transportation cost.

Julie Vaughn

Julie Vaughn, Global Business Development Director, Emerald Kalama Chemical LLC (now part of Lanxess Polymer Additives): After 2020, everyone had hoped for a return to normal. However, 2021 brought a new set of challenges, starting with the winter storm Uri, then Hurricane Ida, logistics issues, and labor shortages coupled with strong demand. This has wreaked havoc on the supply chain in a number of ways: cost escalation for materials, labor and transit costs, and significantly extended transit times.[1]

Given that many adhesives and sealants products contain a dozen or more ingredients, many details must now be micromanaged to maintain pace with strong but fluctuating demand. This not only impacts purchasing and supply chain but also every other function in the organization that touches operations and the customer. Many companies have redeployed some of their R&D resources to focus on approving alternative suppliers and adjusting formulations as a part of critical business continuity action plans.

Which materials are currently most affected by supply chain concerns?

Dengler: These days, it is more of a question of which materials are not affected by supply chain concerns. In the adhesive industry, it's acrylates, epoxies, isocyanates, and phosphorous chemicals, as well as basic plastics that are widely used for packaging, like polypropylene.

The pandemic has contributed to this shortage and has shown how the global economy and a variety of different industries are intertwined. With many lockdowns and reduced mobility worldwide, the demand for kerosene, gasoline, and diesel collapsed dramatically at the height of the pandemic. Because of this, refineries quickly needed to stop production because their storage capacity was reached. Ethylene and propylene, as well as other commodities, are side products of refining oil that could no longer be produced. As a result, the demand for such basic chemicals quickly exceeded their supply, leading to a shortage of many chemical products.

Hubbard: Because chemicals are the building blocks for nearly everything produced, chemicals are short due to very high demand. Materials coming from non-domestic sources are especially affected by logistics challenges.

Kirchner: We are experiencing impacts across nearly all technologies and materials of our broad portfolio. Based on the current market situation, silicone sealants are the most affected material as the capacities are highly concentrated in Asia and thus imbalanced across regions. The supply to North America and the European Union is affected by the current energy situation in China, with power cuts across the country. On top of that, we are facing the trade conflict between China and the U.S. and increasing logistics costs.

Vaughn: One purchasing manager I met recently described the situation aptly as: "What's the problem 'this week'?" The U.S. petrochemical industry manufactures 13% of the global demand, and Texas and Louisiana together produce 80% of the U.S. primary petrochemical supply.[2] Winter storm Uri took about 60% of the U.S. ethylene and propylene production offline and also impacted chlorine and butadiene. Hurricane Ida further disrupted production in Louisiana, with companies safely shutting down ahead of the storm. That said, Ida affected six facilities producing ethylene in the region, accounting for roughly 16% of U.S. ethylene capacity, according to IHS Markit,[3] and further pushing up prices.

These events have had a massive downstream impact, as they are critical feedstocks for key polymers, especially those used in adhesives and sealants. ChemQuest provided an excellent diagram mapping out the supply chain from natural gas and crude oil to the transformation to key polymers and additives.[4] These include acrylic, PVA, VAE resins, polyols, polyolefins, epoxies, and butadiene-containing rubber and block copolymers.

Further, converting silicon to other products such as silicone polymers requires high energy, a challenge given China's energy shortage. This may drive a shift from silicones to other polymers in sealant applications, such as polysulfides and hot-melt systems.

Which end-use sectors are currently most affected by supply chain concerns?

Dengler: Depending on their prevention strategies, it becomes obvious that industries differ in the extent to which they are affected. From the sectors we are active in, the auto industry is most affected. Apart from the known chip shortage, there are also supply issues with other materials, like basic plastics. The consumer electronics industry is finding it difficult to produce the number of pieces that it would like.

Hubbard: Nearly every end-use sector is affected; there are very few exceptions. We are seeing it practically across the board, and where we aren't seeing shortages as pronounced is where supply is abnormally high due to high capacity.

Kirchner: We see impacts across all our business segments, from consumer and DIY products to construction, packaging, and industrials such as electronics and automotive.

Vaughn: The tightness in raw materials has impacted pretty much every end-use sector in adhesives and sealants. The challenges in logistics, port congestion, and driver shortages have impacted us all.

Glen Bowen

What steps has your company taken to alleviate or compensate for supply availability issues?

Glen Bowen, Head of Sales–Polymer Additives North America, Lanxess Corp.: This has been a topic of conversation at every conference and meeting. Relationships are important, and a "no-surprises" approach to communications is key. Increased, in-depth, and transparent communication with suppliers and customers has been critical to understand capabilities, planned forecasts, schedules, and developing contingencies.

Our company also has multiple manufacturing locations and suppliers in a number of product lines. Wherever possible, we have worked to shift things around in order to overcome constraints. We have also made alterations to our logistics network, specifically in how and where we stock material to compensate for challenges in transportation.

Dengler: In my opinion, many companies have just optimized material costs for many years without evaluating the risks of this approach. Risk management needs a proper role within the management system of companies. Even a missing screw can have devastating results. At DELO, we have always taken risk management very seriously, even in good times. We pride ourselves on giving quality and reliability of our suppliers a much higher priority than raw material prices.

This is a result of our business model. Most of our customers use our premium products for expensive, high-quality, and highly automated production lines. If these lines were to stand still due to adhesive supply issues, the costs would be much higher than the money they could save when using an inexpensive adhesive with raw materials from cheaper, less reliable suppliers.

So even in non-pandemic times, we had a very large stock of raw materials. As we saw COVID approaching last spring, we even doubled our already large stock.

We did not stop there. We have been using a dynamic risk management system for all our raw materials. On the one side, it looks at our demand, based on customer forecasts and our predictions, and at availability on the other side. A traffic light system tells us which raw materials we can relax on and for which we need to act.

To create this data, we have been in communication with our suppliers and invested a lot of effort in properly understanding their supply chains. That way, we are made aware early when a shortage of a pre-commodity arises, and we can adapt. This is a big investment of manpower, as chemical supply chains are extremely complex. In some cases, you need 20 pre-materials for a final material, and you need all 20 of these. And if you use a few hundred raw materials in your production, you get a sense of what my team and I have been busy with for the last 18 months.

In case a supplier has problems shipping goods, you need alternatives. In this instance, we were able to use our second sourcing options that we had built and qualified in previous years, always knowing that second sourcing is more expensive than single sourcing. Also, we could use our own chemical synthesis in which we can produce raw materials on our own—not just on a lab scale but on a production scale.

With risk management always having been a top priority and having conducted all these measures, we did not need to postpone a single scheduled production order due to raw material shortage within the last 18 months. That's a big success.

Hubbard: For many years, H.B. Fuller has taken a proactive, strategic approach to building strong relationships with our suppliers. We truly consider our suppliers to be partners, and the resulting collaboration has enabled us to secure the materials we need to meet growing customer demands, despite countless external challenges across the global supply chain.

It is nearly impossible to succeed in short markets, like we've experienced over the past 18 months, without the preparations we made in the years leading up to 2020. Our preparations leverage the best practices of strategic sourcing. We routinely look for ways to create value in the supply chain as opposed to taking value from our suppliers. This collaborative win-win approach has helped foster strong, healthy relationships with our suppliers, which have been key to our procurement success in these most challenging times and have helped grow our topline results throughout 2020 and 2021.

Kirchner: At Henkel, we are working very closely with our customers and have installed crisis teams to mitigate challenges and steer our supply base with full commitment of the teams. Our Supply Chain team has the tools and processes to proactively detect supply risks and to quickly decide on appropriated actions. As a result, we could avoid even more significant impacts on our operations in Adhesive Technologies and in customer supplies. In addition, we are constantly adapting our sourcing strategy to stay agile and flexible and are also closely working with our strategic global suppliers and partners.

What are you anticipating in terms of supply chain volatility in the 2022 first quarter? First half?

Dengler: Over the summer, I was actually very optimistic that the chemical supply chains would be back to normal by Spring 2022. But what I see now is that refineries have been operating at full load for quite some time. Many of them will need maintenance next year. This will stop production for several weeks (a normal maintenance can last for two months). I don't expect raw material supply to be much better next year.

This is accompanied by extreme price increases. Some raw materials are three times more expensive than before, others 10 times. The world hasn't seen such a seller's market before.

With regard to logistics, supply chains are still quite catastrophic. And as the pandemic isn't over and won't be for some time, I don't expect that logistics capacity and reliability will become better anytime soon.

Hubbard: We are beginning to see some improvements. Big petrochemical assets are running well now, and feedstocks are being produced. It is important to watch consumer spending in the major economies around the globe, which will continue to perpetuate supply chain issues.

Barring a major economic disruption that would lead to a big drop in demand, we expect demand to continue to outpace supply. We expect inventories up and down the supply chains will remain insufficient, and inflationary pressures will continue throughout 2022. In addition, logistics challenges are anticipated throughout 2022.

Scott Kellogg

Scott Kellogg, Head of Global Supply Chain, Lanxess: We are working our way out of the raw material volatility that has been attributed to storms Uri and Ida from this year. That said, weather-related events occur every year; companies and municipalities need to continue to improve their response and reduce the impact of such events.

Return of inventories for the full suite of raw materials to the pre-pandemic levels needed for "smooth" operating throughout the supply chain is still ongoing, likely through the second quarter of 2022. We do not see improvements in the logistics situation during this timeframe due to systemic issues that will take time to work out.[5]

For example, the "megaports" in the Los Angeles/Long Beach area receive over 25% of all U.S. imports. The congestion at megaports such as these to offload the containers is not the only problem; the underlying lack of truck drivers and nearby storage (25% short) create further constraints.[6] While new equipment will alleviate the problem longer term, this takes time to build and deploy. Use of alternative ports may alleviate this to some extent, but driver[5] and equipment challenges will remain. Industry experts expect the situation to improve either later in 2022 or early in 2023.

Kirchner: From today's point of view, the situation in global supply chains will likely continue to remain challenging in the foreseeable future, in terms of cost and availability for both materials and logistic services. We do not expect significant improvements of the overall situation across the first half of 2022.

For additional details, visit www.delo-adhesives.com, www.hbfuller.com, www.henkel.com, and https://lanxess.com.

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Opening image courtesy of Illerlok_Xolms via gettyimages.com.

LOW-REACTIVITY LIQUID LIGHT STABILIZER IN TRANSPARENT MODIFIED SILANE SEALANTS

Although powder-based light stabilizers play an important role in modified silane sealants, they can also cause the sealant to become darker or yellowish. A recently developed liquid technology can alleviate that problem.

By Kuoching Peng, Ray Sung, Robert Lin, Steven Lee, Ray Chang, and Y.H. Huang, Specialty Chemicals Business Unit, Everlight Chemical Industrial Corp.

Modified silane sealants are primarily used for joint filling, waterproofing, airflow blocking, and bonding. As the application of prefabricated buildings and curtain walls has become mature in recent years, the market size of modified silane sealants has grown rapidly.

Modified silane sealants can be classified into two types: polyether main chain with silane-terminated resin (silyl-terminated polyether, STPE), and silane-terminated polyurethane (silylated polyurethane, SPU).[1] Modified silane sealants can resolve the issue of dirt in the joints, which is often the result of using silicone. These sealants are also environmentally friendly, solvent and isocyanate free, and paintable.

The addition of ultraviolet absorbers (UVAs) and hindered amine light stabilizers (HALS) to modified silane sealants can significantly improve weather resistance to meet harsh outdoor weathering requirements. The UVA products added to modified silane sealants are mainly powdered benzotriazole UVAs, which are also typically in powder form.

In recent years, a proprietary liquid light stabilizer series* was designed specifically for modified silane sealants.[2] Their liquid form enables these light stabilizers to be quickly mixed with liquid resin without extra heating, lowering energy costs and reducing the production time between batches while simultaneously improving the sealant's weather resistance.

Although light stabilizers play an important role in improving the weather resistance of modified silane sealants, they also cause some issues. For example, the color of the sealant becomes darker or yellowish, an issue that becomes worse when the stabilizer is applied to colorless and transparent sealants.

In order to address the issue of color darkening caused by light stabilizers while retaining weather resistance, we first investigated the factors that may cause the darkening of the modified silane sealant formula. Next, we used the design of experiment (DOE) coupled with statistical software (JMP) to confirm the key factors that cause the darkening of the color.[3] Lastly, we finalized an appropriate light stabilizer solution that not only can reduce the impact on the color of the transparent sealant but can also meet the requirements of weather resistance.

Experiment Details

Materials used throughout these studies included: STPE liquid resin; 1,2-cyclohexane dicarboxylic acid diisononyl ester (DINCH) plasticizer; fumed silica; organotin catalyst (U-220H); adhesion promoter (A-1110); and light stabilizers. Table 1 details the light stabilizer information.

Table 1. Light stabilizer details.

Name	Type	State	Notes
UVA-1	Benzotriazole UVA	Yellow powder	Typical product for modified silane sealants
HALS-1	HALS	White powder	Typical product for modified silane sealants
Blend-1	Triazine UVA and HALS blend	Yellow liquid	All-purpose weathering additives
Blend-2	Oxanilide UVA and HALS blend	White powder	All-purpose weathering additives
Liquid stabilizer*	UVA and HALS blend	Yellowish liquid	Special products for modified silane sealants

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The sealing panel formula is shown in Table 2. To produce the transparent sealant, panels used throughout the tests, light stabilizer, plasticizer, and fumed silica were added to the liquid resin, and then stirred and mixed. The mixture was held under vacuum at 120°C for 2 hrs to dehydrate and remove air bubbles, and then cooled to 50°C; catalyst and adhesion promoter were then added. After being evenly mixed in a planetary mixer, the material was placed in molds and transparent sealant panels with a thickness of approximately 20 mm were created.[4]

A Minolta colorimeter was to measure the sealants' yellowness index (YI index) and color difference index (Delta E). Weather resistance tests were conducted with a Q-LAB UV accelerated weathering machine according to ASTM G154.

Table 2. Transparent modified silane sealant formula.

	Dosage (phr)
Fixed Components	
STPE liquid resin	100
Plasticizer	55
Fumed silica	25
Components Adjusted Based on DOE	
Adhesion promoter	2-4
Catalyst	0.5-1.5
UV absorber/light stabilizer	0-2

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Key Factors Affecting Color

The first experiment focused on confirming the key factors affecting the color of transparent sealant and the level of the impact with a screening design of four factors and two levels. The experimental factors included catalyst U-220H, adhesion promoter A-1110, UVA-1, and HALS-1. The panels were produced based on the dosages listed in the experimental design table (see Table 3) and the panel production process. The YI value (appearance color) of each panel was measured after curing for 7 days. Data results are shown in Table 3.

Table 3. Experimental design table and YI value.

Run	Pattern	A-1110	U-220H	UVA-1	HALS-1	YI
1	+++	4	1.5	0	2	27.3
2	+++	2	1.5	2	0	45
3	++	2	1.5	0	0	25.4
4	+++	4	1.5	0	0	25.4
5	++	4	0.5	0	2	13.4
6	++	2	1.5	0	2	24
7	+++	2	1.5	2	2	40.4
8	++	4	0.5	2	0	24
9	+++	4	1.5	2	0	43.5
10	+++	4	1.5	2	2	40.4
11	++	2	0.5	0	0	39
12	+--	4	0.5	0	0	13.9
13	++	2	0.5	2	2	21
14	---	2	0.5	0	0	16.3
15	++	4	0.5	2	2	23
16	---	2	0.5	0	2	18

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Figure 1 shows the lightest and the darkest panel. The difference in the appearance of the transparent modified silane sealant can be visually distinguished easily.

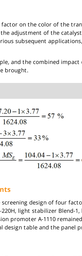

Figure 1. The initial appearance color (YI) of the lightest panel (left) was 13.4, while the darkest panel (right) was 45.0.

According to the parameter estimation table (see Table 4), the significant factors affecting the color of the sealant are U-220H and UVA-1 because they are both yellowish. For this reason, this effect would be intensified when U-220H and UVA-1 are added to the transparent sealant. In addition, the interaction between U-220H and UVA-1 is also the main factor affecting the color. It is inferred that the benzotriazole-based UVA is easily chelated with the metal catalyst, causing the color to darken and affect the overall color of the transparent sealant.

Table 4. Parameter estimation table.

Item	Estimated Value	Standard Deviation	t value	p value
Intercept	26.3125	0.4856	54.19	< .0001
U-220H (0.5, 1.5)	7.6125	0.4856	15.68	< .0001
UVA-1 (0, 2)	5.8500	0.4856	12.05	< .0001
U-220H×UVA-1	2.5500	0.4856	5.25	0.0002

$R2 = 0.97$, adjusted $R2 = 0.97$, $RMSD = 1.94$

Get the data ▸ Created with Datawrapper

In Figure 2, we can see the level of influence of each significant factor on the color of the transparent sealant. The catalyst is the most critical among all the factors. However, as the adjustment of the catalyst requires consideration of the curing speed, the operations time, and various subsequent applications, it is difficult to make changes to the catalyst.

In contrast, the adjustment of light stabilizers is relatively simple, and the combined impact of light stabilizers also reached as high as 39%. If this can be improved, benefits can be brought.

Figure 2. The level of influence of the significant factors.

$$\rho_{U220H} = \frac{SS_{U-220H} - \sigma^2_{U-220H} \times MS_E}{SS_T} = \frac{927.20 - 1 \times 3.77}{1624.08} = 57\ \%$$

$$\rho_{UVA-1} = \frac{SS_{UVA-1} - \sigma^2_{UVA-1} \times MS_E}{SS_T} = \frac{547.56 - 3 \times 3.77}{1624.08} = 33\%$$

$$\rho_{U-220H \times UVA-1} = \frac{SS_{U-220H \times UVA-1} - \sigma^2_{U-220H \times UVA-1} \times MS_E}{SS_T} = \frac{104.04 - 1 \times 3.77}{1624.08} = 6\%$$

Light Stabilizer Suitability for Transparent Sealants

As in the first experiment, the second experiment adopted the screening design of four factors and two levels. However, the experimental factors were changed to catalyst U-220H, light stabilizer Blend-1, light stabilizer Blend-2, and the proprietary liquid light stabilizer. The dosage of adhesion promoter A-1110 remained at 3 phr. The panels were produced based on the dosages listed in the experimental design table and the panel production process (see Table 5).

Table 5. YI value and the experimental design table.

Run	Pattern	Blend-1	Blend-2	Liquid*	U-220H	YI
1	+++	0	1	0	1.5	13.5
2	++++	1	1	1	1.5	17.6
3	+--	0	1	0	0.5	7.2
4	--++	0	0	1	1.5	16.3
5	+---	1	0	0	0.5	11.3
6	----	0	0	0	0.5	7.8
7	+++	0	1	1	1.5	15
8	+--	1	1	0	0.5	11.3
9	+--	1	0	1	0.5	11.5
10	--	0	0	1	0.5	9.5
11	+++	1	1	1	1.5	17.8
12	+++	1	1	1	0.5	11.5
13	--	0	1	1	0.5	9
14	+--	1	0	1	1.5	16.2
15	+--	1	0	0	1.5	17.7
16	----	0	0	0	1.5	12.9

Get the data ▸ Created with Datawrapper

According to the parameter estimation table (see Table 6), none of the three composite light stabilizers interacted with the catalyst to darken the appearance color. In addition to the catalyst U-220H, the other significant factor that affects the color of the sealant is Blend-1, which itself is yellowish. The level of influence of Blend-1 is 18.3%, which is high enough to cause the discoloration of the sealant.

As for Blend-2 and the proprietary liquid stabilizer, the level of influence is 0.3% and 3.4%, respectively. Their influence on the color of the sealant is negligible compared to U-220H's 75.1%. Although Blend-2 and the liquid stabilizer can avoid the yellowing of the initial color of the sealant, their weather resistance still needs to be verified.

Table 6. Parameter estimation table.

Item	Estimated Value	Standard Deviation	t value	p value
Intercept	12.8813	0.1151	111.870	<0.0001
Blend-1 (0, 1)	1.4813	0.1151	12.860	<0.0001
Blend-2 (0, 1)	-0.2188	0.1151	-1.900	0.0866
Liquid stabilizer* (0, 1)	0.6438	0.1151	5.590	0.0002
U-220H (0.5, 1.5)	2.9938	0.1151	26.000	<0.0001
Blend-1 × liquid stabilizer*	-0.4063	0.1151	-3.530	0.0055

$R2 = 0.99$, adjusted $R2 = 0.98$, $RMSD = 0.46$

Weather Resistance Verification

The third experiment sought to verify the difference in the light stabilizers' weather resistance. Three groups of light stabilizers were selected for weatherability testing: Blend-2, the liquid stabilizer, and UVA-1 mixed with HALS-1 in a 1:1 ratio. The dosage of these three items is 1 phr, respectively. They were made into a 2-mm-thick panel separately. The panels were placed in an accelerated weathering machine for testing according to ASTM G154.

As is evident in Table 7 and Figure 3, the YI value of the UVA-1/HALS-1 panel is 10.8 before exposure to light, which is significantly higher than the value of the other three groups. Specifically, the color of the UVA-1 and HALS-1 panel is obviously yellow.

Table 7. Accelerated weathering test results and data.

Item	YI	Delta E			Degradation Time
	0 hr	100 hrs	1,000 hrs	3,000 hrs	
Blank (no light stabilizer)	2.8	9.0	—	—	100 hrs
UVA-1 (0.5 phr)/HALS-1 (0.5 phr)	10.8	1.0	1.9	4.6	>3,500 hrs
Liquid stabilizer* (1 phr)	4.1	2.5	4.0	6.7	>3,500 hrs
Blend-2 (1 phr)	3.4	3.4	6.2	7.8	3,000 hrs

After 100 hrs of accelerated weathering testing, the color of the panel without any light stabilizer added was obviously yellow (Delta E is 9.0). Moreover, the surface of the panel began to stick and crack. By contrast, the other three groups of panels with light stabilizers added could still maintain Delta E below 4.0 after 100 hrs.

Both the panel with UVA-1/HALS-1 and the panel with the proprietary liquid stabilizer could last more than 3,500 hrs before degradation started, while the panel with Blend-2 could withstand up to 3,000 hrs. During the experiment process, we discovered that the liquid stabilizer is more compatible when applied to liquid resin. It can avoid problems of uneven mixture and the migration of powder additives after the sealant is cured.

Figure 3. The level of degradation of the panels.

	100 hrs	3,000 hrs
Blank		Completely melted
UVA-1 and HALS-1		
Liquid stabilizer*		
Blend-2		

Conclusion

Adding light stabilizers to improve sealants' weather resistance is a relatively simple and effective method. The main factors affecting the color of transparent sealants caused by light stabilizers include the color of the light stabilizer itself and the reactivity of the light stabilizer with the catalyst.

Although the commonly used combination of powder UVA-1 and HALS-1 can effectively improve the weather resistance of transparent sealants, it interacts with catalysts to cause the color of transparent sealants to become darker and yellow. In contrast, the liquid light stabilizer provides excellent performance and avoids affecting the transparent sealants' appearance color. Moreover, as a liquid additive, it has good compatibility with liquid resin and is easy to mix without causing migration.

For more information, visit https://en.ecic.com.

Eversorb® HF, developed by Everlight Chemical, Taiwan.

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CHOOSING THE RIGHT FORMULATION SOFTWARE

Electronic laboratory notebook software enables users to store raw materials, formulas, protocols, notes, and more, but which solutions are right for you?

By Carolyn Womer, Vice President, Formulator Software

When it comes to managing your laboratory or R&D data, having flexible software is a must. It is critical to find software that is both configurable and meets your needs. Electronic laboratory notebook (ELN) software is a standard solution for many companies. Much like using a paper notebook, ELNs allow users to store raw materials, formulas, protocols, notes, and more.*

Cloud-Based vs. On-Premise Solutions

The pandemic prompted many companies to consider a cloud-based software solution for storing raw materials and formulas. With a cloud platform, users can connect to the database from nearly anywhere in the world with internet access. This means that users can easily work remotely if their position allows it.

On-premise ELN systems are available for companies that prefer an in-house solution. Most on-premise software comes with an option for program maintenance (PM), which allows for a certain amount of telephone and email support. It also will allow for free downloads and software upgrades. PM contracts are usually valid for one year, with the option of renewal. As with other types of software, the cost of the PM contract will be roughly 20-25% of the software's MSRP.

With cloud-based software, companies typically pay a monthly subscription fee for as long as they would like to have access to the software. In contrast, on-premise software generally requires a one-time perpetual license fee for the file server. It is important to keep in mind that when a company gets a new file server, it may be necessary to purchase a new version of the on-premise software.

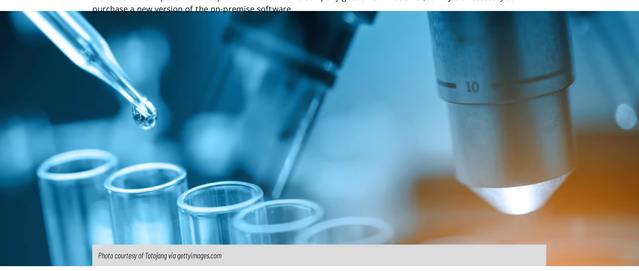

Photo courtesy of Totojang via gettyimages.com

Security and Access Considerations

Most companies report an improvement with security when they choose a cloud-based platform. Data is encrypted, and disaster recovery plans are more efficient. For added levels of security, find a software package that is FDA CFR Part 11 compliant. If using cloud-based software, ask about utilizing two-factor authentication.

In addition to user and/or user group security, software packages can allow certain formulas to be assigned to security groups. In these cases, only the members of the security group will have access to the formulas.

It is possible to make the software available to all users who can benefit from it. This may include some surprises, like salespeople. Salespeople find software useful for tracking costs, sell prices, product data sheets, safety data sheets (SDS), and certificates of analysis. If the software offers sample tracking or project management, that is an added plus.

It is also important to identify a software product that can grow as the company expands. Find one that makes it easy to add users and modules as they become necessary.

Many companies find an auditing option to be beneficial. Most software provides a date and time stamp for formula records. Some packages will also keep logs of activity by username, which allows users to quickly find where they left off for certain projects. Activity records also give management information about which areas users are spending most of their time in, as well as help determine which areas need more staff or analysis.

> "With software that allows user-definable properties and equations, users should be able to hit target objectives while formulating."

Functionality Options

Companies in the adhesives and sealants industry should always look for software that is designed for process manufacturers. Several software companies offer discreet manufacturing software, but this is altogether different. Process manufacturing software provides the option of mixing various units of measure. For example, you might work in grams, pounds, kilos, bags, gallons, and liters. Look for software that will also allow various weight and volume units but enable users to formulate by weight % or volume % if needed.

Implementing physical properties and equations is another key function needed in the adhesives and sealants industry. Choosing a software system should reduce or eliminate the need for calculators and spreadsheets. With software that allows user-definable properties and equations, users should be able to hit target objectives while formulating. For example, users may wish to achieve a target viscosity or specific gravity but only want to adjust part of the formula. Good formulation software provides users with tools to meet these types of requirements.

Companies find that software enables: simple and speedy formulation development; selection by use of previous formulas; and instant access to materials, costing, and prediction of physical property performance. Software that has a "compare" feature is useful because it enables formulas to be compared side-by-side.

Software also helps eliminate data entry mistakes. Once data is entered, it can be used without re-entry. Packages can also enable users to create their own fields and specify whether these fields are required during data entry.

Going one step further, some software packages feature the ability to import existing data, as well as functions to import and export from spreadsheets. Companies that have an existing software system that they have outgrown should be sure to look for a solution that allows for data import. Some formulation software also has options to integrate data from another software system. On the other hand, a company can look at this as an opportunity to clean up data.

Supply Chain Management

During the pandemic, raw material supplies have dwindled or perhaps vanished all together. Software can provide the ability to find all formulas that use scarce raw materials, as well as search and replace tools to formulate with raw materials that are available.

Other tools such as material requirements planning are key to keeping a close eye on supply and demand for production. In addition, advanced costing capabilities allow users to enter future costing for raw materials and packaging so that the long-term cost of formulas can easily be managed.

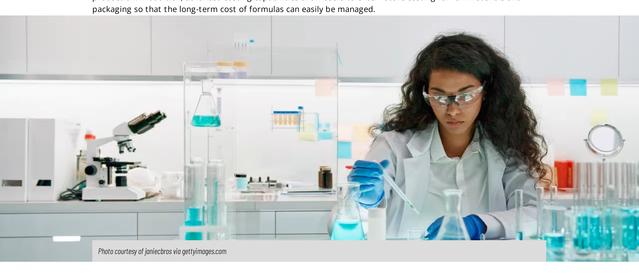

Photo courtesy of jonkerzcross via gettyimages.com

Data Sheets and Reporting

In the adhesives and sealants industry, it is beneficial to find software that enables users to generate SDS using the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) format. SDS-related data should be accessible by all users who are involved in the design or output of the SDS. Find a software package that follows a reputable resource for SDS design and content, such as the United Nations Purple Book.

Each company's GHS SDS output should be based on its current formulations. Therefore, it is imperative that the software uses current raw materials and formulas for calculating the various sections of the SDS.

When needed, find a software package that uses third-party report design software to customize reports. If the document will be customer-facing, be sure to add elements such as the company logo to be consistent with other vital documents that the customer base receives.

Trials and Training

Some formulation software provides users with an opportunity to download and install a trial version. If you plan to take advantage of this, be sure to use the software during the trial period. Check with the formulation software company to make certain that you will not lose any of the data entered during the trial period. Consider whether to purchase some training time and take advantage of implementing the software to meet your needs. If you decide to buy, users will have a jump-start on implementing the software.

Take advantage of software training. Implementing the software often requires special configurations or techniques to suit a company's needs. The return on investment (ROI) for training time is very short. Many companies implement successful systems by training a few key people and then having those people train others internally. This allows the trainers to imbed company-specific procedures along with the software training.

Multiple Considerations

Many aspects need to be considered when choosing the right formulation software. Cost is important but should not be the only deciding factor. Laboratory and R&D personnel can provide details regarding what software tools they need to provide the company with the advantages that lead to success. Make certain that the same personnel are part of the decision-making process, and the ROI will be well worth it.

For more information, call (908) 735-2145 or visit www.formulatorus.com.

**Such as cloud and on-premise PC-based solutions from Formulator Software LLC*

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EUROPEAN BIO-ECONOMY EXPERIENCING GROWTH

The bio-economy in Europe is robust, as sales in bio-based industries are on the rise.

The bio-based industries continue their ascent in the European bio-economy, marking a total contribution of €780 billion (approximately $874.9 billion). This figure is an increase of 4% compared to 2017 and more than 20% compared to 2008, which is the earliest data taken into account in this series of reports by nova-Institute. The first report of the series was commissioned by the Biobased Industries Consortium (BIC) in 2017. Since then, the report has been updated on an annual basis; this latest version covers the period from 2008 to 2018.

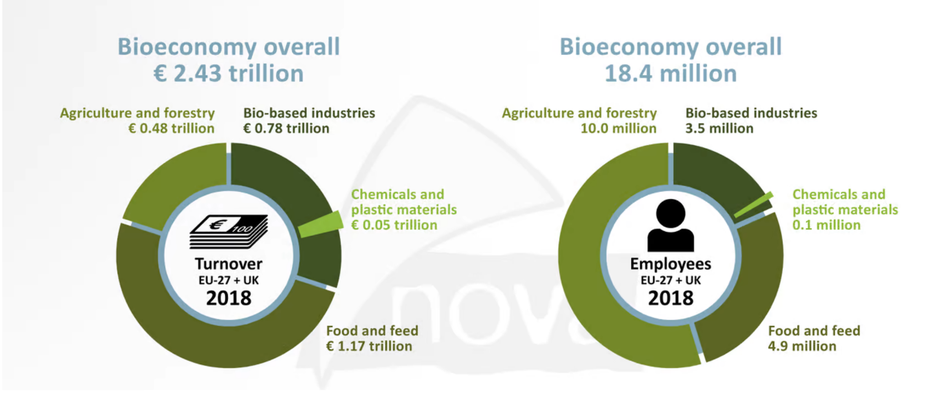
Sales Figures

The primary sectors (agriculture, forestry, and fisheries), as well as food, beverage, tobacco, and paper and paper products, can be considered fully bio-based and are thus fully accounted for in the bio-economy. For other manufacturing sectors (e.g., chemicals, pharmaceuticals, and textiles), the bio-based shares were estimated and included in the report's assessment.

Figures for the bio-based chemical industry (including plastics) reveal a turnover of around €54 billion (~ $60.6 billion) with the bio-based share relatively stable at around 15%, an increase of 7.5% compared to 2008. An analysis of the 2018 Eurostat data shows that the turnover of the total bio-economy, including food and beverages and the primary sectors of agriculture and forestry, amounts to just over €2.4 trillion (~ $2.2 trillion) in the EU-27 and the UK. This represents an increase of around 25% since 2008.

The food and beverage sector accounts for about half of those sales, and the bio-based industries (e.g., chemicals and plastics, pharmaceuticals, paper and paper products, forest-based industries, textiles, biofuels, and bioenergy) account for roughly 30%. Almost another 20% was generated by the primary sectors of agriculture and forestry.

Figure 1. European bio-economy sales and employees, 2018. *(Image courtesy of nova-Institute GmbH.)*



Employment Data

In contrast to the rising sales figures, employment in the European bio-economy declined slightly, from 18.5 million people in 2017 to a total of 18.4 million in 2018. This reduction is largely due to efficiency increases in production. The primary biomass production, mainly agriculture, provides a majority of the entire employment (54%) but comparatively low sales (20%).

The data also demonstrate clear differences between groups of member states. For example, the Central and Eastern European countries of Poland, Romania, and Bulgaria are more represented in the lower value-added sectors of the bio-based economy, which create many jobs. This indicates a strong agricultural sector that tends to be labor intensive compared to the high value-added sectors.

In comparison, Western and Northern European countries generate much higher turnover relative to employment, indicating a larger share of refining and value-added industries. The countries with the highest turnover-to-employment ratios are Finland, Belgium, and Sweden.

The full report is available free of charge at https://renewable-carbon.eu/publications. Opening image courtesy of metamorworks via iStock / Getty Images Plus.

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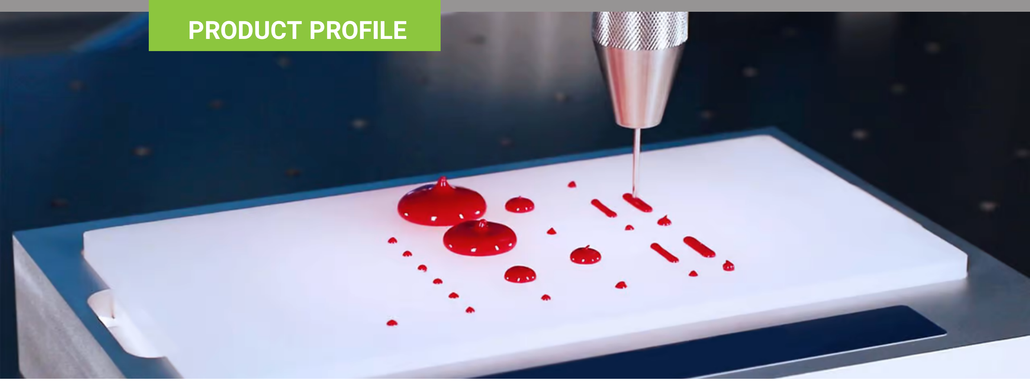


HIGH-PERFORMANCE DISPENSING FOR ELECTRONICS APPLICATIONS

New dispensing technologies offer the electronics industry maximum productivity, flexibility, and functionality.

The electronics market is booming, and its trends toward component miniaturization, increasingly short cycles, and highest dispensing quality require constant innovation. Dispensing systems are key technologies in an environment of increasing automation and demand for high product output.

Scheugenpflug reports that it has introduced two dispensing solutions to support electronics production in the automotive, industrial, medical, and consumer markets for dispensing small quantities and up to 10 times higher dispensing speeds. These new products offer maximum productivity, flexibility, and functionality to cope with increasing material viscosities, decreasing cycle times, and reduced dispensing quantities.

High Performance

Material usually must be dispensed as quickly as possible when using high-viscosity materials, such as thermal interface materials (TIMs), whether for control units or battery systems. A high-performance dispenser like Scheugenpflug's DosP DP2001 is reportedly able to dispense up to 10 times faster than comparable solutions. It dispenses one-component materials from 0.06-20 ml and two-component materials from 0.1-40 ml. The high dispensing speed for highly automated production lines enables a new valve system with extremely short switching times. It works without a diaphragm and is pressure stable.

The new technology is particularly advantageous in combination with the piston dispensing principle, meaning not only the smallest points and lines can be dispensed. The system also offers a high degree of flexibility in terms of dispensing rates and volumes. Powerful servo drives ensure the high dispensing speeds. In addition, new process possibilities arise, such as adaptation of the mixing ratios to product-specific properties. This ensures greater flexibility and thus an extended range of applications.

The high-performance DosP DP2001 is up to 10 times faster than existing dispensing units.

Maximum Flexibility

The trend toward the miniaturization of electronic components is leading to increasingly small dispensing quantities and potting volumes. The recently introduced DosPL DPL2001 low-volume dispenser dispenses dots smaller than pin heads quickly, reliably, and with maximum repeat precision. The dispensing quantity includes one-component materials from 0.003-2 ml and two-component materials from 0.006-4 ml. This high dispensing accuracy with fast cycle times is made possible by a new displacement-free valve system, which is also suitable for the use of abrasive materials due to its robustness.

Whether for bonding, sealing, filling, or heat dissipation, their simple, robust design makes piston dispensers appropriate to use for many different tasks and a wide range of materials. In addition to very liquid adhesives, sealants, and potting materials, piston dispensers are also suitable for highly viscous and/or filled and highly abrasive materials. The DosPL DPL2001 can be used to dispense extremely small volumes down to a few µl. At the same time, the maximum cylinder filling of up to 4 ml with two-component materials ensures maximum flexibility.

The DosPL DPL2001 is based on advanced low-volume dispensing technology, which makes it the right choice for a wide range of smaller component designs and applications. The volumetric piston dispensing principle, in combination with the advanced sensor technology, ensures highest precision and process reliability during dispensing. The smallest dots and thinnest lines as well as accurate micro-fillings can thus be reliably performed. High dispensing speeds and extended service lives contribute to maximum efficiency in fully automated production environments.

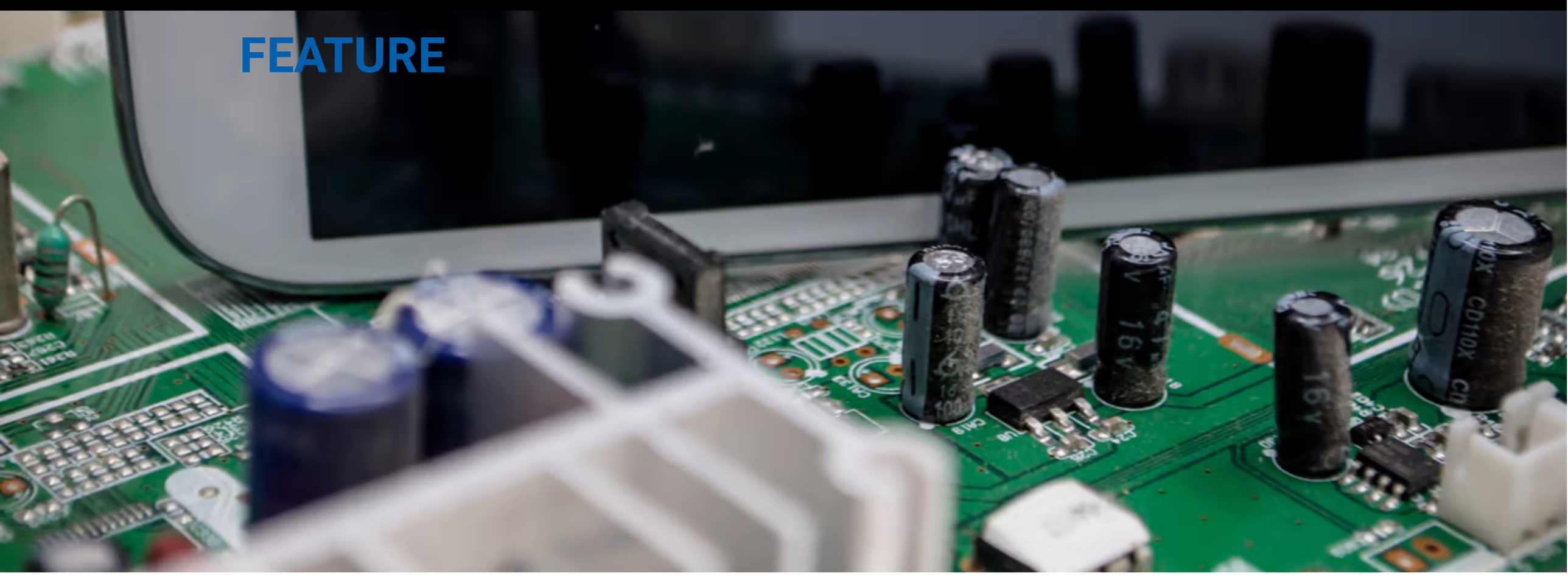
Additional Benefits

According to Scheugenpflug, both dispensing solutions feature reliable process monitoring and access to relevant process parameters. The new sensor technology and software continuously monitors the dispensing pressure by component. Improved start/stop behavior as well as more precise contours are additional advantages, especially in the smallest quantity range, and are made possible by the new parameter selection of the material-specific dispensing pressure in the dispensing program.

Both dispensing units can be used in the multi-function DispensingCell DC803 for atmospheric applications. Alternatively, they can also be used as an integration solution in conjunction with the process module.

For additional information, visit www.scheugenpflug-dispensing.com.

Note: Images courtesy of Scheugenpflug GmbH.



ELECTRONICS INDUSTRY TO GATHER AT IPC APEX EXPO 2022

IPC APEX EXPO returns as an in-person event January 22-27 in San Diego, Calif.

IPC APEX EXPO 2022 will welcome the electronics manufacturing community to the San Diego Convention Center in San Diego, Calif., on January 22-27. The largest North American event for the electronics manufacturing industry is expected to draw approximately 9,000 attendees from 45 countries.

Attendees will be able to choose from more than 100 educational opportunities and network with hundreds of exhibitors, as well as peers and industry leaders from across the world. Attendees, exhibitors, speakers, instructors, staff, and all convention center contractors at IPC APEX EXPO will be required to present either proof of full vaccination or a negative COVID-19 test (NCT) within 72 hours of arrival to enter the event.

"The safety, security and health of those experiencing IPC APEX EXPO is our top priority," said John Mitchell, IPC president and CEO. "IPC APEX EXPO is a large, indoor event with several thousand attendees expected, increasing the risk of transmission. To mitigate that risk, we will follow the guidelines set by the California Department of Public Health, requiring vaccine verification or negative testing to 'indoor mega events' involving 1,000 or more participants. IPC will continue to monitor and evaluate the situation and may update protocols as we get closer to the event."

Professional Development and Technical Sessions

Professional Development Courses on a number of topics will be offered January 23-24. Training opportunities are organized into several areas of interest: Assembly Processes; Circuit Design and Component Technologies; Factory of the Future; Management; PCB Fabrication and Materials; and Quality, Reliability, Test, and Inspection.

The Technical Conference begins on January 25, and sessions will be held through January 27. Four tracks comprise this year's technical session offerings: Factory of the Future Implementation; PCB Fabrication and Materials; Quality, Reliability, Test, and Inspection; and Materials, Assembly, and Environment.

Exhibit Hall

Exhibits will be open January 25-27, and the event will offer multiple activities on the show floor. The Ribbon Cutting Ceremony will kick off the exhibition at 9:45 a.m. on January 25.

Booth 1701 will house the Factory of the Future Pavilion to showcase solutions for real business challenges by identifying new technologies that modernize industry processes. On hand will be technologies such as AI-enabled inspection, AI-machine learning, CAD, 3D design, simulation, additive manufacturing, and more.

A Show Floor Reception will be held January 25 from 5-6 p.m. to provide attendees with the opportunity to network with industry colleagues, make new connections, and interact with leading suppliers. In addition, January 26 will bring an Ice Cream Social from 2:30-3:30 p.m.

Booth 3815 is earmarked to enable attendees to meet with poster presenters during these networking sessions. In addition, poster presenters will be available on January 27, from 12-2 p.m.

Additional Networking Opportunities

As the industry returns to in-person events, many activities are planned to enable safe interactions. For those who haven't attended IPX APEX EXPO previously, a Newcomers Reception is planned for January 24 from 5-6 p.m. The International Reception will be held the same evening, from 5:30-6:30 p.m.

January 25 from 6-7:30 p.m. will bring the Women in Electronics Reception. And two events are scheduled for January 26: the Tribal Knowledge Cultivation Project (1:30-2:30 p.m.) and Trivia Networking Night (6-7:30 p.m.).

For registration and additional details, visit www.ipcapexexpo.org.

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PRESSURE-SENSITIVE TAPES ON THE RISE

Pressure-sensitive tape manufacturers are tapping into the packaging, medical, and transportation sectors to gain ground.

Today's manufacturers have unrestrained access when it comes to bonding solutions. Pressure-sensitive tapes and labels have grown as a viable option, but why are these solutions important?

Pressure-sensitive tapes and labels are designed with an adhesive that responds well to pressure. Their versatility and simplicity leaves them well-suited to an expansive array of consumer products. Furthermore, advantages such as convenience, efficiency, diversity, and adaptability are estimated to contribute significantly in augmenting the growth prospects of the global pressure-sensitive tapes and labels market from 2021-2027.

It has been estimated that the global pressure-sensitive tapes and labels market may cross $130 billion by the end of 2027. Three key verticals are expected to emerge as significant business segments for the overall market.

Food and Beverage

Across the overall food and beverage industry, pressure-sensitive tapes and labels are widely used for packaging purposes. Given that the technology has established a strong footprint in the packaging sector, the development of the pressure-sensitive tapes and labels market is massively influenced by the transforming trends of the flexible packaging industry.

For food packaging, it is of utmost importance that none of the ingredients in the adhesives incorporated in tapes and labels negatively impact the quality of the food. The label is typically not directly applied to the food but on the package. Thus, the packaging (e.g., plastic film) stands as a barrier between the food and the label. Such products need to comply with indirect food contact regulations to be certain that the quality of the food is not compromised.

Healthcare and Medical

Pressure-sensitive tapes are easily adapted to a wide range of medical applications, including joining components like panels in medical equipment, fastening parts in handheld diagnostic devices, wound care dressings, and sealing surgical drapes. These tapes are formulated to form high-strength bonds when used in medical devices or to bind different dressings and drape substrates together.

Tapes can also offer gentle adhesion when used in a stick-to-skin application. In these applications, pressure-sensitive tapes and labels boast properties such as nontoxicity, compatibility with different forms of sterilization, adhesion to inorganic and organic surfaces, and more.

Automotive and Transportation

The trillion-dollar automotive industry is yet another profitable business avenue for pressure-sensitive tapes and labels. Growing demand for lightweight vehicles to support increases in fuel economy and reduced emissions is projected to increase the adoption of pressure-sensitive tapes for transportation-related bonding applications in the near future.

New Bonding Solutions

Pressure-sensitive tapes and labels have managed to trade for a larger chunk of industrial and other adhesive applications over the past few years, paving the way for smaller, smoother, and highly aesthetic bonding solutions. By allowing different industrial sectors to experiment with a plethora of design possibilities, pressure-sensitive tapes and labels are on their way to becoming the most trusted and permanent bonding solutions for numerous verticals.

Additional details are available at www.gminsights.com.

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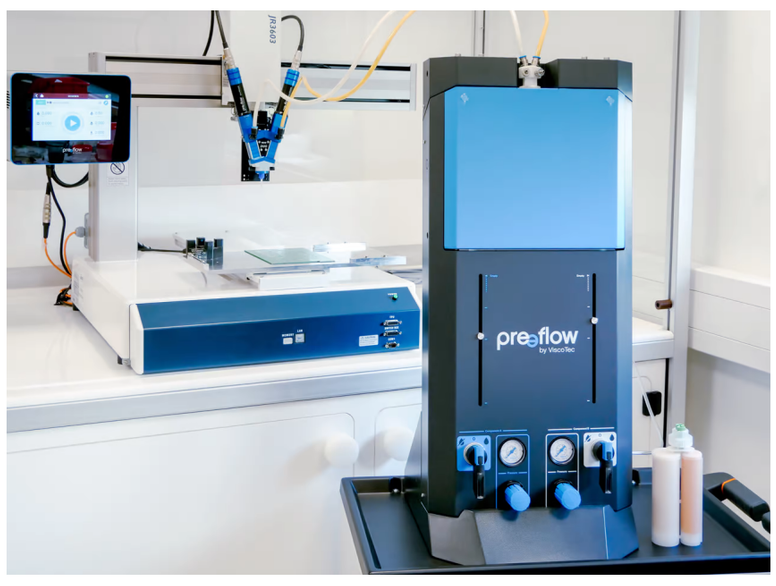
VISCOTEC

Automated Cartridge Emptying System

An addition to the preeflow® portfolio—eco-FEED—reportedly simplifies the emptying of double-chamber cartridges. The fully automatic pneumatic cartridge emptying system takes over the squeezing function to provide steady emptying while achieving precise material supply to the eco-DUO dispenser in a process-safe manner. eco-FEED is a stand-alone squeezing device for two-component, side-by-side double-chamber cartridges with separate control of the respective material chambers. The system can be operated as a desktop or integrated version.

www.preeflow.com

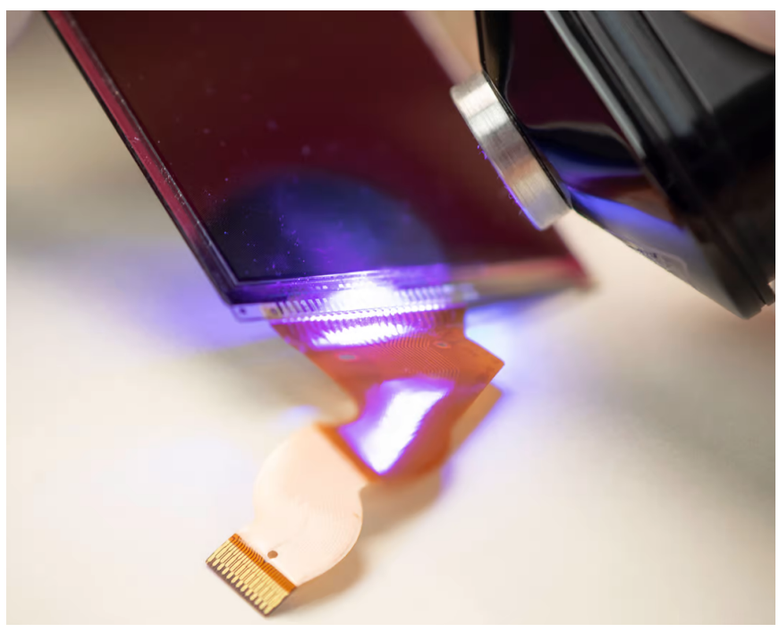


MASTER BOND

LED-Curable Adhesive

LED405FL3 is reportedly a flexible, one-component, LED-curing adhesive system with excellent optical clarity and a refractive index of 1.51. Its flexibility allows for stress minimization, especially when bonding substrates with different coefficients of thermal expansion. It also utilizes a fluorescent dye for detection purposes, which enables easy visual inspection. The company reports that this no-mix system achieves full tack-free cure following exposure to a 405-nm wavelength light source without any oxygen inhibition. In thinner sections, full cures can be achieved in 30-45 seconds.

www.masterbond.com



H.B. FULLER INDIA

Adhesive for Paper Straws

A new food-safe adhesive has been introduced under the Swift®tak brand to meet increasing demand for paper straws, which have been a challenge for the industry and consumers alike. This latest launch reportedly offers differentiated advantages in terms of sustainability, safety, and manufacturing efficiency. The new water-based technology enables improved food-safe solutions that reportedly maintain straw integrity while the consumer is enjoying a beverage. In addition, the adhesive helps create durable paper straws that withstand three-hour resistance in a wide range of liquids, including water, juices, soft drinks, and milk.

www.hbfuller.com

CHARLES ROSS & SON CO.

Double-Planetary Mixer

Double-planetary mixers are used for high-precision mixing, granulation, and vacuum drying. According to the company, its mixer excels in rugged applications that require enormous torque. Patented high-viscosity (HV) blades work in tandem to knead and mix from a vertical orientation, augmented by large shafts and generous bearing spreads to provide an ideal combination for tough-to-mix formulations of up to 6 million cP or higher. The design includes a heavy-duty fabricated gearbox engineered for stability and smooth planetary movement of the stirrers as they orbit a common axis.

www.mixers.com

XLYNX MATERIALS

Molecular Glue

A new class of adhesives—termed molecular glues by the company—reportedly makes it possible to permanently adhere difficult-to-bond polymers such as polyethylene and polypropylene to themselves and to other materials through strong chemical bonds. BondLynx® employs bis-diazirine chemistry to create covalent chemical bonds between polymer chains, permanently crosslinking them together through strong carbon-carbon bonds. This is the same type of joinery found between carbon atoms in the polymer chains themselves. Once BondLynx has been applied to a polymer, the crosslinking process can be initiated by heat, ultraviolet (UV)/visible light, or an electric field.

www.xlynxmaterials.com

ASK DR. DAVE

ALTERNATIVE CURE SYSTEMS FOR RTV SILICONES

We use RTV silicones in our assembly operations, and our workers keep complaining about the strong vinegar smell. Somebody told me that we might be able to get low-odor, low-volatile silicones. What issues should we be aware of?

Room-temperature vulcanizing (RTV) silicones are well-known for their extreme durability. They are convenient one-component sealants that cure by reaction with moisture from the atmosphere. Your current product is known as an acetoxy silicone. During the curing reaction with water, short-chain molecules in the liquid silicone, called siloxanes, link together to form a tough, rubbery sealant and give off acetic acid (vinegar) as a byproduct.

You should talk to your supplier about providing you with a low-odor silicone. These materials have similar cure chemistry but give off different byproducts (typically amines, oximes, or alcohols). The odors vary from a slight "fishy" smell to musty to virtually no odor. You may pay a little more for these types of RTV silicones, but they are much more pleasant to handle.

One thing to check is that you do not affect the adhesion in your assembly. I find that acetoxy silicones do tend to have outstanding adhesion, particularly to metals and glass.

You also mentioned low-volatile silicones. These are silicones that have been purified to remove volatile siloxanes that can evaporate during curing and then condense on nearby surfaces. They can degrade performance in electronic assemblies and in automotive oxygen sensors.

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.

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