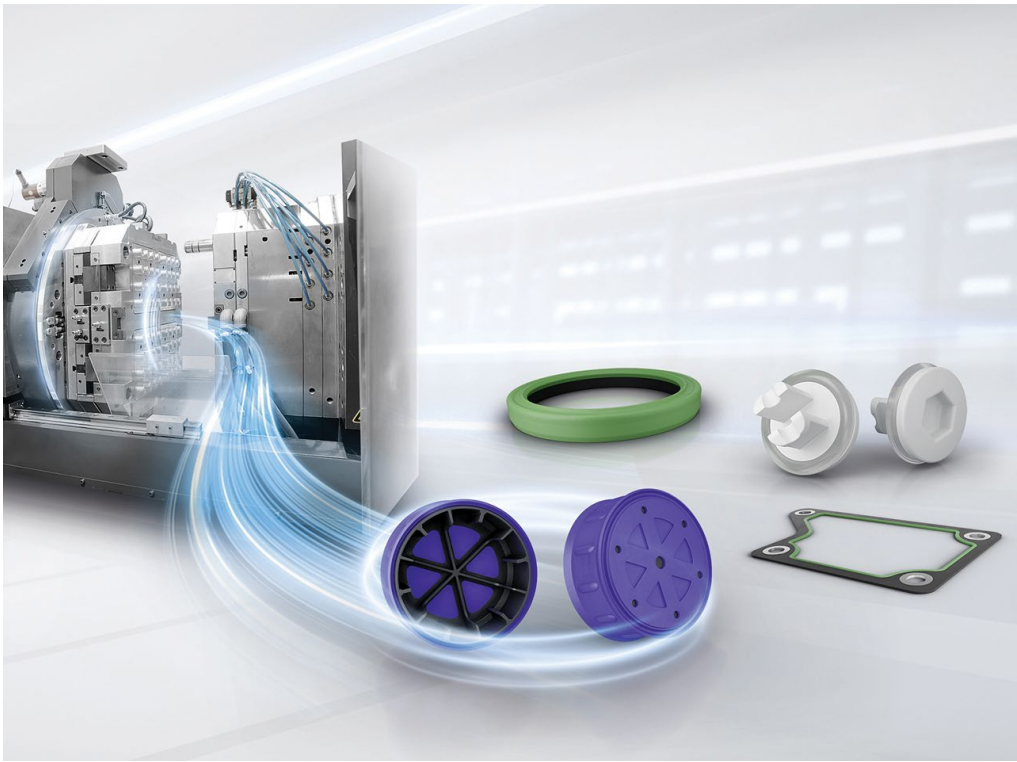
Industrial Bonding of Thermoplastic and Thermosetting Elastomers

Trelleborg Sealing Solutions has developed a process for joining different polymers using multicomponent technology. This allows thermoplastics and elastomers to be combined with a bond of the required strength.

Multipart components made from thermosets and thermoplastics have been a standard feature of the plastics industry for some time. Trelleborg Sealing Solutions has now succeeded in developing a process for bonding elastomers in the same way, which makes it possible to develop combined seal solutions.

The formulations of polymers are generally the intellectual property of the creators and are therefore not readily available. This means that information in particular about elastomers that is needed to ensure a permanent bond with another type of material is often lacking. For this reason, it has rarely been possible to combine thermoplastics and elastomers using bonds of the required strength.



Components made of a combination of thermoplastic and thermosetting elastomers.

Around 50 material combinations already validated

In Trelleborg's Multicomponent Development Center, investigations were therefore carried out into the influence of surface properties and material processing on the bonding of elastomers to a variety of plastic substrates. The result is a process that requires no pre-treatment, adhesives, surface preparation, or other additional steps. It is also ideal for highly automated systems with visual or functional quality controls. Trelleborg has now validated around 50 different material combinations and the tests are being continued with the aim of setting up a database.

Trelleborg already has a number of tried-and-tested processes for manufacturing multicomponent parts that bond liquid silicone rubber with plastics and can withstand the heat required for insert molding. Multicomponent technology can now be used to create a single component from multiple materials. As well as the sealing properties, innovative designs can also influence the structure, housing, and mounting of the sealing solution.

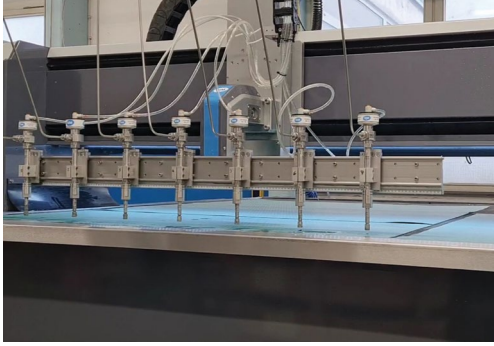
Individual component as a replacement for an assembly

Transforming an assembly into an individual component offers technical and cost-related benefits. Individual components are not only more compact, lighter in weight, and more robust, but also involve lower production and assembly costs. In addition, individual components minimize the risks involved in assembly and overcome any issues relating to tolerance stack-up, blind assembly, or secondary operations. From the manufacturer's perspective, there are fewer suppliers to manage and fewer items need to be kept in stock.

Neal Borg, product manager at Trelleborg Sealing Solutions, explains the benefits of early cooperation: "To take full advantage of everything that multicomponent technology can offer, it is best for us to become involved early in the concept stage of product development. This allows us to understand the application, the assembly, the location of the component, and the potential challenges presented by the production process. We also investigate all the typical parameters of a sealing application, such as the process media, the temperature ranges, the tolerances, and the critical sealing surfaces. This not only improves the quality of the product, but also enables us to optimize the product for mass production at an early stage of the design process. A survey of our customers showed that nine out of ten companies are interested in multicomponent bonds between thermoplastic and thermosetting elastomers." //

Further information:
www.trelleborg.com

Manufacturing Gaskets and Molded Parts Using Water Jet Technology



© Berger S2B GmbH

Water jet system with seven heads

Choosing the right production process is a key factor if high-quality gaskets and molded parts are to be manufactured efficiently. Berger S2B has invested in a high-purity water system with seven heads with the aim of expanding its range of production techniques and its product offering.
Complex shapes, miniaturization, a variety of different materials, shorter times-to-market, and pressures on costs are all factors that frequently affect the development of gaskets and/or molded parts. The prototyping phase is generally followed by production, and this is where Berger S2B is using its new water jet system, alongside the existing plotters, kiss-cutters, and die-cutters.
The STM 2035 Premiumcut high-purity water system, which has seven cutting heads, can produce components with the most complex structures quickly and efficiently from almost any material to a high standard of quality. Using DXF files, it is possible to cut parts to a tolerance of ± 0.1 mm. The quality of the cuts is determined by the operating speed of the machine, which distinguishes between separation, quality, fine, and precision cuts. The advantage of this process for precision gaskets and molded parts is that no heat is generated and, therefore, there are no changes in the structure of the material at the edges.

Processing a wide variety of materials

From a cost perspective, other benefits include the fact that no tools and reworking are needed and that highly efficient use can be made of the materials. This is an increasingly important consideration with the current emphasis on sustainability.
Almost any material can be processed, because abrasive cutting is also possible. For example, the system can cut elastomer and rubber parts made of EPDM, silicone, PUR, NBR, natural rubber, SBR, chloroprene, FKM, and IIR, together with films, multilayer materials, and rubberized fabrics. The process is also suitable for fiber gasket materials, thermoplastics, cellulose compounds, foams, expanded rubber, cellular rubber, and high-temperature materials made from glass, ceramic, and cork. //
More information: www.bergers2b.com

Quality Assurance Documentation Ensures the Safety of Electric Cars

More and more seal components manufactured using functional films perform a system-related function in products. As a result, a high standard of quality and corresponding documentation are required. All major technological developments are characterized by setbacks. This is true of electric cars, where battery fires, for example, have been a problem. In many respects, these vehicles represent uncharted territory. A correspondingly large quantity of development work is involved, together with the verification of ideal solutions. The thermal management of the vehicles, which are used in all the climate regions in the world, remains one of the key challenges. If a battery fire occurs, the investigation into the causes covers the entire value chain. The aim is to discover what brought about the fire and how the problem can be resolved quickly. Quality management data is used for this purpose, which should ideally be available for the entire project, because this is the only way of locating a problem rapidly and identifying a solution.

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Quality management and documentation along the entire value chain is a key feature of modern development projects and services.

Developing the ideal thermal management materials

A project data flow is an important feature of development partnerships of the kind that Tec-Joint is often involved in. For the Swiss company, the data not only form the basis for product and process improvements and flexible modifications, but also simplify the rapid identification of causes of complaints. The data flow begins with the selection of the material and the documentation of the specified solution. Data from prototype tests confirm that the approach chosen is the correct one. Production figures demonstrate that the specified quality standards and tolerances have been met, including the surface finishing system often selected for processing seals and molded parts based on functional films and multilayer materials. This also applies to projects and subcontract finishing of final and semi-finished components. During the production of batteries, this allows users to be certain that the thermal management material has been carefully developed, thoroughly tested, and correctly manufactured. In the quality management process, these data are then combined with production data. According to Tec-Joint, the data allow corresponding solutions to be developed more easily and cases of damage to be analyzed quickly. Companies with ISO 9001 and ISO 14001 certification that are familiar with the quality requirements of their industry and supply high-quality products can also provide end-to-end documentation of the processes. //
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New Adhesives Improve the Integration of Holographic Films

New UV adhesives for optoelectronics enable the fast and true-color bonding of holographic films in augmented reality head-up displays. This was demonstrated in joint tests carried out by Delo and Covestro. The automotive industry and other sectors will benefit from rapid roll-to-roll manufacturing and better integration of the films into holographic end-use applications.

Head-up displays (HUDs) in vehicle cockpits represent one of the most important future applications for holographic films such as Bayfol HX from Covestro. A new development is augmented reality HUDs, in which the projections merge with reality so that the navigation appears to be displayed directly on the road. In these HUDs, holographic films are integrated into the windshield, thus allowing for brighter and larger images while reducing installation space.
In addition, film technology also offers advantages for vehicle lighting, for example for the rear lights. Alongside more design freedom and reduced space requirements, customized holograms can be designed to increase safety, for example by providing a warning message that says 'Stop' in the driver's field of vision.
As well as having all this versatility, holographic films are also thin, lightweight, and completely invisible under so-called off-bragg conditions – whenever the coupled light does not meet certain requirements, such as the correct wavelength. The films usually consist of RGB-sensitive photopolymers on a transparent carrier film. This is embedded between two protective cover layers.

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Vehicle with AR elements

Low optical interaction, high strength

A precondition for high component quality is, in particular, low optical interaction between the adhesive and the photopolymer. For that reason, the adhesives are chemically adapted in such a way that they do not shift the absorption into other wavelength ranges when they are combined with the photopolymer. They must therefore ensure color fidelity under all conditions.
Until now, mainly silicones have been used to fix the film layers. Silicones are versatile and high-performance materials. However, this is offset by lower strength, slower curing, and, in some cases, strong outgassing. What is more, they emit particles to their surroundings during curing. Due to the potential impact on adjacent manufacturing processes, many automotive suppliers are striving to achieve silicone-free production. According to the companies, the Photobond UV acrylates tested by Delo and Covestro show a highly improved outgassing behavior compared to silicones and reach their full strength within seconds under UV light. //
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Atlas Copco Acquires Lewa and Geveke

Atlas Copco has agreed to acquire Lewa and Geveke and the associated subsidiaries for a combined enterprise value of € 670 million. Lewa is a leading manufacturer of diaphragm metering pumps, process pumps, and complete metering systems. Geveke distributes compressors and develops advanced and complex process pump installations.
Lewa was founded in 1952 and is based in Germany. The company has around 1200 employees and in 2021 generated revenues of € 233 million. Geveke was founded in 1874 and is headquartered in Amsterdam in the Netherlands. With around 170 employees, the company had revenues of approximately € 61 million in 2021. The acquisition is an all-cash transaction utilizing Atlas Copco's funds and is subject to regulatory approvals. The acquisition is expected to be completed during the second quarter of 2022.
The main part of the acquired businesses will have its base in the 'Power and Flow' division within Atlas Copco's 'Power Technique' business area and a smaller part will have its base in the 'Service' division within the 'Compressor Technique' business area. //
More information: www.atlascopco.com

Adhesive from Plastic Bags

On January 1, 2022, a ban was introduced in Germany on disposable plastic carrier bags with a thickness of less than 50 micrometers. However, very thin bags less than 15 micrometers thick are still permitted. An innovative research approach may allow them to be turned into high-quality adhesive.

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Adhesive from plastic bags could be made possible by a new research approach.

Since the start of the year there has been a ban on plastic carrier bags in Germany, with the exception of very thin bags made of plastic less than 15 micrometers thick. In 2019, every person in Germany used on average 36 of these bags. There is currently very little incentive to reuse the bags and most of them are thrown away and incinerated. Researchers at the University of California (Berkeley, USA) have set themselves the target of transforming the plastic bags and the material they are made of (polyethylene,PE) into a higher-quality product, and they have already achieved success.

Option of many different adhesive applications

PE itself does not have good adhesive properties. The team of researchers headed by John Hartwig (Chair in Organic Chemistry at the University of California, Berkeley) therefore wanted to discover whether functionalization using hydroxyl and ketone groups would improve the adhesion of the plastic. They chose a ruthenium-based catalyst for this purpose. The result was a PE compound that retained the original properties of the plastic, but also adhered firmly to metal substrates, for example, and could be painted. The addition of only a relatively small quantity of the functional groups increased the adhesion of PE twenty-fold. The modified PE retains its original properties and could therefore be used in the future for a variety of adhesive applications. The process is not yet cost-effective enough for industrial use, but the research findings represent an important milestone on the route to recycling plastics into sustainable, high-quality products. //

More information: www.klebstoffe.com

Recyclable Packaging Films Made of Monomaterial

Four Fraunhofer institutes are developing a recyclable monomaterial film that combines all the properties necessary for product protection. The aim is to replace multilayer films, which can hardly be recycled.

The many advantages of plastic packaging have contributed to its widespread use in recent decades and have made it an indispensable part of everyday life. At the same time, however, packaging waste also contributes significantly to the accumulation of plastics in the environment. If waste is not properly disposed of, its long persistence will hide the risk of accumulation of the corresponding materials in the environment, with negative effects on wildlife and even humans.

Single-grade disposables can be easily separated and recycled, provided they are disposed of correctly. More problematic are so-called multilayer films, which are made up of several polymer layers that are practically inseparable from each other. Due to their outstanding properties, such composite films are mainly used for packaging in the food sector.

For these materials, the only practical option at the end of the product life cycle is thermal recycling, which, however, is not an ecologically desirable solution, although it is preferable to disposal in simple landfills or even shipping abroad. The focus of current developments is therefore on monomaterials. The first approaches for replacing multilayer films are already being offered on the market for selected applications.

Customized product properties

The recycling of plastic packaging, also in the sense of the circular economy and an associated equivalent use as the original product, is therefore also the focus of a project currently being carried out by the German Fraunhofer Society. The consortium consists of the Fraunhofer Institutes for Organic Electronics, Electron Beam and Plasma Technology FEP in Dresden, for Silicate Research ISC in Würzburg, for Process Engineering and Packaging IVV in Freising, and for Environmental, Safety and Energy Technology UMSICHT in Oberhausen.

Under the coordination of the Fraunhofer IVV, these four institutes are researching to develop a completely recyclable monomaterial film that meets all the requirements of the packaging industry. These include mechanical properties, for example to ensure the stability of stand-up pouches, as well as requirements for the barrier effect with regard to gases, vapors, and aromatic substances.

© Fraunhofer IVV

Among other things, the monomaterials films combine stability and a barrier effect.

The central idea of the project is to separate the property profile of the polymer granulate to be extruded from the later product properties of the film by specifically modifying the film material afterwards. Compared to the solutions already available, it is possible to increase the stiffness as required and thus save material. For this purpose, technologies are used that can be applied in-line to the film extrusion. According to the project partners, this enables the production of recyclable films while still maintaining the previous production costs. //

Further information:
www.ivv.fraunhofer.de

3D Printing Using the PUR Polycomponent Process

The 'Goliath' 3D printer can print large-format urban furniture and other objects from any type of granulate. A future innovation step is the printing process under water.

© Teu2tec

The Goliath manufacturing system can be used to produce large-format objects from any type of granulate using the paste extrusion modeling process (PEM).

The Goliath manufacturing system, which has been newly developed by the German start-up Teu2tec in Gütersloh, enables fast 3D printing of large-format objects from any type of granulate using the paste extrusion modeling process (PEM). For this purpose, the system uses classic two-component polyurethane binders with fast curing times and granules with grain sizes of up to 2 mm. According to the company, the fast curing of the material at less than 10 s ensures both economical production and almost unlimited design freedom. By adapting the binders and materials used, the product properties can also be flexibly adjusted. All products to be manufactured can therefore be made to cure either elastically or firmly, the company adds.

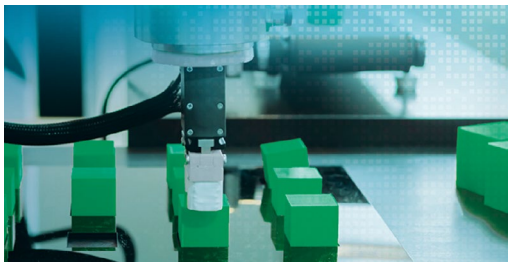
Printing process

The company reports that the special design of the printing head also enables the printing of high-viscosity pastes. Due to the pot life of less than 10 s, printing

speeds of up to 300 mm/s and a mass flow of up to 100 g/s can be achieved. The layer height can be adjusted from 3 mm to 12 mm, which not only enables fast printing processes, but also – due to the low layer height – makes it possible to produce optically complex components. At 2200 x 2200 x 2000 mm, the volume is large enough to be used, for example, to design furniture or complete playground equipment for urban development.
In an initial test series, the team already succeeded in setting down and repositioning the print head during the active printing process. The process technology used makes it possible to interrupt the extrusion during the additive process and to reposition the printing head without further printing paste leaking from the nozzle.
The company says that, since the beginning of 2022, the first printing tests under water have been completed. It is already becoming clear that, with appropriate binder systems, the process will enable the printing of components under water. //
More information: https://teu2tec.de

Guidelines for the Cost-Effective and Safe Integration of Cobots

The Fraunhofer IGCV has worked together with the VDMA to publish guidelines on the flexible use of collaborative robots, or cobots. The guidelines provide a clear and practical insight into successful human-robot collaboration.



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The guidelines help with the integration of flexible collaborative robots.

Human-robot collaboration (HRC) systems are rarely found in small and medium-sized enterprises (SMEs). Improved access to new applications in robotics will help to overcome the challenges involved in using collaborative robots. The Fraunhofer Institute for Casting, Composite and Processing Technology IGCV has collaborated in this area with the German Mechanical Engineering Industry Association (VDMA) as part of the German 'Mittelstand 4.0' project, which is aimed at SMEs. In February 2022, the two organizations published joint guidelines with the aim of giving future users a clear, practical insight into the successful integration of HRC.
Over recent years, huge progress has been made in the field of HRC. The benefits are obvious: the standards have been defined, a wide variety of components for implementing HRC systems are already available, and the potential of the technology is well known. Companies that have already automated their production processes will benefit from increased productivity and quality in just the same way as first-time users. However, HRC applications are not widely used, particularly in SMEs. The aim of the guidelines for the flexible use of collaborative robots, which are available free of charge, is to change this situation. The 40-page document outlines the most important steps, from the suitability evaluation through to the implementation of an HRC application. There are links in the guidelines to additional supporting documents such as templates and checklists that can be found online.

Practical and theoretical aspects of HRC integration

The authors put the emphasis on giving practical answers to questions as well as providing theoretical information and presenting the material in a user-friendly format. "The guidelines are based on the experiences and expertise of more than 25 companies and institutions that form part of the 'Robotics for SMEs' expert network," explained Christian Härdtlein, author and group manager engineering of adaptive production modules at the Fraunhofer IGCV. "This gives companies with little or no experience of HRC a clear and easily understandable workflow." //
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