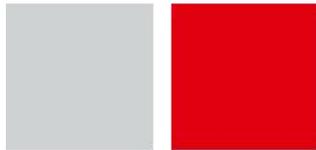


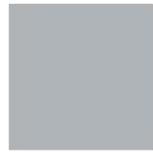
Success Secured with LOCTITE®

Joining Technology of the Future

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LOCTITE®
BONDERITE®
TECHNOMELT®
TEROSON®
AQUENCE®



Excellence is our Passion

Abstract

Development of new materials with their wide-ranging application potential poses major challenges for modern bonding technology. In production, adhesive technology enables optimum use of specific material properties and implementation of new construction methods such as lightweight construction. Use of structural adhesives has also become essential to the widely used mixed construction method as well as the application of all kinds of metal, synthetic and fiber composite materials. As the world's leading manufacturer of adhesives and sealants Henkel provides a general-purpose selection of structural adhesives for all kinds of industrial applications with its strong Loctite® and Teroson® brands.

In recent years, the use of modern adhesive technologies has become increasingly prominent in the industry. There is a good reason for this, as high-performance adhesives deliver numerous advantages for constructors and processors alike. In particular, the property of bonding all kinds of materials quickly and securely is one of the reasons why adhesives are now regarded as an established part of many production processes. Almost all types of metals – both conventional standard steels and stainless steel and aluminum – as well as synthetic and fiber composite materials and glass or ceramics can be combined adhesively with professional application. In this way, the specific material properties can be optimally utilized for a component in product manufacture.



"Structural bonding has now become an essential fitting method in all industrial sectors, especially where different materials have to be bonded together," says Gerd Dietz, Technical Customer Service Manager. Manufacture of domestic appliances, building facades, filters and wind turbines – there are many examples of the wide range of industrial applications. In truck construction, nearly all modern box bodies are now bonded and sealed at the same time. The sandwich design of modern wall and ceiling elements enables lightweight structures that can only be fitted by means of bonding. Henkel provides the right solution for the majority of structural applications with its LOCTITE and TEROSON adhesives.

Structural Adhesives Compared with Other Fitting Methods

In addition to their all-round versatility, there are other factors in the increasingly important role of adhesives in trade and industry. On a like-for-like basis, the traditional connection technologies have familiar disadvantages. Mechanical processes such as riveting or bolting only enable transfer of force at specific points. The flux results in peak stresses at the whole or spot edges that increase the risk of fatigue fracture and thus adversely affect the dynamic and static strength of the bond. In contrast, when bonding connections are effected correctly, the stress or load transfer is more evenly distributed across the entire bonding surface. Compared with traditional fitting methods, bonds are superior

in the presence of dynamic stress. In addition, the parts to be bonded are not weakened by the drilling of holes.

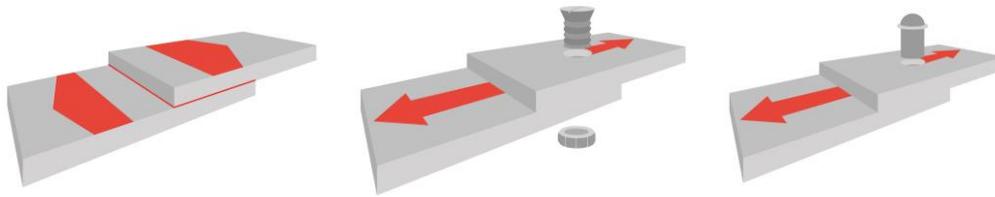


Figure 1. Stress distribution in bonding, screwing and riveting.

Compared with welding and soldering, the use of adhesives chiefly stands out by virtue of its flexibility. Heat-sensitive materials such as aluminum or plastic as well as very thin components can therefore be securely bonded. There is no negative impact on the strength of the material here. The low heat build-up is another key criterion when processing fitting parts that already have their final surface finish, for example chrome-plated steel. As a non-conducting material, cured adhesives also have an insulating effect, thus preventing contact corrosion.

Technology Overview

Depending on the field of application, various adhesive technologies with specific product properties are available for structural bonding. This chiefly involves 1- or 2-component reaction adhesives that cure at room temperature or as a result of heat. Henkel covers the entire spectrum of adhesive technologies. This includes epoxy, acrylics and polyurethane adhesives as well as silane-modified polymers and silicone-based products. For selecting the most suitable adhesive, expert advice from the manufacturer is extremely important. "To make the right adhesive choice, it is essential to know and take into account the subsequent everyday requirements for bonded connections," says Gerd Dietz, Technical Customer Service Manager.

One distinguishing criterion is the difference between rigid and flexible bonds, both of which have different advantages. Conventional rigid bonds are mainly used for high mechanical transfers of force and replace traditional fitting methods in this case. They enable a tough adhesive bond on the surfaces to be joined, and meet all practical requirements in terms of their strength properties, as demonstrated by numerous examples in the aircraft and vehicle industry. In contrast, elastic adhesives are increasingly being used in the presence of high dynamic stress resulting from temperature differences or component movements.

Practical Application in Industry

Adhesive technology can be practically integrated into existing production processes in all industrial sectors. Depending on the application, the coating is applied manually, semi-automatically or fully automatically by robot. For this purpose, Henkel provides a complete range of dispensing systems that ensure secure and constant production. According to the quantity and type of adhesive used, a suction device is sometimes necessary – staff is advised to wear protective clothing and equipment in each case. The principal factor in the quality of the bond is the surface quality of the fitting parts. For example, inadequate cleaning of oil or grease from fitted parts to be bonded is a common



source of faults in practical application. Another essential condition is correct application of the adhesive by the staff. The effectiveness of bonded structures is heavily dependent on the production conditions. These include preparation of the fitted parts, correct mixing in the case of 2-component adhesives and their application as well as fixing

of and adherence to curing times. This is why adhesive manufacturers like Henkel regularly arrange seminars and workshops to train specialist workers.

Who Benefits?

The extent to which the use of structural adhesives at metal-processing firms pays off commercially must be assessed on a case-by-case basis. In the design and manufacture of composite materials, the fitting method of bonding provides significant freedom of design and the ability to integrate many functions in one component. Optimizing the materials used not only reduces the weight of the component, but also enables a more cost-effective design. In addition, the possible increase in process speed compared with many mechanical joining technologies also delivers commercial benefits. In terms of visual aspects, one advantage is the prevention of surface pitting due to spot-welded connections.

Before industrial use of structural adhesives, Henkel experts recommend tests under realistic conditions before the product goes into series production. Henkel is on hand with extensive advice and services for industrial customers who want to try out the use of adhesives for their application purposes. At its locations in Garching (near Munich) and Heidelberg, the company also has state-of-the-art centers for development and application technology where tests and analyses through to customer-specific modification and processing of products can be carried out.



Outlook

In view of the prevailing trend towards lightweight design and the targets of high productivity and economic efficiency in manufacture, the use of structural adhesives opens up attractive future prospects for small and large firms alike. They will come increasingly to the fore, as resource-conserving lightweight design is hard to implement without adhesives. There is a clear trend towards composite materials and alloys. In future, the economic success of a metal-processing firm will increasingly depend on the extent to which the high innovation potential is utilized in the manufacture of composite materials. In this context, structural bonding is an important factor, which is why it is constantly referred to as a key technology of the 21st century.

For technical enquiries, contact Loctite Technical Hotline 1300 885 556 or email loctite.enquiries@henkel.com