

**DELO**



Lenses on LED modules



**Adhesive and  
Process Solutions  
for LED Packaging**



# Bonding LED packages

## Adhesives for new lighting concepts

LED technology stands for sustainable modern lighting design. Manufacturers make the most of the infinite design options offered by LEDs to develop versatile, innovative lighting concepts for building technology and lighting engineering in the automotive sector.

Adhesives play a key role in the design and manufacture of LED packages. They are indispensable to the long-lasting function and uniform brightness of the diodes and permit production in the space of a second. The prerequisite however is that the adhesives are precisely tailored to the relevant application area.

DELO has developed special adhesives both for first-level packaging (p. 3), in which the adhesive is located in the immediate vicinity of the LED semiconductor, and for second-level packaging (p. 6), in which the focus is on reliably bonding lenses and housing. In standard tests and implementation by customers worldwide they yield outstanding results and satisfy the high requirements of LED manufacturers.

Manufacturing ever smaller LED packages is one of the requirements. Flip-chip technology (p. 7), and thus the use of conductive adhesives, unlocks new possibilities for manufacturers in this respect.

## LED adhesives – your benefits

- Long-lasting high intensity of the LED and thus high optical quality
- Automated, cost-efficient production possible thanks to light curing
- Design creativity thanks to invisible joining, even of unconventional shapes and materials



**WATCH VIDEO  
NOW**

[www.DELO.show/LED-Bright-Test](http://www.DELO.show/LED-Bright-Test)



Tell our experts what you need and together we will find the right adhesive and process solution for your application field – no matter whether for first-level packaging, second-level packaging, pin sealing or encapsulation. We will be happy to help you turn your product innovations into reality.



# First-level packaging

## LED-compatible adhesives

Adhesives and other materials in the immediate vicinity of the LED semiconductor are generally exposed to considerable stressing by high temperatures and LED radiation. In addition, neither the materials themselves, nor potential outgassing elements may be allowed to negatively interact with the LED.

Above all, adhesives based on densely crosslinked epoxies, like DELO DUALBOND adhesives, have proved their worth in these applications. They not only offer

temperature and light resistance, but also low outgassing levels.

Another crucial advantage is their special curing mechanism combining light and heat. Light curing permits swift fixing of the optical components to one another, while heat curing ensures reliable curing even in shadowed areas. And of course, purely light- or heat-curing adhesives are also available.

## DELO DUALBOND product features

### Long-lasting high intensity of the LED

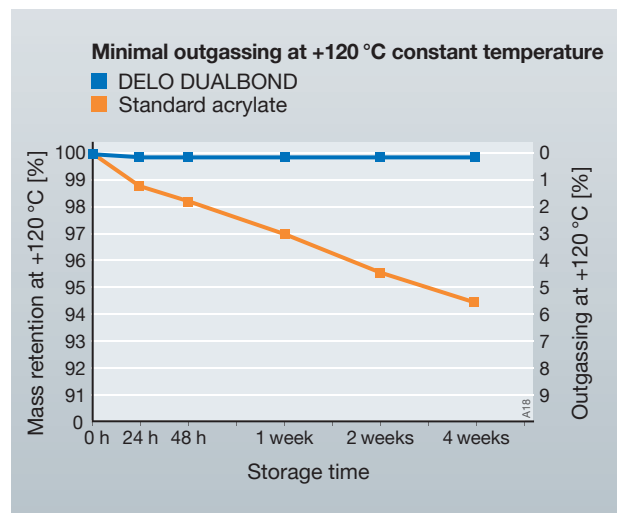
- Minimum outgassing
- Yellowing-resistant
- High temperature resistance

### Swift processes

- Easy dispensing and integration into the production process
- Optimum curing with DELOLUX LED lamps
- Fast prefixing with light possible

### Additional qualities

- Low temperature impact via light curing or heat curing at low temperatures
- Reflow resistance
- Optically clear products available



Significantly lower outgassing of DELO DUALBOND compared to standard acrylates.



Wide range of halogen-free adhesives according to IEC 61249-2-21

### Lens shear test

Polycarbonate lens is sheared off the board by a plunger

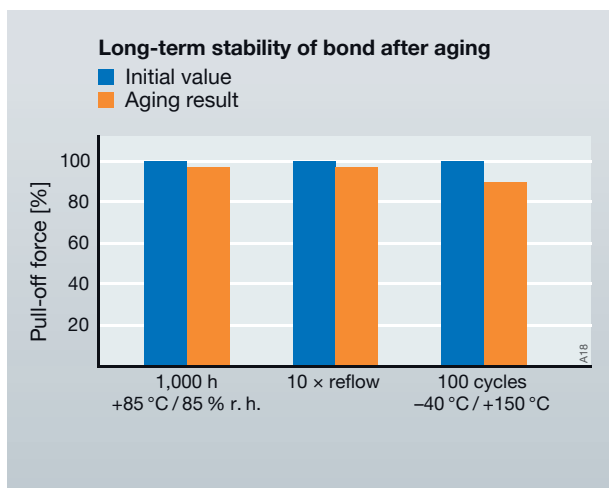


# First-level packaging tests

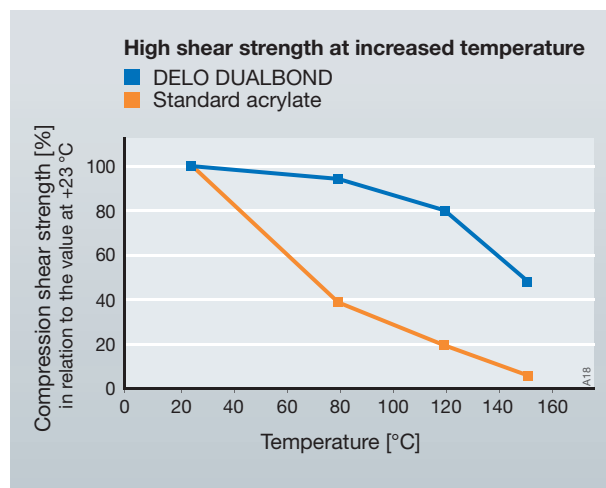
## Test procedure

Reliable joining is an essential prerequisite when bonding optoelectronic components. Various standardized test procedures can be used to verify whether adhesives comply with the relevant requirements. These tests are an important reference for us to optimally advise our customers on their choice of adhesives.

Among other things, DELO DUALBOND adhesives achieve very good results in humidity storage, thermal shock and repeated reflow tests, thus ensure long-lasting bonding stability. They also display high shear strength both at low and high temperatures and thus very good bond strength.



DELO DUALBOND displays high bond strength in standardized reliability tests.



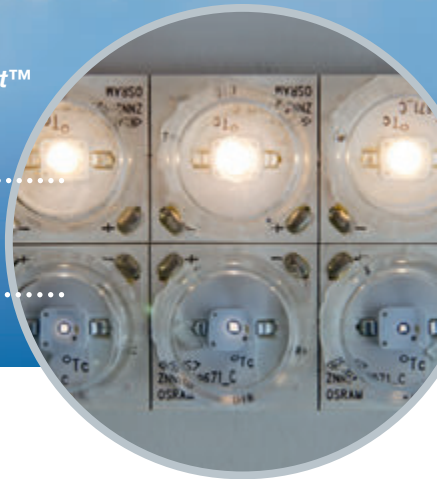
In the lens shear test (see above) DELO DUALBOND shows high bond strength compared to a standard acrylate – especially at high temperatures.



**1,000 h LED Bright Test™**

*DELO DUALBOND OB:  
Permanently high intensity*

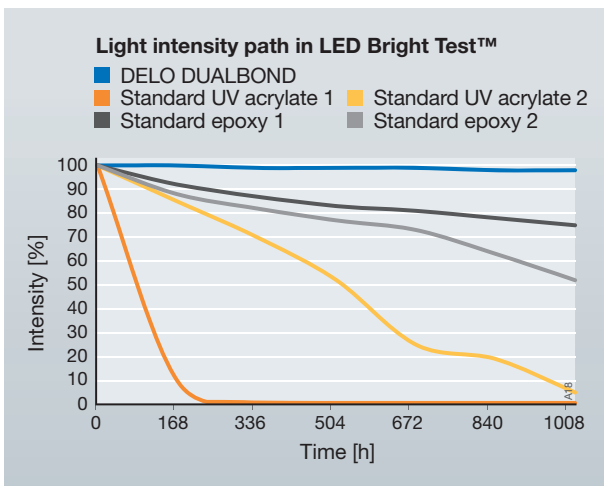
*Standard acrylate:  
Outgassing leads to  
fast LED degradation*



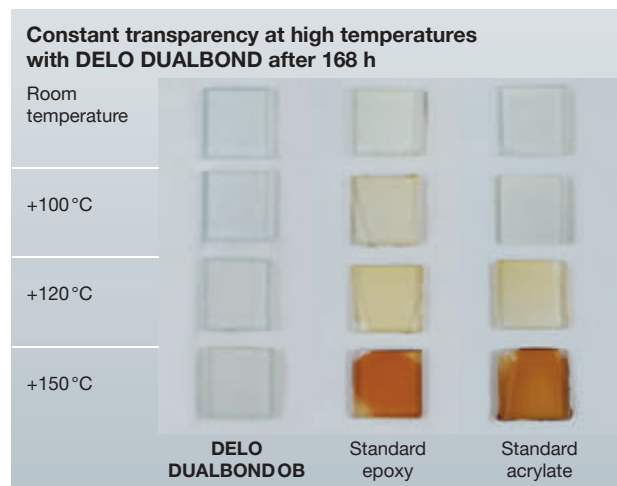
## LED Bright Test™

Adhesives close to the light-emitting diodes are exposed to high stressing due to the heat and radiation given off by the LED. Optical stability may be permanently compromised as a result of yellowing or interaction with decomposition products. DELO DUALBOND adhesives are based on special properties to avoid both these risks.

In the LED Bright Test™ the adhesives display only minimum outgassing and changes in intensity. A further temperature test underscores the adhesive's optical stability at high temperatures. DELO DUALBOND thus ensures permanently uniform LED brightness.



The outgassing behavior of many standard adhesives reduces LED intensity whereas DELO DUALBOND remains stable.



DELO DUALBOND OB adhesives are stabilized against thermal aging so they remain transparent.

Precise, fast and automated application of lenses with UV adhesives



1 Dispensing of DELO PHOTOBOND

2 Placement of the lens on the LED module

3 Light curing with DELOLUX 80

## Second-level packaging

### Tension-equalizing adhesives

Adhesives used to join lenses, covers, housing and housing components around LED modules are subject to different requirements to first-level packaging. Above all, due to the greater dimensions and different materials used, they need to be proficient in equalizing any tensions that may arise, for instance, due to changes in temperature. As joints are usually accessible to light, light-curing adhesives in the DELO PHOTOBOND series have proved their worth in this application area.

### DELO PHOTOBOND product features

#### High LED intensity

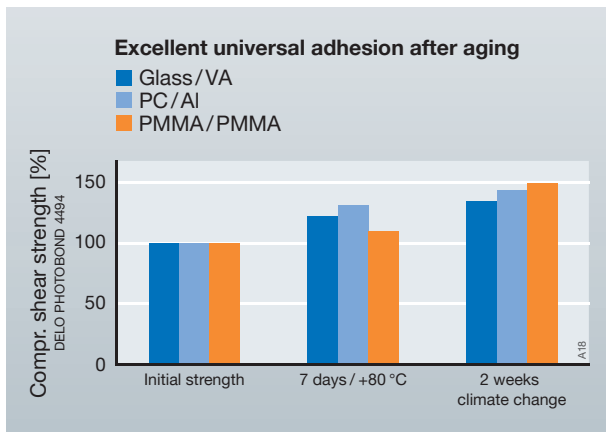
- Low-outgassing
- Yellowing-resistant

#### Permanent bonding

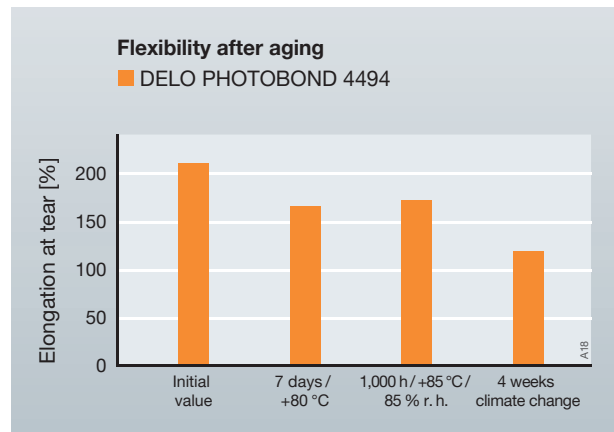
- Tension-equalizing
- Humidity-, vibration- and temperature-resistant
- Universally good adhesion

#### Processing advantage

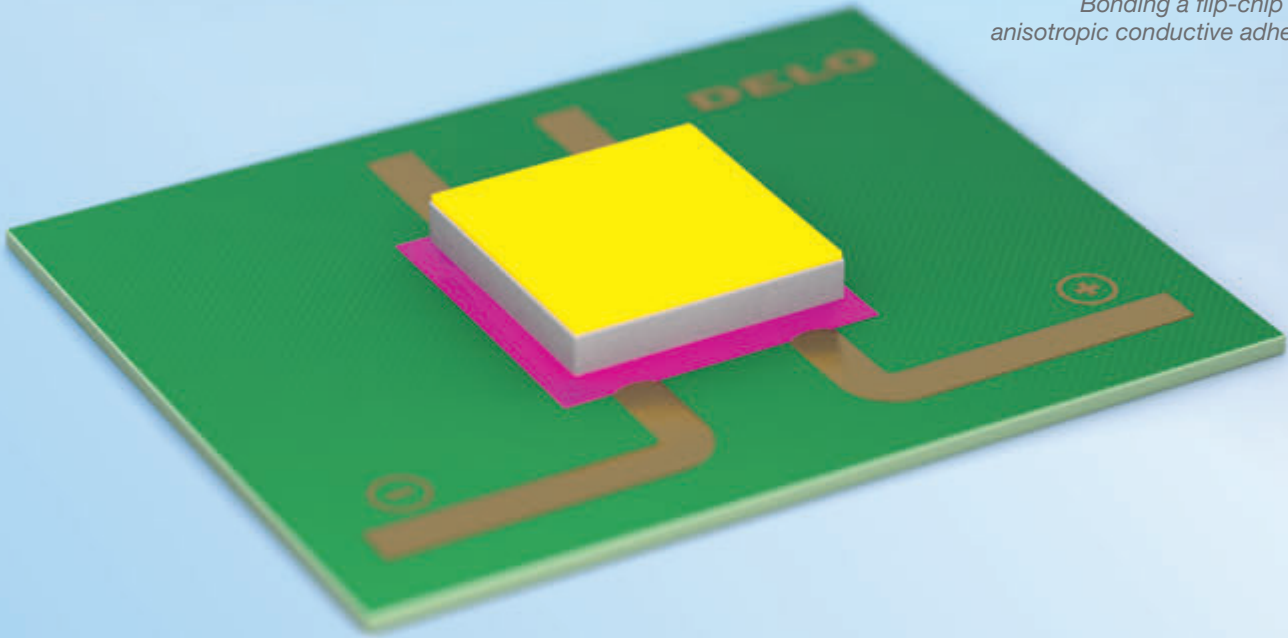
- Light curing in seconds
- Different viscosity versions



During the aging process compression shear strength increases slightly while at the same time tension-equalizing properties are preserved.



Even after the aging process DELO PHOTOBOND 4494 retains its flexibility with elongation at tear greater than 120%.



# Flip-chip technology for LED packaging

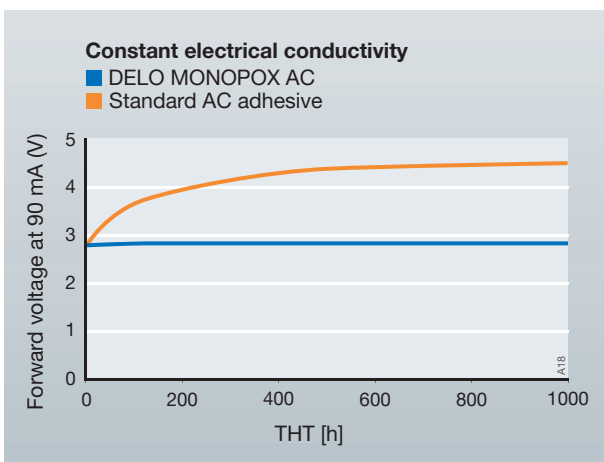
## Anisotropic conductive adhesives

In many LED applications there has been a clear trend towards the use of ever smaller LED chips; edge lengths of less than 200  $\mu\text{m}$  are by no means uncommon. However, conventional contacting via bond wires with pad sizes already of similar dimensions, results in high light yield losses and processing difficulties.

In this case, flip-chip LEDs are the technology of the future. With contacts on the substrate side and anisotropic electrically conductive adhesives they can be bonded directly to the substrate, thus eliminating the need for a further wire bond or reflow process. This also enables the use of different substrates, including the flexible films with metallic coating which are indispensable for new lighting concept designs.

DELO MONOPOX AC series adhesives, which are filled with conductive particles, were specially developed for bonding flip-chips and ensure both permanent contacting and high processing rates.

For many years now DELO has led the market in contacting flip-chips for RFID labels in roll-to-roll processing. Drawing on close cooperation with machine builders, DELO can best advise and support customers both in their choice of adhesives and at process level.



DELO MONOPOX AC adhesives ensure constant electrical conductivity.



# CONTACT

**DELO** Industrial Adhesives  
Headquarters

▶ **Germany** · Windach / Munich .....

- ▶ **China** · Shanghai
- ▶ **Japan** · Yokohama
- ▶ **Malaysia** · Kuala Lumpur
- ▶ **Singapore**
- ▶ **South Korea** · Seoul
- ▶ **Taiwan** · Taipei
- ▶ **Thailand** · Bangkok
- ▶ **USA** · Sudbury, MA

..... [www.DELO-adhesives.com](http://www.DELO-adhesives.com)



The data and information provided are based on tests performed under laboratory conditions. Reliable information about the behavior of the product under practical conditions and its suitability for a specific purpose cannot be concluded from this. It is the customer's responsibility to test the suitability of a product for the intended purpose by considering all specific requirements and by applying standards the customer deems suitable (e.g. DIN 2304-1). Type, physical and chemical properties of the materials to be processed with the product, as well as all actual influences occurring during transport, storage, processing and use, may cause deviations in the behavior of the product compared to its behavior under laboratory conditions. All data provided are typical average values or uniquely determined parameters measured under laboratory conditions. The data and information provided are therefore no guarantee for specific product properties or the suitability of the product for a specific purpose. Nothing contained herein shall be construed to indicate the non-existence of any relevant patents or to constitute a permission, encouragement or recommendation to practice any development covered by any patents, without permission of the owner of this patent. All products provided by DELO are subject to DELO's General Terms of Business. Verbal ancillary agreements are deemed not to exist.

© DELO – This brochure including any and all parts is protected by copyright. Any use not expressly permitted by the Urheberrechtsgesetz (German Copyright Act) shall require DELO's written consent. This shall apply without limitation to reproductions, duplications, disseminations, adaptations, translations and microfilms as well as to the recording, processing, duplication and/or dissemination by electronic means. 03/19

ADHESIVES

DISPENSING

CURING

CONSULTING

**DELO**