



LOCTITE[®] 3211™

June 2006

PRODUCT DESCRIPTION

LOCTITE[®] 3211™ provides the following product characteristics:

Technology	Acrylic
Chemical Type	Acrylated urethane
Appearance (uncured)	Transparent to slightly hazy liquid ^{LMS}
Components	One component - requires no mixing
Viscosity	Medium, thixotropic
Cure	Ultraviolet (UV)/ visible light
Cure Benefit	Production - high speed curing
Application	Bonding
Flexibility	Enhances load bearing & shock absorbing characteristics of the bond area.

LOCTITE[®] 3211™ is primarily designed for bonding polycarbonate to itself, while not inducing stress cracking under typical molded stress levels. LOCTITE[®] 3211™ cures rapidly to form flexible, transparent bonds when exposed to ultraviolet light and/or visible light of sufficient irradiance and has shown excellent adhesion to a wide variety of substrates including glass, many plastics and most metals. The thixotropic nature of LOCTITE[®] 3211™ reduces the migration of liquid product after application to the substrate.

ISO-10993

An ISO 10993 Test Protocol is an integral part of the Quality Program for LOCTITE[®] 3211™. LOCTITE[®] 3211™ has been qualified to Loctite's ISO 10993 Protocol as a means to assist in the selection of products for use in the medical device industry. Certificates of Compliance are available at www.loctite.com or through the Henkel Loctite Quality Department.

TYPICAL PROPERTIES OF UNCURED MATERIAL

Specific Gravity @ 25 °C	1.13
Refractive Index	1.48
Flash Point - See MSDS	
Viscosity, Brookfield - RVT, 25 °C, mPa·s (cP):	
Spindle 5, speed 20 rpm	8,000 to 14,500 ^{LMS}

TYPICAL CURING PERFORMANCE

LOCTITE[®] 3211™ can be cured by exposure to UV and/or visible light of sufficient intensity. To obtain full cure on surfaces exposed to air, radiation @ 220 to 260 nm is also required. The speed of cure will depend upon the UV intensity and spectral distribution of the light source, the exposure time and the light transmittance of the substrates.

Stress Cracking

Liquid adhesive is applied to a medical grade polycarbonate bar 6.4 cm by 13 mm by 3 mm which is then flexed to induce a known stress level.

Stress Cracking, ASTM D 3929, minutes:
17 N/mm² stress on bar >15

Fixture Time

Fixture time is defined as the time to develop a shear strength of 0.1 N/mm².

UV Fixture Time, Glass microscope slides, seconds:

Black light, Zeta[®] 7500 light source:
6 mW/cm², measured @ 365 nm ≤18^{LMS}

UV Fixture Time, Polycarbonate, seconds:

Metal halide bulb (doped), Zeta[®] 7400:
30 mW/cm², measured @ 365 nm, 5 to 10

Electrodeless, H & V bulbs:
50 mW/cm², measured @ 365 nm, <5

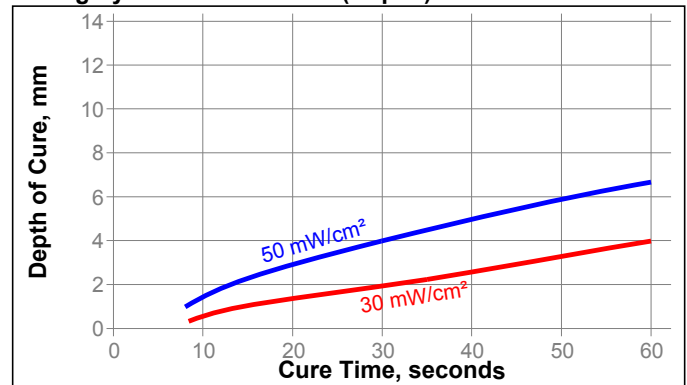
Electrodeless, D bulb:
50 mW/cm², measured @ 365 nm, <5

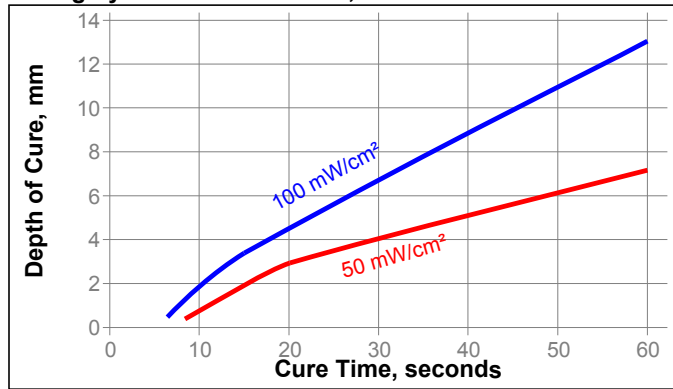
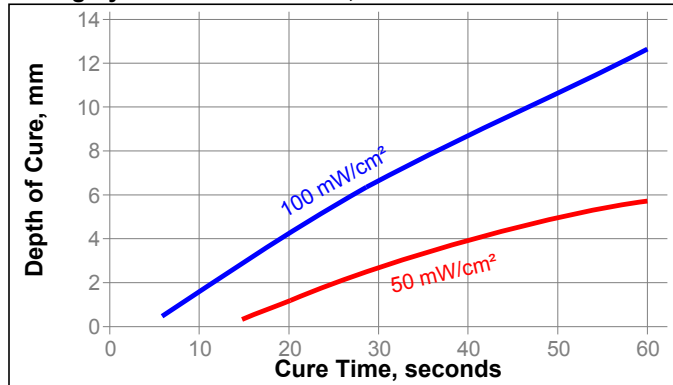
Depth of Cure vs. Irradiance (365 nm)

The graph below shows the increase in depth of cure with time at 50mW/cm² - 100mW/cm² as measured from the thickness of the cured pellet formed in a 15mm diameter PTFE die.

Note: When exposed to a V Bulb at irradiances of 50 and 100 mW/cm² for 30 to 60 seconds, a depth of cure greater than 13 mm was achieved. The performance for medium pressure Hg will be similar to Electrodeless system, H bulb.

Curing System: Metal Halide (Doped)



Curing System: Electrodeless, D bulb**Curing System: Electrodeless, H bulb****TYPICAL PROPERTIES OF CURED MATERIAL**

Cured @ 30 mW/cm², measured @ 365 nm, for 80 seconds using a glass filtered metal halide light source

Physical Properties:

Shore Hardness, ISO 868, Durometer D	51
Refractive Index	1.5
Water Absorption, ISO 62, %:	
2 hours in boiling water	2.72
Elongation, at break, ISO 527-3, %	260
Tensile Modulus, ISO 527-3	N/mm ² 207 (psi) (30,000)
Tensile Strength, at break, ISO 527-3	N/mm ² 17 (psi) (2,500)

Electrical Properties:

Dielectric Constant / Dissipation Factor, IEC 60250:	
100 Hz	5.69 / 0.04
1 kHz	5.61 / 0.02
1 MHz	5.13 / 0.04
Volume Resistivity, IEC 60093, Ω·cm	8.9×10 ¹⁴
Surface Resistivity, IEC 60093, Ω·cm	8.7×10 ¹⁴
Dielectric Breakdown Strength, IEC 60243-1, kV/mm 24	

TYPICAL PERFORMANCE OF CURED MATERIAL**Adhesive Properties**

Cured @ 30 mW/cm², measured @ 365 nm, for 80 seconds using a metal halide light source, (samples with 0.5 mm gap).

Lap Shear Strength, ISO 4587:

Polycarbonate	N/mm ² 11 (psi) (1,600)
---------------	---------------------------------------

TYPICAL ENVIRONMENTAL RESISTANCE

Cured @ 30 mW/cm², measured @ 365 nm, for 80 seconds using a metal halide light source, (samples with 0.5 mm gap).

Lap Shear Strength, ISO 4587:

Polycarbonate

Heat Aging

Aged at temperature indicated and tested @ 22 °C

Lap Shear Strength, ISO 4587, % of initial strength:

Polycarbonate:

Aged @ 71 °C for 170 hours	100
Aged @ 71 °C for 340 hours	100
Aged @ 93 °C for 170 hours	100
Aged @ 93 °C for 340 hours	100
Aged @ 121 °C for 170 hours	75
Aged @ 121 °C for 340 hours	60

Chemical/Solvent Resistance

Aged under conditions indicated and tested @ 22 °C.

Environment	°C	% of initial strength		
		2 h	24 h	170 h
Boiling water	100	70	-----	-----
Water immersion	49	-----	-----	60
IPA immersion	22	-----	95	-----
Heat/humidity	38	-----	-----	75

Effects of Sterilization

In general, products similar in composition to LOCTITE® 3211™ subjected to standard sterilization methods, such as EtO and Gamma Radiation (25 to 50 kiloGrays cumulative) show excellent bond strength retention. LOCTITE® 3211™ maintains bond strength after 1 cycle of steam autoclave. It is recommended that customers test specific parts after subjecting them to the preferred sterilization method. Consult with Loctite® for a product recommendation if your device will see more than 3 sterilization cycles.

GENERAL INFORMATION

This product is not recommended for use in pure oxygen and/or oxygen rich systems and should not be selected as a sealant for chlorine or other strong oxidizing materials.

For safe handling information on this product, consult the Material Safety Data Sheet (MSDS).

Directions for use

1. This product is light sensitive; exposure to daylight, UV light and artificial lighting should be kept to a minimum during storage and handling.
2. The product should be dispensed from applicators with black feedlines.
3. For best performance bond surfaces should be clean and free from grease.
4. Cure rate is dependent on lamp intensity, distance from light source, depth of cure needed or bondline gap and light transmittance of the substrate through which the radiation must pass.
5. Recommended intensity for cure in bondline situation is 5 mW/cm² minimum (measured at the bondline) with an exposure time of 4-5 times the fixture time at the same intensity.
6. For dry curing of exposed surfaces, higher intensity UV is required (100 mW/cm²).

7. Cooling should be provided for temperature sensitive substrates such as thermoplastics.
8. Plastic grades should be checked for risk of stress cracking when exposed to liquid adhesive.
9. Excess uncured adhesive can be wiped away with organic solvent (e.g. Acetone).
10. Bonds should be allowed to cool before subjecting to any service loads.

Loctite Material Specification^{LMS}

LMS dated November 30, 2001. Test reports for each batch are available for the indicated properties. LMS test reports include selected QC test parameters considered appropriate to specifications for customer use. Additionally, comprehensive controls are in place to assure product quality and consistency. Special customer specification requirements may be coordinated through Henkel Quality.

Storage

Store product in the unopened container in a dry location. Storage information may be indicated on the product container labeling.

Optimal Storage: 8 °C to 21 °C. Storage below 8 °C or greater than 28 °C can adversely affect product properties.

Material removed from containers may be contaminated during use. Do not return product to the original container. Henkel Corporation cannot assume responsibility for product which has been contaminated or stored under conditions other than those previously indicated. If additional information is required, please contact your local Technical Service Center or Customer Service Representative.

Conversions

$(^{\circ}\text{C} \times 1.8) + 32 = ^{\circ}\text{F}$
 $\text{kV/mm} \times 25.4 = \text{V/mil}$
 $\text{mm} / 25.4 = \text{inches}$
 $\mu\text{m} / 25.4 = \text{mil}$
 $\text{N} \times 0.225 = \text{lb}$
 $\text{N/mm} \times 5.71 = \text{lb/in}$
 $\text{N/mm}^2 \times 145 = \text{psi}$
 $\text{MPa} \times 145 = \text{psi}$
 $\text{N}\cdot\text{m} \times 8.851 = \text{lb}\cdot\text{in}$
 $\text{N}\cdot\text{m} \times 0.738 = \text{lb}\cdot\text{ft}$
 $\text{N}\cdot\text{mm} \times 0.142 = \text{oz}\cdot\text{in}$
 $\text{mPa}\cdot\text{s} = \text{cP}$

Note

The data contained herein are furnished for information only and are believed to be reliable. We cannot assume responsibility for the results obtained by others over whose methods we have no control. It is the user's responsibility to determine suitability for the user's purpose of any production methods mentioned herein and to adopt such precautions as may be advisable for the protection of property and of persons against any hazards that may be involved in the handling and use thereof. In light of the foregoing, **Henkel Corporation specifically disclaims all warranties expressed or implied, including warranties of merchantability or fitness for a particular purpose, arising from sale or use of Henkel Corporation's products. Henkel Corporation specifically disclaims any liability for consequential or incidental damages of any kind, including lost profits.** The discussion herein of various processes or compositions is not to be interpreted as representation that they are free from domination of patents owned by others or as a license under any Henkel Corporation patents that may cover such processes or compositions. We recommend that each

prospective user test his proposed application before repetitive use, using this data as a guide. This product may be covered by one or more United States or foreign patents or patent applications.

Trademark usage

Except as otherwise noted, all trademarks in this document are trademarks of Henkel Corporation in the U.S. and elsewhere. ® denotes a trademark registered in the U.S. Patent and Trademark Office.

Reference 1.1