

November 2014

APM Unocol 382

Description	
System:	UV/VIS light-curing adhesives
Adhesive type:	modified urethane acrylate
Colour:	colourless, transparent
Viscosity:	liquid/thixotropic
Solid bodies:	100% / solvent-free
Curing:	UV light/blue light
Temp. range:	-55 °C to +125 °C, dense up to +150°C

Application / specifications	
APM number:	102834
Application:	Medicinal instruments
Adhesion:	glass / metal / plastics
Biocompatibility:	fulfils ISO 10993 fulfils USP Class VI
Directive 2011/65/EC:	fulfils RoHS Directive
EC - no. 1907/2006:	fulfils REACH requirement

Unocol 382 is a flexible acrylate adhesive. The adhesive can be cured with UV light or visible light. Unocol 382 is typically used for plastic bonds, particularly soft PVC (plastic tubes) and polycarbonates. However, the adhesive also has very good adhesion to glass or metal. A thin glue line of 0.10 mm is typical. It can be varied from 0.05 to 0.5 mm due to its high viscosity depending on the dimensions of the parts to be bonded, the temperature range and the difference in thermal expansion. Unocol 382 is often used to adhere plastic or glass displays and as an adhesive for electronic devices or sensors. The advantage of Unocol 382 is the long shelf life of the liquid adhesive at room temperature with the possibility of rapid curing under UV light or visible blue light. Many plastics are

Properties of fluid adhesive	
Colour:	colourless transparent
Characterisation:	urethane acrylate
Viscosity (25°C):	5 - 10 Pa.s
Density (25°C):	1.08 g/cm ³
Refractive index (25°C):	1.49

Surface pretreatment / cleaning

The surfaces to be bonded must be dry and free from dust, oil, separating agents and other impurities. The selected type of surface pretreatment is dependent on the requirements profile (cleanliness, strength, age resistance). Above all, mechanical pretreatment, e.g. grinding or sand-blasting, achieves an improvement in adhesion for metals and in many cases for non-ferrous surfaces as well.

It is best to clean glass surfaces using the aqueous ultrasound cleaning method at raised temperature. Clean metallic surfaces with aqueous cleaners or clean solvents.

For many materials and in particular plastics, surface pretreatment using plasma has proven successful. Plasma treatment dries the surface and improves wettability. This achieves good adhesion of the adhesive.

With plastics, the surface is also chemically modified. With poor adhesive plastics this produces an adhesive surface.

Primers are no replacement for surface pretreatment. Adhesion and ageing resistance can also be improved by using primers.

The adhesive can be completely cured within a few seconds by exposure to UV light at a wavelength of 365 nm or blue light of 405 nm. In areas where the light does not reach the adhesive, it remains liquid and only hardens thermally at temperatures of more than 120 °C.

Curing the adhesive

UV light 365 nm	50 mW/cm ²	15 seconds
UV light 365 nm	1000 mW/cm ²	3 seconds
Blue light 405 nm	50 mW/cm ²	30 seconds
Blue light 405 nm	1000 mW/cm ²	10 seconds

After the adhesive is cured, the parts can be further processed. However, the bond only achieves optimum strength and resistance after a few days.

Applying the adhesive

The ideal processing temperature is between 20°C and 28°C. Viscosity falls at high temperature. It is not necessary to store the adhesive in the refrigerator after opening the container. Normally, the adhesive can be applied from the cartridge using a dosing device. The adhesive can also be applied with a steel needle or a spatula. Optimum strength can be achieved with adhesive thicknesses of 0.05 to 0.15 mm. Optimum resistance is dependent on the temperature range and the expansion coefficients of single parts. A uniform adhesive thickness can be ensured by a specific bond geometry or by inserting spacers, e.g. glass fibres or plastic beads.

Properties of cured adhesive

Colour:	colourless transparent
Shore D (25°C):	53
Thermal conductivity:	1.6 W/mK
Therm. expansion (0-40 °C)	$\alpha = 110 \times 10^{-6}/K$
Refractive index (25 °C):	1.50
Therm. expansion (0-40 °C)	$\alpha = 120 \times 10^{-6}/K$
	(-40-0°C) $60 \times 10^{-6} /K$
	(40-85°C) $170 \times 10^{-6} /K$
Softening temperature T _g :	35 to 45 °C
Tensile strength (25°C):	20 N/mm ²
Elongation at rupture (25°C):	250 %
E-module (25 °C):	200 N/mm ²
Dielectric strength:	26.0 kV/mm
Dielectric constant 25°C:	5.0 at 1.0 KHz

Cleaning the adhesive

Residue from non-cured adhesive on the substrates and processing equipment can be removed or cleaned using a solvent such as isopropanol or acetone. Organic solvents may lead to component destruction or stress cracking in plastics. For this reason, avoid use of aggressive solvents such as acetone, ketones and esthers. Comply with the official safety regulations when handling combustible solvents. Cured adhesive can only be removed mechanically. The adhesive becomes very soft at temperatures over 100 °C.

Temperature stability

The typical application temperature range is from -55 °C to +125°C. Depending on the application, the adhesive can also be used below -55 °C. The adhesive becomes very hard at these temperatures and may result in cracks in the substrate or signs of the adhesive detaching from the substrate.

At temperatures of +100°C the adhesive becomes very soft, which may be an advantage depending on the load since the adhesive can compensate for a variety of thermal expansion stresses without becoming destroyed. After cooling down to room temperature, the adhesive re-assumes its usual properties. Thermal destruction of the adhesive only occurs at temperatures over 175 °C.

Tensile shear strength / material

Tensile shear strength according to ASTM-D 1002 shows the excellent adhesion of the adhesive on various substrates:

Tensile shear strength at 23°C:	
Polycarbonate on glass	7.2 N/mm ²
Polycarbonate on polycarbonate	5.2 N/mm ²
PMMA (perspex) on glass	5.9 N/mm ²
PMMA (perspex) on PMMA	4.9 N/mm ²
ABS on glass	5.5 N/mm ²
Soft PVC on polycarbonate	2.4 N/mm ²
GFK (epoxy) on glass	11.0 N/mm ²
Glass on glass	12.5 N/mm ²

Ageing resistance of adhesive bonds

The typical application temperature range of Unocol 382 is from -55°C to +125°C. Adhesive bonds are very age resistant within this temperature range. The cured adhesive has excellent temperature stability and solvent resistance.

Tensile shear strength after ageing

Polycarbonate on polycarbonate	5.2 N/mm ²
Thermal cabinet 7 days at +125 °C	6.5 N/mm ²
Stored in water 50°C after 2 h	5.2 N/mm ²
Thermal cabinet 14 days at +150 °C	11.3 N/mm ²
Thermal cabinet 21 days at +120°C	15.0 N/mm ²
Boiling water after 2 h at 100°C	5.2 N/mm ²
50°C / 90 % rel. hum. after 7 days	5.2 N/mm ²
Isopropanol at 23°C and 24 h	5.2 N/mm ²

Safety instructions

Avoid contact with skin and eyes. When applying the adhesive, always wear gloves and safety goggles. If adhesive comes into contact with the skin, do not use solvents to remove. Instead wash the affected area (hands) with warm water and soap and then dry. Liquid adhesive irritates on contact with the eyes and may lead to permanent eye damage. Before use, please observe the instructions in the safety data sheet.

Storage

The adhesive has the best shelf life at temperatures between 8°C and 25°C. The adhesive shelf life in its unopened original packaging is at least 12 months under these conditions. Higher temperatures shorten the standard shelf life. Lower temperatures cause a temporary higher viscosity.

Compliance

Unocol 382 and all its constituents comply with the requirements of the RoHS Directive and REACH regulations. Always comply with the safety data sheet when handling the adhesive.

Procurement

The light-sensitive adhesive is available in black standard cartridges of 5 / 10 / 30 or 55 cc. Unocol 382 can also be supplied to customer requirements filled in containers.

Disposal

The liquid components of the adhesive must be disposed of as hazardous waste in the same way as synthetic resin or paint components. Cured adhesive is disposed of as hazardous waste in the same way as thermosetting plastics depending on local legal requirements or as domestic waste.

The specifications in this data sheet are based on meticulous tests and our previous experience in everyday practice. They are non-binding instructions, in the same way as our application advisories are also non-binding, whether verbal, in writing or by trials since we cannot accept any liability due to the wide variety of possible influences during processing and application. APM Technica AG disclaims all other explicit or implicit warranties, conditions and terms, be they of real or legal nature, including those which refer to usual market quality, their suitability for a particular use, satisfactory quality or observance of third-party trademarks. APM Technica excludes all liability to the extent permitted by law – whether arising from contract, quasi contract or tort (including negligence) – for direct, indirect and consequential damages, punitive damages awarded by court, loss of business of all kinds, loss of information or data or any other financial losses which may result from the sale, installation, maintenance, use, performance, failure or interruption of operation of the product or in connection therewith, even if we were informed of the possibility of occurrence of such damages. Data and other specifications concerning the nature and suitability of our products are non-binding general conditions and specifically represent no guarantee of certain characteristics. We advise you to perform your own adequate tests to determine the suitability of our products for your specific application. The user is himself responsible for defining the suitability of production methods mentioned in the technical data sheet for his purposes and for taking precautionary measures which are suitable to protect assets and persons from any danger which may occur during the handling and usage of these products. In all other respects our General Terms and Conditions of Business shall apply.