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Easy-Mix PE-PP

Complex series of tests
at English university

Bonding instead of welding



www.weicon.com





Bonding instead of welding

Complex series of tests at English university

A research team at the University of Northumbria in Newcastle, England, has conducted extensive experiments with various adhesives – also a WEICON product was among the tested.

Objective target

The aim of the experiments was to find out whether gas pipes can better and more economically be connected using adhesives instead of the commonly used electrofusion welding process.

The research project was supported by well-known adhesive manufacturers, including WEICON, who provided the researchers with the materials they needed for the experiments.

Preparation

For the test series pipe sections of usual gas pipelines for road constructions were provided with a T-piece normally used for house connections. The T-connectors were not connected by electrofusion welding but bonded with the different adhesives.

This was the biggest challenge for the researchers. The polyethylene pipes which is a low-energy plastic can normally only be bonded with special technical adhesives such as WEICON Easy-Mix PE-PP.



Complex test series

The prepared specimens were tested in three experiments. The series started with a quasi-static compression test. Slowly, pressure was set up to simulate the loads through the ground. The second one was a shock test. The bonding was hit by a weight that fell from a certain height onto the specimen. This should simulate the load of a cut with a spade at the building site. In the third test the gas tightness was tested. The T-piece was charged with the multiple of the normal operating pressure.

These experiments simulated the influences realistically that the pipes will later be exposed to in practice. In real life, the adhesive bondings are subjected to ground movements and heat expansion, and need to be able to withstand such influences for a long period of time.



Complex series of tests at English university

Bonding instead of welding

Results

In the quasi-static compression test the bonding with Weicon Easy-Mix PE-PP 45 could not be destroyed. Instead, the branch pipe of the T-piece was deformed by the experiment. In the impact test a weight of 10 kg, which was dropped from a height of 1.7 meters, could not cause significant damage to the bonding. In the experiment for gas tightness the T-piece was charged about three hundred times of the normal operating pressure of a gas pipeline. No drop of pressure was observed after 24 hours.

Conclusion

In test series in which tensile and impact energies were brought to the bonding, WEICON Easy-Mix PE-PP 45 scored the best results and could be clearly distinguished from all competitive products.

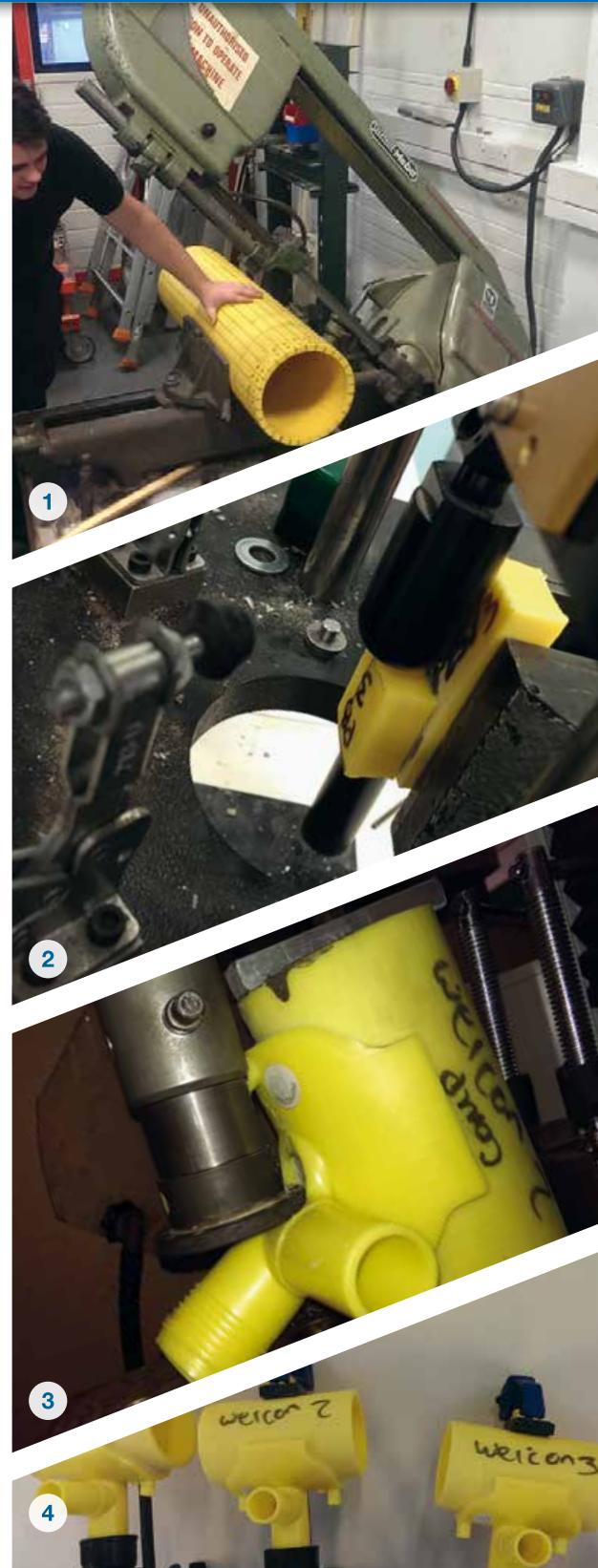
It was clearly shown that certain adhesives could be an economical and technical alternative to the currently usual electrofusion welding process and should be considered when planning processing steps.

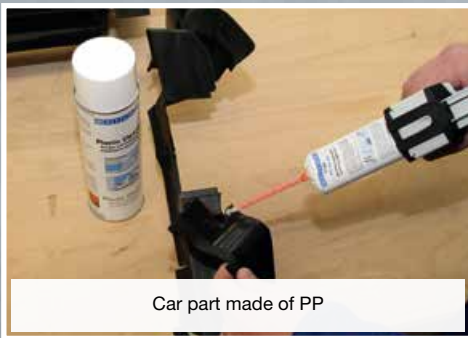
Very good results

Holger Lütfring, product manager at WEICON: "When the research team from England contacted us, we got on board right away and needless to say were happy to provide them with our products. We have followed the complex trials with great interest. Of course, we are even more excited that our Easy-Mix PE-PP performed as the best product in the test series!"

The results of the experiments are of great interest to industrial sectors such as the operators of supply networks, as they have direct practical relevance and now offer engineers a real alternative to the previous welding method.

- 1 Preparation of the test samples
- 2 Fixed sample for impact test
- 3 Material failure of the T-piece
(bonding is still intact)
- 4 Fixed T-pieces





Car part made of PP



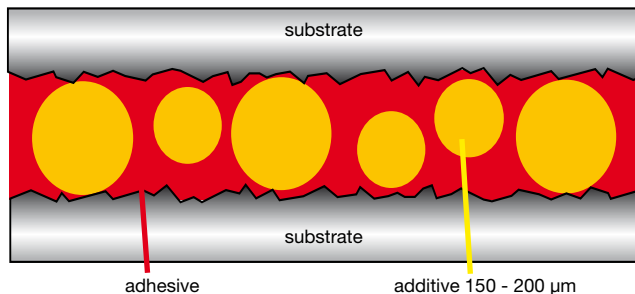
Switch housing made of flame-retarding ABS



WEICON Easy-Mix PE-PP 45 features the following characteristics:

- No pre-treatment of the parts to be bonded („integrated primer“)
- Short pot life and processing time
- Fast development of strength
- High final strength
- Curing with residual elasticity
- Aging resistant
- Chemical resistant
- Controlled bonding gap of min. 0.15-0.20 mm through special additives (glass beads)
- Pasty, stable

Graphical representation of a bonding gap with WEICON Easy-Mix PE-PP



Thanks to the modern mixing and dosing system WEICON Easy-Mix, the adhesive can be cleanly and accurately automatically dosed, mixed and applied in only one working operation.

Product advantages:

- ready for use
- dosing, mixing and application in just one working operation
- tedious mixing by hand is no longer necessary, so that no mixing and dosing mistakes are possible
- speedy in application, thus faster cycle times in series production are possible
- economical in use, due to minimal material wastage

Processing:

The prerequisite for perfect adhesion are clean and dry surfaces (e.g. cleaning and degreasing with Cleaner S or Plastic Cleaner). Smooth surfaces can be roughened mechanically, for example with grinding paper grain size P 120.

WEICON Easy-Mix PE-PP 45 can only be processed with the WEICON Dispenser Pistol with special piston (10:1) and the special mixing nozzles for this system. It is absolutely essential that the mixing nozzle is put on correctly (details hereof can be found in the instructions for use attached to each packing unit).

Optimum processing is at room temperature (+20°C/+68°F to +25°C/+77°F).

WEICON Easy-Mix PE-PP 45 has a pot life and a processing time of approx. 2-3 minutes. Immediately after the application of the adhesive, the parts to be bonded should be joined, then positioned and fixed for curing.

The integrated additives (glass beads) provide a minimum thickness of the adhesive layer of 0.15 mm to 0.20 mm. This thickness is required for the chemical reaction between the adhesive and the plastic to be bonded. Best strength values are achieved with adhesive layers of 0.20 mm to 0.30 mm.

Physiological properties / health and safety at work

Structural Acrylic Adhesives

PE-PP 45

Easy-Mix PE-PP 45

Fast, high strength, process-safe

WEICON Easy-Mix PE-PP 45 is a two-component construction adhesive on the basis of methyl acrylate. It is in particular suitable for structural, high-strength bonding of low energy plastics like PE, PP and TPE. A pre-treatment of the surfaces to be bonded is not required.

In addition, WEICON Easy-Mix PE-PP 45 can be used as „universal adhesive“ for plastics like:

- Rigid PVC (polyvinyl chloride)
- PA (polyamide)
- PC (polycarbonate)
- ABS (acrylonitrile-butadiene styrene)
- PMMA (polymethyl methacrylate)
- Fibre reinforced materials (GRP, CRP, fibre glass etc.) and many others.



38 ml
10660038

WEICON Easy-Mix PE-PP 45, when properly handled and completely cured, is toxicologically essentially harmless. When using the adhesive, the physical, safety technical, toxicological and ecological data and regulations in our EC safety data sheets (www.weicon.com) must be observed.

Storage

6 months at 0°C to +4°C (+32°F to +39°F)

3 months at +20°C to +25°C (+68°F to +77°F)

Plastics like PE and PP are increasingly used in almost all industrial areas nowadays due to their specific properties, like plasticity, elasticity, breaking strength, and temperature, thermoforming, and chemical resistance.

For the adhesion of these plastics, the surfaces have had to be extensively pretreated until now, for example:

- Mechanically (grinding, sandblasting, etc.)
- Chemically (fluorination)
- Physically (flame treatment, corona, plasma)

With the new adhesive WEICON Easy-Mix PE-PP 45, these pretreatments are no longer required. The „primer integrated“ into the adhesive activates the surfaces and makes high-strength bonds possible.

WEICON Easy-Mix PE-PP 45 can be used for individual applications as well as for small-lot fabrication or industrial series production, e.g. bonding and repair of small appliances, signs and displays, loudspeaker parts, battery housings, plastic tanks and many other plastic parts.



Hand Dispenser PE-PP
10663038

Mixing Nozzles PE-PP
10660002

Special Piston
10663110

For retooling the Hand Dispenser
Easy-MixD 50 to Easy-Mix PE-PP 45

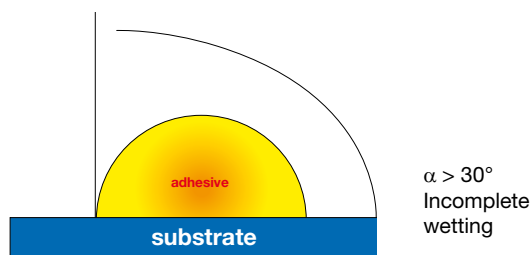


Plastic adhesive bonds with WEICON Easy-Mix PE-PP 45

Difficulties in the adhesion of plastics arise from a low surface tension (low-energy) and the resulting incomplete wetting of the adhesive surface.

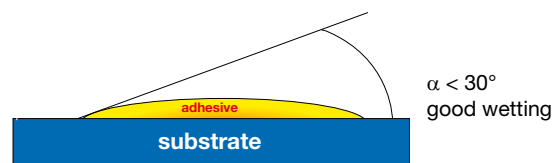
Incomplete wetting:

- Low surface tension of the material
- Low adhesive power



Good wetting:

- High surface tension of the material
- High adhesive power



WEICON Easy-Mix PE-PP 45 increases the surface tension of low-energy plastics through a chemical interaction between the plastic and the adhesive („integrated primer“). PE and PP can thus be adhered at strengths up to material breakage.

Some materials and the values of their surface tension are listed in the following table. The lower the surface tension, the more difficult it is to adhere the materials.

Material	Abbreviation	Surface Tension mN/m
Low surface tension (difficult to bond)		
Polypropylene	PP	29
Polyethylene	PE, HDPE	31
Polyester	PBT	32
Polyamide	PA	<36
Acrylic	PMMA	<36
Epoxy resin	EP	<36
Polyacetal	POM	<36
High surface tension (easy to bond)		
Polystyrene	PS	38
Polyvinylchloride	PVC	39
Polyester	PET	41
Phenolic resin	PF	42
Polyurethane	PUR	43
Polycarbonate	PC	46
Water	H ₂ O	73
Aluminium	Al	840
Copper	Cu	1100
Iron	Fe	2550

Structural Acrylic Adhesives

PE-PP 45

Technical Data

WEICON Easy-Mix PE-PP 45 in liquid condition		
Basis:	Methyl methacrylate	
Condition/Nature:	pasty	
Supplied in:	double cartridge	
Content:	38 ml	
Mixing proportion by volume resin / hardener:	10 : 1	
Pot life with 10 ml material and at +20°C (+68°F):	2 - 3 minutes	
Density of the mixture:	1.07 g/cm ³	
Viscosity of the mixture at + 20°C (+68°F) Brookfield:	45,000 mPa·s	
Temperature:	Processing, optimal:	+20°C to +25°C (+68 to +77°F)
	curing:	+15°C to +70°C (+59 to +158°F)
Colour before curing:	colourless, translucent	
Bonding gap:	Processing, optimum:	0,2 - 0,3 mm
	Curing	1,0 mm
Cure time at + 20°C (+68°F)	Handling strength (35% strength) after:	2-3 hours (PP-PP) 6 hours (Alu-Alu)
	Mechanical loads (50% strength) after:	6 hours (PP-PP) 24 hours (Alu-Alu)
	Final strength (100% strength) after:	24 hours (PP-PP) 72 hours (Alu-Alu)
WEICON Easy-Mix PE-PP 45 in cured condition		
Average strength of the pure MMA adhesive in accordance with DIN 53281-83	Shore hardness D:	55
	Tensile strength:	13 MPa.S
	Max. expansion:	5,3 %
Colour after curing:	yellowish, transparent	
Average tensile shear strength as per DIN 53283 on	ABS:	10.5 N/mm ² (1.500 psi)
	GFK:	17.0 N/mm ² (2.470 psi)
	GFK Gelcoat:	10.1 N/mm ² (1.470 psi)
	PA 6.6 (30% glass fibre particles):	5.7 N/mm ² (830 psi)
	PC:	5.9 N/mm ² (860 psi)
	PE HD (high density):	7.4 N/mm ² (1.070 psi)
	PE LD (low density):	2.8 N/mm ² (410 psi)
	PE UHMW (ultrahigh molecular):	5.2 N/mm ² (750 psi)
	PMMA:	6.6 N/mm ² (960 psi)
	PP:	7.6 N/mm ² (1.100 psi)
	PS:	5.3 N/mm ² (770 psi)
	PVC:	14.1 N/mm ² (2.050 psi)
	PTFE:	- N/mm ²
	Aluminium:	15.7 N/mm ² (2.280 psi)
	Glass:	4.5 N/mm ² (650 psi)
	Copper:	15.7 N/mm ² (2.280 psi)
Bright steel:	17.2 N/mm ² (2.490 psi)	
Steel, slightly oiled:	14.8 N/mm ² (2.150 psi)	
VA steel:	15.9 N/mm ² (2.300 psi)	
Peel strength at +20°C (+68°F) (HDPE):	2.9 N/mm	
Temperature resistance:	-50°C to +80°C (-58 to +176°F)	
Thermoforming resistance:	+35°C (+95°F)	
Coefficient of thermal expansion:	below T _g (<+35°C/+95°F):	125 x 10 ⁻⁶ /K
	above T _g (>+35°C/+95°F):	170 x 10 ⁻⁶ /K



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New

WEICON Easy-Mix PE-PP

Bonding instead of welding

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