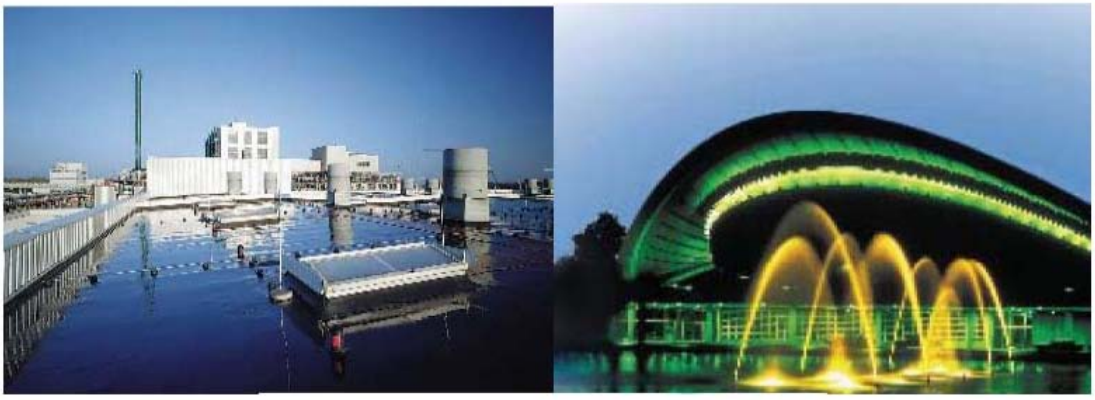
Baytec® Hybrid

Production and properties of elastomer polyurethane-polyurea coatings

formulated from Baytec® Hybrid 30BV70
and Desmodur® VP.PU 0309



BAYTEC® Hybrid

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This information sheet describes the process for producing Baytec® Hybrid and indicates the formulation and the key properties of the resultant polyurethane-polyurea coating.

Please read this leaflet carefully before starting production in order, as far as possible, to avoid errors in the production process and inferior end products.

Should you require any further information, for example on production plant design, specific product properties or possible applications of Baytec® Hybrid, please get in touch. Our experts in Leverkusen will be happy to answer your technical queries:

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1 Introduction

Baytec® Hybrid 30BV70 is combined with Desmodur® Trial Product PU 0309 to produce high-grade polyurethane spray coatings for a variety of applications. This plasticizer- and solvent-free Baytec® Hybrid system can be processed at ambient temperatures of between approx. 8 and 50 °C and has been developed for the coating of metal parts, concrete, stone and porous organic and inorganic materials.

Baytec® Hybrid offers the following processing advantages:

- The reaction components are free of solvents and plasticizers
- The system can be processed on simple high- and low-pressure equipment in a mixing ratio of 1:1
- It cures at room temperature
- Thicknesses ranging from approximately 2 mm to several cm can be produced in one step

– Rapid solidification of the reaction mix enables the system to be applied on vertical surfaces and overhead.

Descriptions of the following raw materials (specifications, typical properties), together with their packaging, storage conditions and handling advice are given in individual product and material safety datasheets:

Baytec® Hybrid 30BV70

Desmodur® trial product PU 0309

2 Processing

Because of their high-speed reaction, Baytec® Hybrid 30BV70 and Desmodur® VP.PU 0309 can only be processed by machine.

During spray application, operators must wear face masks (preferably with a fresh air supply). Further details on safety precautions are given in the product information sheets.

2.1 Equipment

Our experience to date shows that Baytec® raw materials are best processed on low- and high-pressure spraying equipment.

Low-pressure (Unipre)

These machines are equipped with gear pumps and dynamic or static mixers. The pressure can rise to 30 bar depending on the discharge rate. Both mixer types can be used for spraying, with additional dry compressed air being supplied to the spray nozzle.

High-pressure, airless

As the quality of Baytec® Hybrid depends heavily on the mixing of the components, the working pressures of the polyol/isocyanate should be the same and between 140 and 225 bar, depending on the size of the mixing tank. Experience shows that if the raw materials are heated to 80 °C, their viscosity falls below 200 mPas, resulting in a clean spray cone.

At temperatures below 20 °C, it may be necessary to preheat the products.

Important: Switch to circulation mode after spraying.

2.2 Formulations and processing conditions

Product	pbw	pbv
Baytec® Hybrid 30BV70	100	100
Desmodur® VP.PU 0309	110	100

Metering

The systems can be safely processed at ambient temperatures of between + 8 °C and +50 °C. The actual processing temperatures of the raw materials vary according to the type of machine and mixer used, as shown below:

– Low pressure machine with dynamic mixer approx. 20 – 50 °C

– Low-pressure machine with static mixer approx. 45 – 60°C

– High-pressure machine with impingement injection mixer approx. 80 °C

The reaction mix solidifies to a wax-like consistency some 10 – 15 seconds after the components have been mixed together. After approx. 20 minutes an elastic state is attained. This means, for example, that a coating on a solid substrate at RT can be walked on (carefully) after about 20 minutes. At room temperature, the coating attains its final properties after about three days. Post-curing is not necessary.

2.3 Adhesion/Adhesion promoter

2.3.1 Pretreatment of the substrate

a) Concrete and other absorbing or porous substrates

By way of pretreatment, the substrate – (in this case concrete) should be sandblasted and allowed to dry (max. 6% residual moisture).

Substrates such as concrete, wood, rigid polyurethane foam, roofing felt and the like frequently have pores, small cracks or other flaws in their surfaces. Pin holes may form in the coating when these substrates are sprayed. This phenomenon can be eliminated by first sealing the surface of the substrate.

The following formulations are suitable as sealants:

70 pbw Desmodur® E 21

30 pbw Solvesso® 100* or Shellsol® A**

or

90 pbw Desmodur® E 23

10 pbw Solvesso® 100 or Shellsol® A

or

40 pbw Desmodur® E 21

40 pbw Desmodur® E 23

20 pbw Solvesso® 100 or Shellsol® A

*Supplier: Esso AG

**Supplier: Shell AG

The solvent concentration given here is merely a guide and must be adjusted to suit the prevailing working conditions. It is very important that this moisture-curing sealant, which in many cases can also serve as an adhesion promoter for the substrates listed above, is applied thinly to ensure that it will not foam up. The mean coverage rate is about 250 g/m² (including solvent), and must be matched to the absorbency of the particular substrates.

Curing of the sealant is dependent on climatic conditions, and takes around three hours at 20 °C and 60 % relative humidity.

After this, the Baytec® Hybrid should be applied. This task must be completed within about eight hours in order to ensure a strong bond.

If more than eight hours have elapsed, the ability of the sealant to bond with Baytec® Hybrid deteriorates significantly, and steps must be taken to remedy this before further layers are applied. One method is to apply a second, thin coat of sealant with an increased solvent content. Alternatively, diluted Rudol Adhesion Promoter* can be used. Experience to date shows that either of these remedies should only be used once, and then only within 24 hours of the initial application of sealant.

Porous concrete surfaces can also be effectively sealed with solvent-free EP resin as prescribed by TL-BL-EP (German technical terms of delivery for reaction resins for priming, sealing and scratch-filling on concrete under asphalt surfaces). Curing at 20 °C and 60 % relative humidity takes about 24 hours, however. Spreading fire-dried silica sand (grain size 0.7 to 1.2 mm) over the EP resin also reduces the risk of pin hole formation. All excess sand must, however, be removed and approx. 100 g/m²) Rudol Adhesion Promoter applied before coating with Baytec® Hybrid.

b) Steel substrate

By way of pretreatment, the substrate should be degreased, blasted and have all dust removed from it.

The following formulations have proved successful for preparing the surface:

40 pbw Desmodur® E 21

40 pbw Desmodur® E 23

20 pbw Solvesso® 100 or Shellsol® A

or

Rudol Adhesion Promoter P 438 I/Crosslinking Agent V 438 II* in a diluted solution.

The recommended coverage rate is 80 – 120 g/m².

*Supplier: Rudol-Fabrik Hermann Hagemeier, Sürther-Str. 172, 50321 Brühl, Germany

Peeling strengths** of over 80 N/cm can be achieved between steel and Baytec® Hybrid if the above-mentioned adhesion promoters are used and if the surface of the steel is pretreated correctly. The supplier of the adhesion promoter can advise on the correct procedure.

** The adhesive strength also depends on the coating thickness.

c) Other substrates

Other substrates such as GF-UP, foams and aluminum can also be coated with Baytec® Hybrid.

Galvanized steel should be washed with solvent or simply steam blasted. Other plastics should be washed with alcohol and have their surface slightly roughened. In view of the large number of possible applications and the consequent variety of demands made on the coating, users must perform trials to establish which adhesion promoter is best suited to their requirements.

2.3.2 Applying successive layers of Baytec® Hybrid

Elastomer layers applied in rapid succession on top of one another form a firm bond whose strength corresponds to the inherent strength of the material.

If fresh reaction mix is applied to an already largely cured layer that is more than two hours old, an adhesion promoter must be applied to the (clean) surface. Our experience to date (limited to short-term tests) shows that Rudol Adhesion Promoter P 438 l/Crosslinking Agent V 438 II is suitable for this purpose.

In order to ensure a good bond between an old layer (more than three days old) and a new elastomer layer, the existing elastomer must first be roughened, cleaned and then washed down with a solvent. After about 15 minutes, the adhesion promoter should then be thinly applied (100 - 150 g/m²). As soon as the bonding agent is practically tack-free (curing time), the new layer of Baytec® Hybrid should be applied. This task must be completed within about eight hours. The flash-off time for the bonding agent is about two hours at 20 °C and 60 % relative humidity. For further details, see the manufacturers information sheet. The strength of the bond obtained corresponds approximately to the strength of the elastomer.

General advice

It is recommended that a preliminary test be carried out to check the sealing and bonding effect. For all coating operations, the temperature of the substrate must be at least 3 °C (5 °C for metal) above the dew point. The dew point can be determined from Table 2.

3 Properties of Baytec® Hybrid

3.1 Mechanical properties

Density	DIN 53479	g/cm³	approx. 1.0
Shore hardness A	DIN 53505		80
Stress at 100% strain	DIN 53504	Mpa	4.1
Stress at 300% stain	DIN 53504	Mpa	7.4
Tensile strength	DIN 53504	Mpa	10.9
Elongation at break	DIN 53504	%	486
Tear propagation resistance	DIN 53515	kN/m	27.4
Rebound resiliance	DIN 53512	%	41
Abrasion	DIN 53516	mm³	148

3.2 Behavior at low and high temperatures

It is clear from the curve of the shear modulus (Fig. 1) that, starting from room temperature, Baytec® Hybrid

- becomes stiffer as the temperature falls and only loses its coating properties gradually once the temperature drops to below approx. -40 °C (glass transition temperature)
- exhibits a practically constant modulus as the temperature rises (up to approx. 110 °C).

Although Baytec® Hybrid will withstand thermal loads up to 200 °C for short periods (2 – 3 minutes), the permanent service temperature in a dry environment should not exceed 80 °C.

The maximum permissible service temperature in an aqueous environment should be determined by preliminary trials. The coefficient of linear expansion is constant over a temperature range of - 40 °C to + 160 °C; in the case of sprayed Baytec® (density 0.9 kg/m³), it amounts to 182 × 10^{-6}/°C.

3.3 Chemical properties

Baytec® Hybrid shows good resistance to hydrolysis and aging, and is largely resistant to microorganisms. Dilute acids and caustic solutions only slightly attack the material at room temperature. Organic solvents may produce varying degrees of swelling, so prolonged contact with such media should be avoided. Aliphatic hydrocarbons and many lubricating oils cause only limited swelling. If permanent contact is likely, the compatibility of these substances and other chemicals with Baytec® Hybrid should

always be tested first (see Table 1 for individual values).

Figure 4 shows the change in the mechanical properties of Baytec® Hybrid after storage in water at 80 °C.

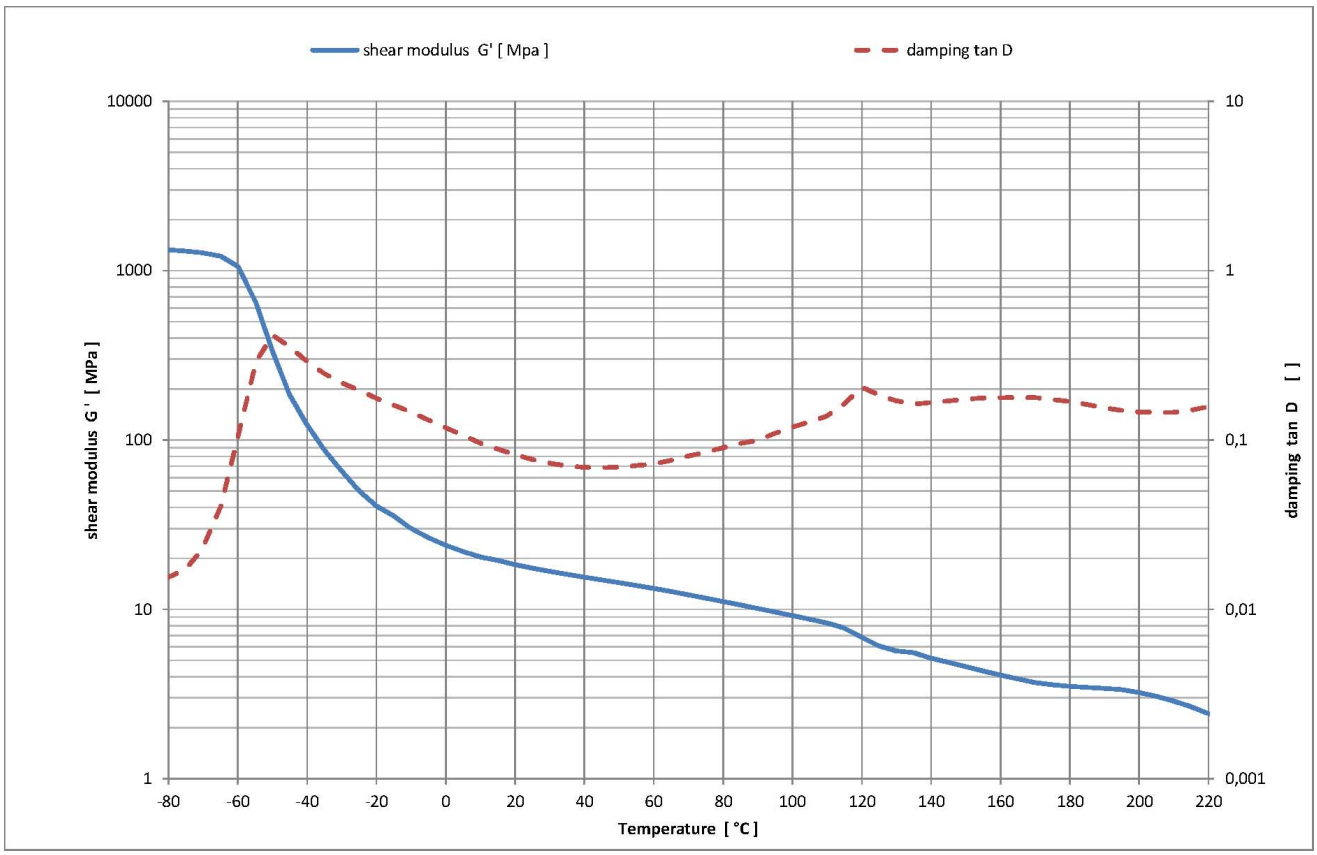
3.4 Behavior on outdoor exposure

Baytec® Hybrid is not lightfast and thus its color will change when exposed to light. The pigmentation of the coating (cf. 2.2.) keeps color changes to a minimum, however.

In addition, weathering also results in slight erosion of the surface over time. As demonstrated by the test results from Table 1 and Fig. 3, the effect this has on the functional properties is minimal.

It is also possible to apply a lightfast topcoat.

Shear modulus curve



Dew point table

Dew point table (dew point established on the basis of temperature and relative humidity)														
Air temperature	**Relative humidity**													
	30 %	**35 %**	**40 %**	**45 %**	**50 %**	**55 %**	**60 %**	**65 %**	**70 %**	**75 %**	**80 %**	**85 %**	**90 %**	**95 %**
+ 2°C	-12.8	-11.0	-9.5	-8.1	-6.8	-5.8	-4.7	-3.6	-2.6	-1.7	-1.0	-0.2	-0.6	+1.3
+ 4°C	-11.3	-9.5	-7.9	-6.5	-4.9	-4.0	-3.0	-1.9	-1.0	0.0	+0.8	+1.6	+2.4	+3.2
+ 5°C	-10.5	-8.7	-7.3	-5.7	-4.3	-3.3	-2.2	-1.1	-0.1	+0.7	+1.6	+2.5	+3.3	+4.1
+ 6°C	-9.5	-7.7	-6.0	-4.5	-3.3	-2.3	-1.1	-0.1	+0.8	+1.8	+2.7	+3.6	+4.5	+5.3
+ 7°C	-9.0	-7.2	-5.5	-4.0	-2.8	-1.5	-0.5	+0.7	+1.6	+2.5	+3.4	+4.3	+5.2	+6.1
+ 8°C	-8.2	-6.3	-4.7	-3.3	-2.1	-0.9	+0.3	+1.3	+2.3	+3.4	+4.5	+5.4	+6.2	+7.1
+ 9°C	-7.5	-5.5	-3.9	-2.5	-1.2	0.0	+1.2	+2.4	+3.4	+4.5	+5.5	+6.4	+7.3	+8.2
+ 10°C	-6.7	-5.2	-3.2	-1.7	-0.3	+0.8	+2.2	+3.2	+4.4	+5.5	+6.4	+7.3	+8.2	+9.1
+ 11°C	-6.0	-4.0	-2.4	-0.9	+0.5	+1.8	+3.0	+4.2	+5.3	+6.3	+7.4	+8.3	+9.2	+10.1
+ 12°C	-4.9	-3.3	-1.6	-0.1	+1.6	+2.8	+4.1	+5.2	+6.3	+7.5	+8.6	+9.5	+10.4	+11.2
+ 13°C	-4.3	-2.5	-0.7	+0.7	+2.2	+3.6	+5.2	+6.4	+7.5	+8.4	+9.5	+10.5	+11.5	+12.3
+ 14°C	-3.7	-1.7	0.0	+1.5	+3.0	+4.5	+5.8	+7.0	+8.2	+9.3	+10.3	+11.2	+12.1	+13.1
+ 15°C	-2.9	-1.0	+0.8	+2.4	+4.0	+5.5	+6.7	+8.0	+9.2	+10.2	+11.2	+12.2	+13.1	+14.1
+ 16°C	-2.1	-0.1	+1.5	+3.2	+5.0	+6.3	+7.6	+9.0	+10.2	+11.3	+12.2	+13.2	+14.2	+15.1
+ 17°C	-1.3	+0.6	+2.5	+4.3	+5.9	+7.2	+8.8	+10.0	+11.2	+12.2	+13.3	+14.3	+15.2	+16.6
+ 18°C	-0.5	+1.5	+3.2	+5.3	+6.8	+8.2	+9.6	+11.0	+12.2	+13.2	+14.2	+15.3	+16.2	+17.1
+ 19°C	+0.3	+2.2	+4.2	+6.0	+7.7	+9.2	+10.5	+11.7	+13.0	+14.2	+15.2	+16.3	+17.2	+18.1
+ 20°C	+1.0	+3.1	+5.2	+7.0	+8.7	+10.2	+11.5	+12.8	+14.0	+15.2	+16.2	+17.2	+18.1	+19.1
+ 21°C	+1.8	+4.0	+6.0	+7.9	+9.5	+11.1	+12.4	+13.5	+15.0	+16.2	+17.2	+18.1	+19.1	+20.0
+ 22°C	+2.5	+5.0	+6.9	+8.8	+10.5	+11.9	+13.5	+14.8	+16.0	+17.0	+18.0	+19.0	+20.0	+21.0
+ 23°C	+3.5	+5.7	+7.8	+9.8	+11.5	+12.9	+14.3	+15.7	+16.9	+18.1	+19.1	+20.0	+21.0	+22.0
+ 24°C	+4.3	+6.7	+8.8	+10.8	+12.3	+13.8	+15.3	+16.5	+17.8	+19.0	+20.1	+21.1	+22.0	+23.0
+ 25°C	+5.2	+7.5	+9.7	+11.5	+13.1	+14.7	+16.2	+17.5	+18.8	+20.0	+21.1	+22.1	+23.0	+24.0
+ 26°C	+6.0	+8.5	+10.6	+12.4	+14.2	+15.8	+17.2	+18.5	+19.8	+21.0	+22.2	+23.1	+24.1	+25.1
+ 27°C	+6.9	+9.5	+11.4	+13.3	+15.2	+16.5	+18.1	+19.5	+20.7	+21.9	+23.1	+24.1	+25.0	+26.1
+ 28°C	+7.7	+10.2	+12.2	+14.2	+16.0	+17.5	+19.0	+20.3	+21.7	+22.8	+24.0	+25.1	+26.1	+27.0
+ 29°C	+8.7	+11.1	+13.1	+15.1	+16.8	+18.5	+19.9	+21.3	+22.5	+22.8	+25.0	+26.0	+27.0	+28.0
+ 30°C	+9.5	+11.8	+13.9	+16.0	+17.7	+19.7	+21.3	+22.5	+23.8	+25.0	+26.1	+27.1	+28.1	+29.0
+ 32°C	+11.2	+13.8	+16.0	+17.9	+19.7	+21.4	+22.8	+24.3	+25.6	+26.7	+28.0	+29.2	+30.2	+31.1
+ 34°C	+12.5	+15.2	+17.2	+19.2	+21.1	+22.8	+24.2	+25.7	+27.0	+28.3	+29.4	+31.1	+31.9	+33.0
+ 36°C	+14.6	+17.1	+19.4	+21.5	+23.3	+25.0	+26.3	+28.0	+29.3	+30.7	+31.8	+32.8	+34.0	+35.1
+ 38°C	+16.3	+18.8	+21.3	+23.4	+25.1	+26.7	+28.3	+29.9	+31.2	+32.2	+33.5	+34.6	+35.7	+36.9
+ 40°C	+17.6	+20.6	+22.6	+25.0	+26.9	+28.7	+30.3	+31.7	+33.0	+34.3	+35.6	+36.8	+38.0	+39.0
+ 42°C	+19.6	+22.3	+24.7	+26.7	+28.7	+30.5	+32.0	+33.6	+35.0	+36.3	+37.6	+38.8	+39.9	+41.0
+ 44°C	+21.3	+24.0	+26.4	+28.5	+30.5	+32.2	+33.9	+35.3	+36.8	+38.2	+39.3	+40.6	+41.8	+43.0
+ 46°C	+22.9	+25.8	+28.3	+30.7	+32.2	+34.2	+35.8	+37.3	+38.8	+40.2	+41.3	+42.7	+43.8	+44.9
+ 48°C	+24.6	+27.3	+30.0	+32.0	+34.0	+35.9	+37.5	+39.1	+40.5	+43.0	+43.3	+44.5	+45.7	+46.9
+ 50°C	+26.3	+29.3	+31.6	+33.7	+35.9	+37.8	+39.3	+41.0	+42.5	+43.9	+45.3	+46.6	+47.7	+48.9

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