HOTSPRAY

The world of polyurea, polyurethane and hybrid hotspray systems

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Rocathaan Polyurea is an extraordinary technology whose possibilities are limited only by your own imagination. Highly reactive polyurea coatings, or hot spray systems as they are known, are increasingly used to provide a seamless finish, allowing product to be applied as a coating or liner several millimetres thick. The short drying time, 5 to 15 seconds, allows almost any shape to be provided with a seamless polyurea finish.

Polyurea coatings are therefore used in the protection of steel pipes and tanks, combating corrosion. Polyurea has been found to perform far better than normal paint finishes in this application, delivering major savings on maintenance costs. Polyurea coatings offer long-term protection against a variety of weathering effects and other environmental factors.

Lining on RoRo decks

Polyurea liners are also used in industry in sealing and finishing water vessels, storage tanks, waste water capture, water purification installations and emergency capture bunds. The millimetre-thick seamless membrane guarantees a durable seal. Polyurea coatings are extremely resistant to a wide range of aggressive chemicals and can be used at both high and low temperatures.

Rocathaan hot spray coatings are also used as a coating and finish for insulating materials like polyurethane and expanded polystyrene. As well as water resistance, polyurea provides these materials with a hard-elastic finish with a high resistance to pressure.

Hotspray coating on molds

Rocathaan Polyurea also finds multiple applications in the construction sector. The sealing and protection of complex roof shapes, rooftop parking areas, swimming pools, bridge decks, tunnels, cellars, floors and façade constructions are all significant areas of application. This technology also finds numerous applications in coach building and in the maritime world and the off-shore industries, where it is widely used on drilling platforms and floats.

Finishing on car washes

The valuable properties of Rocathaan Polyurea include the following:

- Very strong, tough-elastic and impact resistant
- Exceptional resistance to wear
- Applicable in thicknesses from 1 to 10 mm
- Highly resistant to many chemicals
- Resistant to high and low temperatures
- Resistant to substantial temperature shocks
- Adheres to almost any substrate
- Allows vapour transmission
- Fully waterproof
- Surface can be walked over after as little as 10 to 30 seconds.
- Solvent free

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Resistance to chemicals

Rocathaan's series of polyurea-based materials are distinguished from hot spray polyurethane systems in their hardness, tensile/elastic and thermoplastic behaviour.

The following parameters may be adopted when considering the resistance of the material.

Resistant (among other things) to:

- Hot water
- Distilled water
- Dilute protolysed inorganic acids (sulphuric acid, nitric acid, hydrochloric acid etc) to pH1.
- Dilute protolysed bases (sodium hydroxide, potassium hydroxide) to pH 14
- Faecal matter
- Anaerobic slurry
- Diesel
- Benzenes
- Naphtha
- Long chain aliphatic alcohols
- Brake fluids
- Glycols
- Dissolved salts (sodium chloride, potassium chloride, ferric chloride, bromides etc)

A more extensive summary of the material's chemical resistance is provided on the last page.

Tank lining in- and outside

Linings in secondary containment

Test method

Since a chemical loading often consists of a number of complex, process-specific factors, Prokol have developed a standard test. These tests can be carried out at the request of an application company, following an in-depth consultation about the application of the system in the required circumstances. The test delivers a "go" or "no-go" response to the specific situation in question.

Tensile and elongation testing

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Hot Spray Technology

The term explains itself: we are dealing here with spray application of heated materials.
The most significant characteristics of this technique are:

- Machine process
- In principle only workable in the hot state.
- Rapid or very rapid hardening.
- Solvent free.
- Very wide layer thickness range.
- Quick to apply.

Spraying in practice

Equipment

Hot spray systems invariably involve the use of specialised equipment. The spray equipment has a number of functions:

- Heating, to facilitate or promote the miscibility of the A and B components, to make the material flow and allow it to react with adequate speed.
- To transport the materials.
- To dose the components in the correct ratio.
- To mix the A and B components.
- To atomise the mixed materials to make them sprayable.

Graco Reactor EXP-2

Chemical distinctions between products

In principle there are three main technical differences in the materials.

- The polyurethane technique.
- The polyurea technique.
- The hybrid technique.

Truck Bed Liners

Polyurethane

The most readily apparent properties of this reaction are as follows:

- Reliability is dependent on temperature and the presence of accelerants in the system. In practice this means that the properties of the material produced may vary as the circumstances alter.
- This reaction is relatively sensitive to moisture, and foaming or the formation of blisters may readily occur.

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- Gel time/reaction time may be very short while the reaction may take some time to run its course, so that long intervals may be required between applications or before the object can be handled.

Theme Park Design

Examples of application of polyurethane hot spray include:

- Amusement park figures
- Artificial rocks
- Furniture
- Art objects
- Advertising applications

Polyurea

The most salient properties of this reaction can be summarised as follows:

- Reliability is in principle independent of temperature.
- Accelerants are rarely used in systems of this type.
- The properties of the material are constant in virtually all conditions.
- The reaction is not sensitive to moisture, foaming and blister formation are rare.
- The gel time/reaction time are generally short, and the reaction is usually also quickly completed, so that further coats can be applied and the object handled soon afterwards.
- Polyurea discolours more readily than polyurethane. This is less noticeable with darker shades like black and deep grey than with paler colours.

Examples of applications of polyurea systems include the following:

- Tank coatings, both internal and external.
- Coatings for emergency leakage capture vessels, also known as secondary containment.
- Basins and swimming pools.
- Roof and façade cladding.
- Roof parking areas.

Liquid proofed flooring

In practice, the polyurea systems find their applications where severe chemical and other loadings are experienced in both construction and manufacture.

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Hybrid

The most apparent properties of these complex systems can be summed up as follows:
Reliability is as described under the different reactions. Unintended properties are known to occur in practice, due to defects in the polyurethane and the influence of the polyurea reaction on the polyurethane reaction.

Examples of applications of polyurethane hot spray include:

- Truck and bed liners
- Furniture
- Art objects
- Advertising applications
- A limited range of structural applications.

Wall finish

Substrate requirements

Functional requirements are specified for the substrate to which the system is to be applied.
In general it can be stated that the substrate must be:

- Clean, dry, free of grease and intact: a substrate which fails to meet these requirements may provide inadequate adhesion.
- Closed in nature: otherwise bubbling or blistering may occur. The cause here is not moisture but rather trapped air, which then expands. Porous materials are also regarded as non-closed substrate structures.
- Sufficiently pressure resistant for the proposed application.

High pressure water blasting

For concrete and steel, whether or not with an existing coating, this calls in practice for blasting or abrasion of the substrate. This will guarantee a clean substrate and good adhesion of the primer/spray system. With existing coatings which cannot be entirely removed it is always wise to carry out an adhesion test to provide an indication of the performance of the entire system.

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Applications

Rocathaan Hot Spray systems have already found the following applications:

- Sealing tanks in the chemical and petrochemical sectors.
- Protective coatings for emergency capture containers.
- Swimming pools and sauna complexes.
- Facade cladding and floor finishing.
- Finishing of polystyrene and polyurethane mould components.
- Wear-resistant coatings in ship compartments.
- Coatings for dock shelter drive-over plates
- Wear-resistant seals for conveyor channels, potato silos and gravel hoppers.
- Industrial roofs.
- Works of art and advertising images.
- Floors of freight vehicles, tailboards and tipper wagons.

Swimming pool linings

There seems to be no end to the possibilities in sight, with new applications emerging weekly.

In general our systems are useful where thicker coats require application in a single pass, or where products or surfaces must be able to be handled soon after application. Another significant field of application is where combinations of watertightness and resistance to chemical attack are called for, and where resistance to wear is crucial.

Abrasion resistance finish

Step-by-step instructions

Step-by-step instructions can be provided for every application. Ensuring that the periferal requirements are met, and a painstaking approach based on guidelines and protocols are the keys to success and the achievement of high quality problem and client-focussed solutions.

Roof- and facade finish

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Brake fluid	Aromatic	Aliphatic
CLOROX–>	A	A
Dimethyl Formamide	B	C
Gasoline, unleaded	NR1	A
Hexane	NR	NR
Hot tub water2	A	A
Hydraulic oil	A	A
JEFFAMINE? D-400	B	A
Methanol	A	C
5% Methanol/gasoline	NR	NR
Motor oil	A	C
Propylene carbonate	A	C
Sodium hydroxide,	B1	B1
5%	C	C
10%	A	A
25%	A	A
50%	A	A
Sulfuric acid	B1	B1
5%	A	B
10%	B	B
50%	NR	NR
conc.	NR3	NR3
Vinegar, 5% acetic acid	A	B
Water	A	A

ASTM D 1308: Effect of Household Chemicals on Clearand Pigmented Organic Finishes. This test describes the "spot test" or "watch glass" method to simulate exposure of the coating through possible spillage. Each chemical was in contact with the elastomer system for a period of seven days, except where noted. Visual observations were made on the elastomer daily and additional chemical was added as needed. The tested area was covered with a watch glass to inhibit evaporation and or contamination of the chemicals. Chemicals used as well as results can be found in Table 1

Code describing chemical's effect on elastomer:
A - No visible damage
B - Little visible damage
C - Some effect - swelling, discoloration, cracking
NR - Not recommeneded

1 Some discoloration only
2 Brominated water
3 Less than 24 hour exposure

ASTM D 3912: Chemical Resistance of Coating Used in Light-Water Nuclear Power Plants. This test method describes the immersion method of exposure for a coating system to chemicals. In this testing procedure, a black pigmented aromatic polyurea spray elastomer system was used. This system was spray-applied to 2 mil blast profile steel panels, giving total encapsulation. These coated panels were then immersed halfway into individual chemicals for a period of 1 year at 25ºC, except where noted. The panels were then removed and inspected. Chemicals used as well as results can be found in Table 2.

TABEL 2

Chemical	12 Month Exposure
Methanol	S. swelling, <48 hours
Gasoline	Slight surface change, no hardness loss
Diesel fuel	No visible damage
Toluene	S. swelling, <24 hours
MTBE	Slight surface change
5% MTBE/Gasoline	Slight surface change
Motor oil	Slight surface change, no hardness loss
Hydraulic fluid	Slight surface change, no hardness loss
2-methylbutane	No visible damage
Water, room temperature	No visible damage
Water 82ºC, 14 days	No visible damage
10% NaCl/water, room temp.	No visible damage
10% NaCl/water 50ºC, 14 days	No visible damage
10% sugar/water	No visible damage
Sulfuric acid 5%	No visible damage
Sulfuric acid 10%	No visible damage
Sulfuric acid 3%, 50ºC, 14 days	No visible damage
Hydrochloric Acid 5%	No visible damage
Hydrochloric Acid 10%	No visible damage
Phosphoric Acid 10%	No visible damage
Ammonium Hydroxide 10%	No visible damage
Ammonium Hydroxide 20%	No visible damage
Sodium Hydroxide 10%	No visible damage
Sodium Hydroxide 20%	No visible damage
Sodium Hydroxide 50%	Slight surface discolor, no hardness loss
Sodium Hydroxide 1%, 50ºC, 14 days	Slight surface discolor, no hardness loss
Potassium Hydroxide 10%	No visible damage
Potassium Hydroxide 20%	Slight surface discolor, no hardness loss
Acetic acid 10%	No visible damage

Because of the simplicity of these tests and due to the factors listed above no guarantee or warranty concerning the use of these elastomer systems is either intended or implied. These test results are reported to serve as a guide to the applicability of polyurea spray elastomers in a variety of applications. It is the responsibility of each system supplier and or end user to assess the suitability of polyurea spray elastomers for specific applications.

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