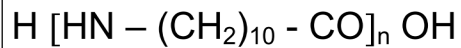


Rilsan PA 11



Corrosion protection / protection against wear / electric insulation

- ❖ **High level strength, rigidity and hardness**
- ❖ **Very good resistance to abrasion and wear**
- ❖ **High shock absorption**
- ❖ **Good lubricant and dry-lube properties**
- ❖ **High resistance to chemicals**
- ❖ **Retains shape up to +150°C**
- ❖ **Shockproof down to -40°C**
- ❖ **Excellent electrical properties**
- ❖ **Antistatic formula**
- ❖ **Physiologically non-affective**
- ❖ **Suitable for foodstuffs, FDA tested**
- ❖ **Attractive range of colours**
- ❖ **Low humidity absorption**
- ❖ **Easily mechanically machinable**
- ❖ **Layer strength from 100μ to 800μ**

The guidelines of DIN 29051 apply to the finishing of the articles to be coated.

PA 11 Rilsan

Rilsan is a high quality polyamide, produced from a base of ricinoleic acid oil. It is a coating material with anti-abrasive and scratchproof properties, is resistant to practically all chemicals and functions as an electrical insulator. Rilsan therefore enjoys multiple uses as corrosion protection, wear guard, and insulating material in the following areas:

- Mechanical engineering – production of machinery/apparatus
- Electronics
- Foodstuffs industry
- Medicinal technology
- Chemical and pharmaceutical industries

Mechanical properties

- high level strength, rigidity and hardness
- abrasion- and scratch-proof
- good resistance to deformation up to +150°C
- high wear resistance
- good lubricant and dry-lube properties
- high shock-absorbing capacity

Chemical Properties

- Rilsan displays a high level of chemical stability. It is especially resistant to oils fats, petrol (gasoline), many solvents as well as water and weaker alkaline solutions.
- Rilsan is less resistant to acids and strong alkaline solutions and certain chlorinated solvents.

Thermal Properties

- Melting point +185°C
- Application temperature of crystalline RILSAN up to max. +150°C in dry conditions
- Where Rilsan coatings are used on elements with permanent water contact the temperature limit +60°C to max. +80°C should not be exceeded.
- Cold: properties remain stable down to –40°C

Crystallinity

- Crystallinity is directly affected by application methods.
- If a melt-on (fused) coating is immediately cooled, the crystallinity can be reduced to 10% or less. In this way the product remains softer and more pliable.
- Where cooling to room temperature takes place slowly crystallinity rises to 30 - 40%. This results in increased hardness and improved resistance to abrasion.

Diffusion / Permeation

- Polyamides in general display low oxygen diffusion and relatively high steam diffusion properties.
- However, the steam permeation rate of Rilsan is approx. 4 times lower than that of many other polyamides.
- The rate of moisture absorption to saturation at +20°C / 65% RH is 1.0% - 1.1%

Electrical properties

- Very good general electrical properties
- Dielectric strength >30 kV/mm
- Electrical properties can be affected by colour pigmentations and the absorption of moisture.
- Rilsan is also available with antistatic properties (spec. resistance < 10⁸Ωcm)

Contact with foodstuffs

- The vast majority of types of Rilsan carry no harm to health.
- A few colour pigmentations are unsuitable for use with foodstuffs.

Weatherproofness

- White, black and pastel coloured Rilsan coatings are highly weatherproof.
- Some colour pigmentations are unsuitable for outdoor use.

Application

The following techniques are possible for the application of Rilsan coatings:

- Fluidised bed dip-coating
- Electrostatic powder spraying (corona or tribo)
- Flame spraying

Substrate preparation

- De-greasing
- Sand-blasting Sa3

Priming

- Powder or liquid form

Coating temperature

- Temperature of substrate +220°C to 380°C with fluidised bed dip-coating
- Temperature of substrate +205°C to 220°C with electrostatic powder spraying.

Retouching of suspension points

- By re-melting

Quality control

- Measure of coating thickness by Dualskop Fischer
- Pinhole free testing with Poroskop Fischer 2.5 – 25kV

Chemical properties of Rilsan Coatings

Rilsan coatings display in general a high level of resistance to mineral salts, alkalis, most solvents and organic acids. In the case of mineral acids, phenols and certain chlorified solvents some caution is necessary. Here it is recommended to consult the technical applications department of Arkema, stating the necessary level of resistance to corrosion required in each case: i.e. the type of metal to be protected, temperature and composition of the chemical fluids which are to be stored in these vessels.

Practical tests have shown that Rilsan coatings are highly resistant to certain chemical solutions in some cases, however to some extent they display permeability to these chemical solutions. The underlying metal is only partially protected since a certain amount of the fluid seeps through the Rilsan coating. This can even lead to the coating separating from the substrate. However the same tests have proved that this does not happen if an Arkema primer is used.

Tests on small vessels made of normal steel with a Rilsan coating on a suitably primed surface:

	after 6 months	after 12 months	after 18 months
Sodium hypochlorite bleach	No change	No change	No change
Chlorine extract	"	"	Minor blistering on bottom
Trichloroethylene	"	"	No change
Dimethylsulfoxide	"	"	"
Dimethylsulfide	"	"	"
Concentrated ammonia	"	"	"
Soda(ium carbonate) saturated solution	"	"	"
Normal petrol (gasoline)	"	"	"
Super petrol (gasoline)	"	"	"
Acetic acid 10%	"	"	Coating begins to separate from bottom
Acetic acid 50%	"	"	Metal slightly attacked, blistering
Phosphoric acid 50%	No change (??) Slight discolouring	No change (??) Slight discolouring	Very slight separations from bottom
Sulphuric trioxide	blistering	Blistering	
Sulphuric acid 28 °Bé	No change	Slight separation of coating	

Resistance of Rilsan to some important chemical products

product	concentration	20°C	40°C	60°C
Acetone	pure	G	G	L
Agricultural sprays		G	G	
Ammonia	concentrated	G	G	G
Beer		G		
Calcium chloride		G	G	G
Citric acid		G	G	L
Copper sulphate	concentrated solutions	G	G	G
Fruit juices		G	G	
Gas-oil		G	G	G
Glucose		G	G	G
Glycerine	pure	G	G	L
Greases		G	G	G
Hydrogen		G	G	G
Lactic acid		G	G	G
Mercury		G	G	G
Milk		G	G	G
Oils		G	G	G
Oxygen		G	G	L
Paraffin (Kerosene)		G	G	
Petrol		G	G	G
Sea Water		G	G	G
Sodium carbonate	concentrated solutions	G	G	L
Sodium chloride	saturated	G	G	G
Stearine		G	G	G
Sulphur		G	G	
Sulphur acid	1%	G	L	L
Turpentine		G	G	G
Wine		G		

G = good L = limited

Physical properties of Rilsan coatings

Rilsan coatings properly applied have properties similar to parts moulded in Rilsan

Melting point	185°C
Specific gravity at 20°C	1,040 g/cm ³
Solubility Solvent for tests and analysis	Met cresol, sulphuric acid, formic acid, Alcohol-phenol mixtures
Solvent for stripping	Ipro CL, Turco 5061
Water absorption to saturation at 20°C and 65% RH	0,9 to the type of transparent powders
at 20°C and 100% RH	1,6 to the type of transparent powders
at 100°C and 100% RH (boiling water)	2,4 to the type of transparent powders
Shore D hardness at 20°C	75
Hardness measured with a Persoz pendulum at 20°C (Norm AFNOR 30-016)	190
Rockwell hardness , R scale, ASTM D 785 at 20°C measured	106
Surface hardness according to DIN 53 456 at 20°C 10 sec. under load	80 N/mm ²
Scratch resistance measured with the Clemen apparatus; load necessary to induce a scratch which reaches the underlying metal for a coating of 0.4mm thickness	59N
Shear strength , ASTM D 732	35 - 42 N/mm ²
Impact resistance	Excellent
Projectile with hemispherical head, 25mm diameter weighing 19.6N, falling from height of 50cm on horizontal coating 0.3mm thick	No fracture of the coating and metal not bared after impact.
Abrasion resistance	Excellent
Taber abrasimeter (wheel type CS 17, load 9.81 N) loss of weight after 100 turns	5 to 8 mg
Coefficient of friction	0,10 - 0,30, according to test conditions
Tensile strength , ASTM D 638 (measured on a stripped coating): Tensile strength at yield	31 - 33 N/mm ²
Elongation at yield	18 - 24 %
Tensile strength at break	39 - 47 N/mm ²
Specific heat	2,09kJ/kg K
Thermal conductivity	0,29W/mK between 323 and 443 K (50° and 170°C)
Latent heat of fusion	83,7 kJ/kg
Coefficient of linear expansion	1,5 - 10 ⁻⁵ C.G.S.
Inflammability ASTM D 635	self-extinguishing

Transverse or volume resistivity , ASTM D 257 at 20°C and 65 % RH at 500V	$3,5 \bullet 10^{14} \Omega \text{ cm}^2 / \text{cm}$
Surface resistivity , ASTM D 257 at 20°C and 65% RH at 500V	$2,4 \bullet 10^{14} \Omega$
Dielectric constant	$10^2 \text{ Hz} = 3,9$ $10^6 \text{ Hz} = 3,1$
Tangent of the angle of loss (power factor) at 20°C and 65% RH at 1,000 V R.M.S, with a current of 1,000 Hz	0,05
Dielectric strength measured at 20°C and 65 % RH influence of the thickness studied on a transparent coating: 0,20mm 0,43mm 0,70mm 0,90mm	$52,8 \text{ kV/mm} \times 0,20\text{mm} = 10,56 \text{ kV}$ $38,4 \text{ kV/mm} \times 0,43\text{mm} = 16,51 \text{ kV}$ $34,7 \text{ kV/mm} \times 0,70\text{mm} = 24,29 \text{ kV}$ $33,1 \text{ kV/mm} \times 0,90\text{mm} = 29,79 \text{ kV}$
Resistance to boiling water	Excellent after 2,000 hours
Resistance to outdoor exposure	- Very good - light yellow, brown discolouring
Resistance to salt spray	No corrosion after 2,000 hours exposure (ASTM B 117)
Resistance to sea water	No corrosion after 10 years exposure