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**COATING PHYSICAL AND CHEMICAL PROPERTIES**



# » Physical properties of the coatings

## Typical results for coating applied according to Arkema specifications

<b>Melting point</b>	ISO 11357	186 °C
<b>VICAT point</b>	ISO 306	181 °C
<b>Specific gravity at 20°C</b> natural powders dipping and ES powders, white	ISO 1183	1.040 g/cm <sup>3</sup> 1.065 g/cm <sup>3</sup> to 1.25 g/cm <sup>3</sup>
<b>Water absorption to saturation</b> at 20 °C and 65% RH  at 20 °C and 100% RH  at 100 °C and 100% RH (boiling water)	ISO 62/1	0.9 to 1.1% according to the type of powder 1.6 to 1.9% according to the type of powder 2.4 to 3% according to the type of powder
<b>Shore D hardness</b> at 20 °C, measured at a thickness greater than 5 mm to eliminate the influence of the substrate	ISO 868	75-85
<b>Hardness measured with a Persoz pendulum</b> at 20 °C	ISO 1522	180-200
<b>Surface hardness</b> at 20 °C 10 sec. under load	DIN 53-456	80 N/mm <sup>2</sup>
<b>Scratch resistance</b> measured with the Clemen apparatus; load necessary to induce a scratch which reaches the underlying metal for a coating of 0.4 mm thickness	ISO 1518	59 N
<b>Pencil hardness</b>	ECCA T4	Note: B
<b>Shear strength</b>	ASTM D 732	35-42 N/mm <sup>2</sup>
<b>Impact resistance</b> Dip coating powder (thickness 350 µm)  ES powders (thickness 100 µm)	ASTM G14 ISO 3678 ISO 6272	> 2 J > 2.5 J > 19 J
<b>Abrasion resistance</b> Taber abrasimeter (wheel type CS 17, load 1 kg) loss of weight after 1,000 cycles	ISO 9352	15 mg
<b>Coefficient of friction</b>  Black powders	NFT 54-112 (8)	Static K: 0.15-0.3 Dynamic K: 0.05-0.2
<b>Flexibility</b> Conical mandrel folding	ISO 6860	> 35%
<b>Specific heat</b>		2.09 kJ/kg K
<b>Thermal conductivity</b>		0.29 W/mK between 323 and 443 K (50° and 170 °C)

<b>Latent heat of fusion</b>		83,7 kJ/kg
<b>Surface resistivity</b> at 20 °C and 65% RH at 500 V	ASTM D 257	2.4 x 10 <sup>14</sup> Ω
<b>Inflammability</b> measured at a thickness greater than 3 mm to eliminate the influence of the substrate	ASTM D 635	self-extinguishing
<b>Dielectric constant</b>	102 Hz 106 Hz	3.9 3.1
<b>Transverse or volume resistivity</b> at 20 °C and 65% RH at 500 V	ASTM D 257	10 <sup>14</sup> to 10 <sup>16</sup> Ω.cm
<b>Tangent of the angle of loww (power factor)</b> at 1,000 V R.M.S., with a current of 1,000 Hz (at 20 °C and 65% RH)		0.05
<b>Resistance to surface tracking</b> KA method	DIN 53-480	Grade KA3c
<b>Dielectric rigidity</b> ES powders thickness ± 100 µm Dipping powders, thickness 350 to 450 µm	ASTM D 149	55 to 90 kV/mm 30 to 36 kV/MM
<b>Dielectric strength</b> Influence of the thickness studied on a natural coating (measured at 20 °C and 65% RH) 0.20 mm 0.43 mm 0.70 mm 0.90 mm		52.8 kV/mm 38.4 kV/mm 34.7 kV/mm 33.1 kV/mm
<b>Resistance to boiling water</b>	ISO 1521	Excellent adhesion after 2,000 hours; neither bubbling nor modification
<b>Resistance to outdoor exposure</b>	ASTM D 1235	3 years Florida exposure: Adhesion 4, NFT 58-112 without any corrosion
<b>Resistance to salt water</b>		No corrosion after 10 years exposure
<b>Salt spray resistance</b>	ISO 9227, on scribed primed plates (testing according to WIS 4-52-01)	< 1 mm corrosion after 2000 hours



# » Chemical properties of the coatings

## Resistance of Rilsan® to various chemicals, as a function of temperature

*In general, Rilsan® coatings have good resistance to inorganic salts, alkalis, most solvents, and to organic acids. Greater caution must be observed in uses involving inorganic acids, phenols and certain chlorinated solvents. In such cases, it is advisable to consult the Arkema Technical Service Department, specifying the practical problem involved: e.g nature of metal to be protected and the temperature and chemical composition of the liquid.*

Resistance (°C)	20	40	60	90
<b>Inorganic bases</b>				
ammonium hydroxide (concentrated)	G	G	G	G
ammonia (liquid or gas)	G	G		
lime-wash		G	G	G
potassium hydroxide (50%)	G	L	P	P
sodium hydroxide (5%)	G	G	L	
sodium hydroxide (10%)	G	L	L	
sodium hydroxide (50%)	G	L	P	P
<b>Inorganic acids</b>				
chromic acid (10%)	P	P	P	P
hydrochloric acid (1%)	G	L	P	P
hydrochloric acid (10%)	G	L	P	P
nitric acid (all concentrations)	P	P	P	P
phosphoric acid (50%)	G	L	P	P
sulphuric acid (1%)	G	L	L	P
sulphuric acid (10%)	G	L	P	P
sulphuric trioxide	L	P	P	P
<b>Inorganic salts</b>				
alum	G	G	G	
aluminium sulphate	G	G	G	G
ammonium nitrate	G	G	G	
ammonium sulphate	G	G	L	
barium chloride	G	G	G	G
calcium arsenate (concentrated solutions of slurries)	G	G	G	
calcium chloride	G	G	G	G
calcium sulphate	G	G	L	
copper sulphate	G	G	G	G
diammonium phosphate	G	G	L	
magnesium chloride (50%)	G	G	G	G
potassium ferrocyanide	G	G	G	
potassium nitrate	G <sup>1</sup>	G <sup>1</sup>	P	P
potassium sulphate	G	G	G	G
sodium carbonate	G	G	L	P
sodium chloride (saturated)	G	G	G	G
sodium silicate	G	G	G	
sodium sulphide	G	L	L	
trisodium phosphate	G	G	G	G

Resistance (°C)	20	40	60	90
<b>Other inorganic products</b>				
agricultural sprays	G	G		
bleach solution	L	P	P	P
bromine	P	P		
chlorine	P	P	P	P
fluorine	p	p	p	p
hydrogen	G	G	G	G
hydrogen peroxide (20 volumes)	G	L		
mercury	G	G	G	G
oxygen	G	G	L	P
ozone	L	P	P	P
potassium permanganate (5%)	P	P		
sea water	G	G	G	
soda water	G	G	G	G
sulphur	G	G		
water	G	G	G	G
<b>Aldehydes and ketones</b>				
acetaldehyde	G	L	P	
acetone (pure)	G	G <sup>3</sup>	L	P
benzaldehyde	G	L	P	
cyclohexanone	G	L	P	
formaldehyde (technical)	G	L	P	
methylethylketone	G	G	L	P
methylisobutylketone	G	G	L	P
<b>Hydrocarbons</b>				
acetylene	G	G	G	G
benzene	G	G <sup>2</sup>	L	
butane	G	G	G	
cyclohexane	G	G	L	
decalin	G	G	G	L
HFA (Forane®)	G			
hexane	G	G	G	
methane	G	G	G	
naphthalene	G	G	G	L
propane	G	G	G	
styrene	G	G <sup>3</sup>		
toluene	G	G <sup>3</sup>	L	L
xylene	G	G <sup>3</sup>	L	L

Resistance (°C)	20	40	60	90
<b>Organic bases</b>				
aniline (pure)	L	P	P	P
diethanolamine (20%)	G	G <sup>3</sup>	G <sup>3</sup>	L
pyridine (pure)	L	P	P	P
urea	G	G	L	L
<b>Organic acids and anhydrides</b>				
acetic acid	L	P	P	P
acetic anhydride	L	P	P	P
citric acid	G	G	L	P
formic acid	P	P	P	P
lactic acid	G	G	G	L
oleic acid	G	G	G	L
oxalic acid	G	G	L	P
picric acid	L	P	P	P
stearic acid	G	G	G	L
tartaric acid (saturated solution)	G	G	G	L
uric acid	G	G	G	L
<b>Various organic compounds</b>				
anethole	G			
carbon disulphide	G <sup>3</sup>	L <sup>2</sup>	P	
diacetone alcohol	G	G <sup>3</sup>	L	P
dimethyl formamide	G	G	L	
ethylene chlorhydrin	P	P		
ethylene oxyde	G	G	L	P
furfural	G	G <sup>3</sup>	L	P
glucose	G	G	G	G
tetraethyl lead	G			
tetrahydrofurane	G	G	L	
<b>Salts, esters, ethers</b>				
amyl acetate	G	G	G	L
butyl acetate	G	G	G	L
diethyl ether	G			
diethylphosphate	G	G	G	L
diethylphthalate	G	G	G	L
ethyl acetate	G	G	G	
fatty acid esters	G	G	G	G
methyl acetate	G	G	G	
methyl sulfate	G	L		
tributylphosphate	G	G	G	L
tricesylphosphate	G	G	G	L

Condition after 18 months contact: G: Good - L: Limited - P: Poor

Resistance (°C)	20	40	60	90
<b>Alcohols</b>				
benzyl alcohol	L	P	P	P
butanol	G <sup>3</sup>	L	P	
ethanol (pure)	G <sup>3</sup>	G	L	
glucérine (pure)	G	G	L	P
glycol	G	G	G	P
methanol (pure)	G <sup>3</sup>	L	P	
<b>Chlorinated solvents</b>				
carbon tetrachloride	P			
methyl bromide	G	P		
methyl chloride	G	P		
perchloroethylene	G	G	L	
trichloroethane	L	P		
trichloroethylene	G	L		
<b>Phenols</b>				
	P	P	P	P
<b>Various products</b>				
beet	G			
cider	G			
crude petroleum	G	G	G <sup>3</sup>	
diesel fuel	G	G	G <sup>3</sup>	
fruit juices	G	G		
fuel-oil	G	G	G	
greases	G	G	G	G
ground-nut oil	G	G		
high octane petrol	G	G	G <sup>3</sup>	
kerosene (paraffin)	G	G	G <sup>3</sup>	
linseed cake	G	G	G	G
milk	G	G	G	G
mustard	G			
normal petrol	G	G	G <sup>3</sup>	
oils	G	G	G	G
solutions or emulsions D.D.T. or lindane				
hydroxy-quionoline (agricultural sprays)	G			
soap solution	G			
stearin	G	G	G	
solvent naphtha	G	G	G <sup>3</sup>	
town gas	G	G		
turpentine	G	G	G <sup>3</sup>	
winegar	G			
wine	G			

1: Slight yellowing - 2: Yellowing - 3: Swelling action

A world-class chemical concern, Arkema combines three strategically related, integrated businesses: Vinyl Products, Industrial Chemicals and Performance Products. With operations in more than 40 countries and 17,700 employees, the company reported revenue of € 5.7 billion in 2005. Leveraging six research centers in France, the United States and Japan and internationally recognized brands, Arkema holds leadership positions in each of its principal markets.

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