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## Advanced Materials

# Rhodeftal® 210 #

Polyamide-Imide (PAI)

**DATA SHEET**

**Rhodeftal® 210 is a polyamide-imide (PAI) in N-Ethylpyrrolidone solvent (NEP).**
**Binder for thermostable paints / lubricants / adhesives / impregnation and varnish**

## KEY DATA

**Specified key data**

| | |
|---|---|
| **Appearance** | **brown liquid** |
| **Solid content (2 hours at 210 °C) (ISO 3251)** | **27-29 %** |
| **Viscosity apparent at 25 °C (ISO 2555)** | **2 500-4 000 mPa·s** |
| **Water content (ISO 760)** | **0 -0.5 %** |

**Specified key data are individually checked throughout and guaranteed.**

## SPECIFIC PROPERTIES

- Heat class 220 °C-250 °C
- Good dielectric rigidity and satisfying flexibility.
- Good chemical properties
- Outstanding adhesion at elevated temperature
- Mixable with Epoxy Resin to reach very good flexibility

## APPLICATIONS

Rhodeftal® 210 may be used for the preparation of thermostable paints. These paints have good adhesion on the usual materials, and good resistance to heat, cold and weathering.

Rhodeftal® 210 is particularly designed for the impregnation of coils for electrical devices and for wire enamel.

Rhodeftal® 210 is used as a protection varnish or, associated with appropriate additives and fillers, it can be used as self-lubricating coatings or thermal insulation layers.

## STORAGE

Rhodeftal® 210 may be stored at room temperature. It is storable for 2-3 years. Some increase of viscosity could be corrected by adding of solvent.

# *In addition to the brand name product denomination may show different appendices, which allows us to differentiate between our production sites: e.g. BD = Germany, US = United States, IN = India, CI = China, etc. These appendices are in use on packaging, transport and invoicing documents. Generally the same specifications apply for all versions. Please address any additional need for clarification to the appropriate Huntsman contact.*

## USE IN PAINTS

### Fillers, Pigments and Additives

Fillers are chosen in order to increase or at least not to reduce the thermal stability of the coating and in addition to impart special properties to the paint.

Zinc powder may be used for primer coats in anti corrosion systems. Titanium dioxide such as Kronos RN 59, talc, barium sulfate, aluminium paste may be employed for finishing coats.

**Pigments** must have good heat stability.

**Solvents and diluents** are used to lower the viscosity. A number of products are suitable and behave either as solvents or as diluents.

| Diluent | Maximum amount for 100 g Rhodeftal 210 |
|---|---|
| N-Ethylpyrrolidone (NEP) | >120 g |
| Dimethylformamide (DMF) | >120 g |
| Dimethylacetamide (DMAc) | >120 g |
| Dimetylsulfoxyde (DMSO) | >120 g |
| g-Butyrolactone (GBL) | >120 g |
| Benzonitrile | >120 g |
| Dioxane | <100 g |
| Methylglycolacetate | < 80 g |
| 2-Nitropropane (2NP) | < 60 g |
| Ethylglycolacetate | < 60 g |
| Ethylacetate | < 60 g |
| Xylene | < 60 g |
| Toluene | < 65 g |
| Methylisobutylketone | < 30 g |

The two following solvent systems provide good results with respect to paint processability and high gloss:

| | |
|---|---|
| Dimethylformamide | 1 part per weight |
| 2-Nitopropane | 1 part per weight |
| N-Ethylpyrrolidone | 1 part per weight |
| Dimethylformamide | 1 part per weight |
| Ethylglycolacetate | 2 parts per weight |

Of course a part from these two mixtures, other solvent systems can be used. However products of low volatility such as NEP for example should not be used in too large amounts. It is not advisable to introduce a diluent such as xylene without premixing with a solvent such as DMF to avoid local precipitation of the polymer, which disappears under agitation. This phenomenon is due to temporary local excess of diluent. Chlorinated solvents must be avoided since they will cause the solution to gel. Anhydrous solvents or diluents should be used to obtain optimum results. The fact that NEP and DMF are hygroscopic solvents should be taken into account.

**USE IN PAINTS (CONTINUED)**

### Additives

In case of application on vertical surfaces the addition of thixotropic agent will avoid dripping and sagging.

Aerosil 200 silica used at a level of 0.3 to 0.5% on Rhodeftal® 210 is effective to impart good thixotropic properties. Beyond these concentrations it tends to give paints with reduced gloss. Silica must be ground with the other components. It is better, before introducing silica into the mix, to prepare a mixture of about 5 % silica in a nonpolar solvent such as xylene in a turbine mixer, which makes its dispersion into the paint easier.

Bentone 27 gives about the same results as Aerosil 200.

In order to prevent the formation of defects such as poor leveling and discoloration we advise using Nuosperse 657[(1)] at a level of 0.2 g per 100 g of Rhodeftal® 210. In addition for very difficult coating conditions we advise adding BYK 310[(2)] at a level of 0.025 to 0.05 g per 100 g of Rhodeftal® 210.

These additives must be preferably incorporated into the paint before grinding. They tend to settle on storage but simple stirring restores their dispersion in the paint medium.

(1) Rhône-Poulenc Chimie, 88 Boulevard Des Belges, F-69006 Lyon
(2) BYK-Chemie GmbH, Abelstrasse 14, D-4230 Wesel; FDA 175.300 approved

### Preparation of the paints

The usual methods (three rolls or ball mill) can be employed. In the latter case homogenisation is achieved in about 72 hours. Generally all the paint components should be ground at the same time.

Depending on the gloss, heat resistance and physical properties various pigment/binder ratios can be used.

### Preparation of substrates

The substrates must be very clean, carefully degreased (washing with trichloroethylene and rinsing with acetone) and dried. Non-metallic substrate (glass, asbestos...) are cleaned by exposure at 300 °C.

### Coating process

Small pieces may be coated either by dipping, brushing or with a spray gun (with either hot or cold paint).

Large surfaces may be also coated with an airless gun using hot or cold paint. It is also possible to use an electrostatic gun.

In the case of a formula well adjusted from the point of view of solvent and thixotropy, the coating can be made on a cold substrate without dripping. A 15 µ dry film can then be applied without blistering. In case of a substrate of very intricate shape it may be advisable to preheat the piece at about 80-90°C.

Curing must be performed at 220 °C minimum but it is better carried out at 250 °C in order to obtain good end properties.

- 3 min. at 250 °C for very flexible paints
- 5 min. at 250 °C usual curing time
- 15 min. at 250 °C for very good chemical resistance

Curing at 300 °C for 2 to 5 min. also gives good results. The caloric capacity of the painted pieces must be taken into account. The above curing times are given for small pieces. Larger pieces need longer times or higher temperatures. When it is necessary to apply several coats of paint in order to obtain good adhesion it is better not to dry completely the preceding coat. 1 to 2 min. curing at 250 °C gives excellent results.

Curing of paints with Rhodeftal 210 may also be made by IR irradiation. In this case, for a 6 W/cm2 apparatus, we recommend 5 min. at about 5 cm from the coated substrate.

**USE IN PAINTS (CONTINUED)**

## Formulations

The following formulations illustrate the main use of Rhodeftal® 210. They must be considered as base formulations and should be adjusted to each particular case.

### Glossy paint of different colors

| | |
|---|---|
| Rhodeftal® 210 | 100 |
| Pigments inorganic | 15 |
| DMF | 27.5 |
| 2NP | 27.5 |
| Dispersion of 5% Aerosil 200 in xylene | 8 |
| Nuosperse 657 | 0.2 |
| BYK 310 | 0.025 |

### Glossy black paint

| | |
|---|---|
| Rhodeftal® 210 | 100 |
| Special black 4 Degussa | 2.5 |
| DMF | 27 |
| 2NP | 27 |
| Nuosperse 657 | 0.2 |
| BYK 310 | 0.025 |

### Industrial red iron oxide coat

| | |
|---|---|
| Rhodeftal® 210 | 100 |
| Red iron oxide 130 F | 45 |
| NEP/xylene 60/40 | 120 |
| Nuosperse 657 | 0.3 |
| BYK 310 | 0.025 |

This paint gives a mat finish.

### Aluminium paint (type car exhaust pipe)

| | |
|---|---|
| Rhodeftal® 210 | 100 |
| Aluminium paste | 15 |
| NEP/xylene 60/40 | 76 |
| BYK 310 | 0.025 |

This paint has a thermal resistance of 1000 h at 300 °C.
Chalking begins after about 200 hours.

All these paints have a good thermal stability. Light shades are however more sensitive because the resin may become discolored without significantly altering the mechanical and adhesion properties.

**We can say that for 1000 hours and more**:

- Light shades are stable at 200 °C
- Dark shades are stable at 220 °C
- Black and very dark shades are stable at 250 °C
- Non-hammer finished aluminium paints are stable at 300 °C

## Protective paints

Besides their thermal stability these paints show good resistance to salt spray. This requires the application of an anti-corrosion primer followed by the application of a finishing coat.

Where temperatures do not exceed 300 °C we recommend the use on steel or aluminium substrates of zinc powder or strontium chromate in the formulation of the primer.

For the under coat we propose the following formulation:

| | |
|---|---|
| Rhodeftal® 210 | 100 |
| Zinc powder | 130 |
| NEP/xylene 60/40 | 100 |
| Aerosil 200 | 2 |
| Nuosperse 657 | 0.1 |
| Byk 310 | 0.05 |

The formulations for decorative coats quoted previously may be used as finishing coats. For good stability at 300 °C we recommend formulations including red iron oxide 130 °F, black special 4 or aluminium powder.

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| **HANDLING PRECAUTIONS** | Mandatory and recommended industrial hygiene procedures should be followed whenever our products are being handled and processed. For additional information please consult the corresponding product safety data sheets. |
| **NOTE** | Rhodeftal® is a registered trademark of Huntsman LLC or an affiliate thereof. |

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