CRYSTIC® 198 & 474PA

Heat and Chemical-Resistant

Polyester Resins

Introduction

Crystic 198 is a medium viscosity orthophthalic based polyester resin of high unsaturation which has good heat and chemical-resistant properties. Crystic 474PA is a pre-accelerated thixotropic version of Crystic 198.

Applications

Crystic 198 and 474PA are exceptionally versatile resins suitable for the fabrication of laminates for a wide diversity of applications throughout the chemical industry, particulary in environments where resistance to heat and chemicals are both required. They are suitable for the construction of tanks, pipes and fumestacks to operate in a range of environments at eleveated temperatures. The resins can be used to back up other specialist Crystic resins, either to produce laminates of a combination of properties, or for economy. They can be used to laminate on Celmar® (glass fibre backed polypropylene) and to reinforce suitably treated uPVC, where the heat resistance and dimensional stability of GRP will upgrade the operating conditions of the material. They are also suitable for the fabrication of moulds for heat-assisted contact moulding and hot press moulding processes. Crystic 198 can be used for the formulation of dough moulding compounds (DMC's) and, with suitable thickeners, for sheet moulding compounds (SMC's).

Formulation

Crystic 198 can be used in both hot and cold curing formulations. Crystic 474PA is suitable for cold curing only. Both resins must be allowed to attain workshop temperature before being formulated for use, and should not be used at temperatures below 15ºC. Scott Bader (Pty) Ltd. will not be liable for problems caused by use at lower temperatures than recommended.

Hot curing: Formulation 1 with Crystic 198.
The catalyst must be thoroughly dispersed in the resin. The catalysed resin will remain usable at workshop temperature (20°C) for several days. Curing should be carried out at a temperature between 80°C and 140°C. For most applications 120°C will be found satisfactory. At this temperature 2 to 5 minutes curing time is usually sufficient but the exact time is largely dependent on the bulk or thickness of the moulding.

Cold curing: Formulation 2 with Crystic 198
The catalyst must be thoroughly dispersed in the resin. The catalysed resin without accelerator will remain usable at workshop temperature (20°C) for approximately 8 hours. Shortly before use the correct amount of Crystic Accelerator E should be added and stirred into the catalysed resin. When accelerator is added to resin which has been catalysed for several hours, the gel time will be shorter than that of freshly catalysed resin.

Table 1: Formulations for Crystic 198 and Crystic 474PA

Parts by weight	Formulation 1	Formulation 2	Formulation 3
Crystic 198	100	100	-
Crystic 474PA	-	-	100
Catalyst Powder B (Lucidol® CH50)	2	-	-
Andonox® KP9	-	2	2
Crystic Accelerator E	-	1 to 4	-

N.B. Peroxide catalysts are highly reactive and may decompose with explosive violence, or cause fires, if they come into contact with flammable materials, metals or accelerators. For this reason they must never be stored in metal containers or be mixed directly with accelerators.

The amount of Accelerator E controls the gel time of Crystic 198. This can be approximately determined from Table 2 which shows the gel time of Formulation 2, 100 pbw Crystic 198 containing 2 pbw Andonox® KP9.

Table 2:

Parts of Accelerator E to 100 parts catalysed Crystic 198	1	2	3	4
Geltime in minutes at 15°C	51	32	24	19
Gel time in minutes at 20°C	30	20	16	12
Gel time in minutes at 25°C	19	13	10	7

Formulation 3 with Crystic 474PA
Crystic 474PA is pre-accelerated and needs only the addition of catalyst to start the curing reaction. The correct amount of catalyst is therefore added and thoroughly stirred into the resin shortly before use.

The resin temperature and the amount and type of catalyst control the gel time of Crystic 474PA. This can be approximately determined from Table 3 which shows the gel time of Formulation 3, 100 pbw Crystic 474PA containing 2 pbw Andonox® KP9.

Table 3: Geltimes in minutes for catalysed Crystic 474PA

Geltime in minutes at 15°C	40
Geltime in minutes at 20°C	22
Geltime in minutes at 25°C	12

Curing should not be carried out at temperatures below 15°C. Scott Bader (Pty) Ltd. will not be liable for problems caused by use at lower temperatures than recommended. The resin must be allowed to attain workshop temperature before being formulated for use. 20°C is recommended.

Post Curing
When Crystic 198 or Crystic 474PA mouldings have been cold cured, post curing is necessary in order to develop optimun heat and chemical resistance in the laminate. After release form the mould, laminates should be allowed to mature for 24 hours at workshop temperature (20°C). They should then be post cured for three hours at 80°C in service a further post curing period at the operating temperature should be given. The post cure is most effective if it is carried out immediately after the 24 hour maturing period. Post curing is not normally necessary for hot-cured mouldings (Formulation 1) provided that the moulding cycle is adequate.

Chemical Resistance
Performance figures for GRP laminates made with these resins in more than 200 different chemical environments are contained in Crystic Technical Leaflet No. 145.3 “Safe Chemical Containment” available on request.

Fillers and Pigments
When reduced fire hazard laminates are required, up to 20% by weight of either resin may be replaced by Crystic Prefil F. When absolutely necessary, the resin may be coloured by the addition of up to 5% of a suitable Crystic Pigment Paste. When laminates with optimum heat resistance, chemical resistance and weather resistance are required, fillers and pigments should not be used since they can adversely affect these properties. Further detailed advice is available from the Scott Bader (Pty) Ltd. Technical Service Department.

Typical Properties

The typical properties of Crystic 198 and 474PA are given in Tables 4 & 5.

Table 4: Typical properties of liquid Crystic 198 & 474PA

Property	Units	Nominal value	
		Crystic 198	Crystic 474PA
Viscosity at 25ºC (Ferranti shear rate 37.35 sec^{-1}) (Ferranti shear rate 4,500 sec^{-1})	poise	550 -	500 330
Specific Gravity at 25ºC		1.11	1.10
Acid Value	mgKOH/g	24	23
Volatile Content	%	36	38
Appearance		light straw	cloudy mauvish
Stability at 20ºC	months	6	3
Gel time at 25ºC using 2% Catalyst Paste H, and 4% Crystic Accelerator E in Crystic 198	minutes	12	-
Gel time at 25°C using 2% Andonox® KP9 in Crystic 474PA	minutes	-	12

Test methods as in BS 2782 : 1980

Table 5: Typical properties of post-cured # Crystic 198 & 474PA (unfilled casting)

Property	Units	Nominal value	
		Crystic 198	Crystic 474PA
Barcol hardness (Model GYZJ 934-1)		50	50
Water absorption	mg	25	25
Deflection temperature under load (1.80 MPa)	°C	110	110
Specific Gravity at 25°C		1.22	1.22
Refractive index n 20/D		1.556	-
Elongation at break*	%	2.0	2.0
Volumetric shrinkage	%	9.0	8.2
Tensile strength	MPa+	60	60
Tensile modulus	MPa	3800	3800

Test methods as in BS 2782:1980

The curing schedule was 24h at 20°C followed by 3h at 80°C, except in determining deflection temperature, where the schedule was 24h at 20°C, 5h at 80°C, 3h at 120°C.
* Filtered resin, void-free casting.+ 1 Mpa = 1 MN/m^2 = I N/mm^2 and is approximately 145 lbf/in^2 or 10.2 kgf/cm^2.

Storage

Crystic 198 and 474PA should be stored in the dark in suitable, closed containers. It is recommended that the storage temperature should be less than 20ºC where practical, but should not exceed 30ºC. Ideally, containers should be opened only immediately prior to use. Where they have to be stored outside, it is recommended that drums be kept in a horizontal position to avoid the possible ingress of water. Wherever possible, containers should be stored under cover.

Packaging

Crystic 198 and 474PA are supplied in 25kg kegs, 225kg drums, and 1125kg intermediate bulk containers. Bulk supplies can be delivered by road tanker.

Health and Safety

Please see the applicable Material Safety Data Sheets, depending on the curing system used.

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