SR GreenPoxy 33 / SD 477x

Epoxy system for composites parts

High bio-based carbon content

***SR GreenPoxy* 33** resin is out coming from the latest innovations in bio-based chemistry.
***SR GreenPoxy* 33** resin is produced with a high content of carbon from plant origin.
The bio-based Carbon content of our system is certified by an independent laboratory using Carbon 14 measurements (ASTM D6866 or XP CEN/TS 16640)

This is a significant technological advance on the following points:
Clarity, color, performances and guarantees of industrial tonnages availability.

***SR GreenPoxy* 33** is an epoxy resin which has 35% of its molecular structure coming from plant origin.
This percentage is function of the carbon origin contained in the epoxy molecule.
The final rate of the mix bio-based carbon content will depend on the hardener choice.

Epoxy system ***SR GreenPoxy* 33 / SD 477x**

- 3 hardeners of extreme low viscosity, special infusion: SD 4772 / 4771 / 4770
  Suitable with ambient temperature of 25 to 40 °C
  Design for infusion or RTM process, for large parts, very thick laminates

- 3 hardeners for hand laminating, bonding: SD 4777 / 4775 / 4773

Clear laminate and final aspect.
High mechanical properties.
Good wetting out properties resulting in low resin consumption.
Good mechanical properties @ ambient temperature, post cure @ 40 to 60 °C

Mix bio-based carbon content of about 27 %.
All components are CMR free

Resin *SR GreenPoxy* 33:

Appearance		Viscous liquid
Color		Clear
Gardner color		3 maximum
Chemical nature		Epoxy resin. Reactions product between Alcohols and epichlorhydrine.
Storage		Can crystallize at low temperature or after a long storage. Shelf life : 2 years @ 18 - 25°C
Density (g/cm^3) ± 0.01	@ 20 °C	1.159
% bio-based Carbon content		34 - 36 %
Viscosities (m.Pas ± 20 %)	@ 15 °C @ 20 °C @ 25 °C @ 30 °C @ 40 °C	6 380 3 240 1 780 1 040 410
Refractive index (± 0.005)	@ 25 °C	1.5562

Base Hardeners SD 477x:

		SD 4777	SD 4775	SD 4773	SD 4772	SD 4771	SD 4770
Aspect Color			Liquid / Clear to yellow				
Gardner color	maximum	8	5	4	3	3	3
Reactivity levels		Very fast	Medium	Standard	Very slow	Ultra slow	Mega slow
Viscosities (mPa.s + 20 %)	@ 15 °C @ 20 °C @ 25 °C @ 30 °C @ 40 °C	71 52 39 30 19	285 190 130 95 55	56 41 31 24 15	13 11 9 7 5		
Density (± 0.01)	@ 20 °C	0.98	1.01	0.98	0.93	0.94	0.94
Refractive index (± 0.005)	@ 25 °C	1.5123	1.4980	1.4779	1.4810	1.4590	1.4603

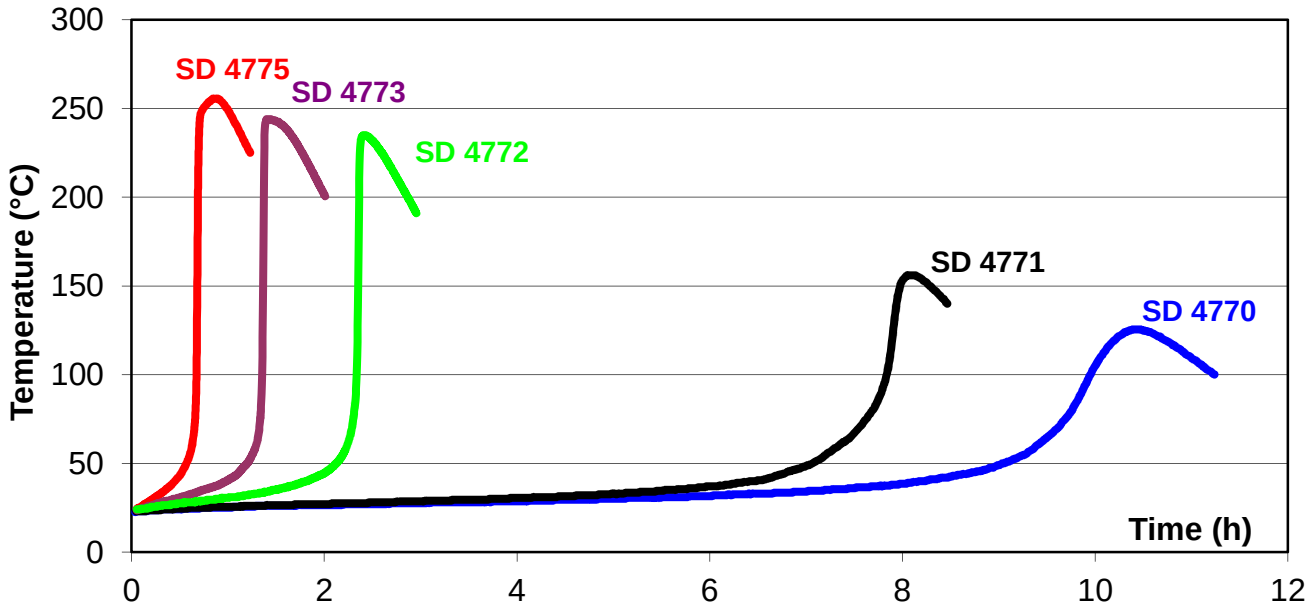
Resin *SR GreenPoxy* 33 / SD 477x Mixes :

		GP33 / SD 4777	GP33 / SD 4775	GP33/ SD 4773	GP33 / SD 4772	GP33 / SD 4771	GP33 / SD 4770
Mixing ratio: Quantity by weigh		**100 g / 27 g**					
Quantity by volume		**100 ml / 32 ml**	**100 ml / 31 ml**	**100 ml / 32 ml**	**100 ml / 33 ml or 3 / 1**		
Viscosities (mPa.s + 20 %)	@ 20 °C @ 30 °C @ 40 °C	910 500 230	1 300 540 270	1 000 500 170	800 260 105		
Gel Time	@ 20 °C @ 30 °C @ 40 °C	1 hr 40’ 55’ 32’	4 hrs 30’ 2 hrs 30’ 1 hr 18’	8 hrs 20’ 4 hrs 20’ 2 hrs 30’	11 hrs 6 hrs 3 hrs 15’	14 hrs 8 h 45’ 5 h 15’	23 hrs 30’ 12 h 30’ 6 h 30’
Minimum time to handle parts - Estimated value (hrs)	@ 20 °C @ 30 °C @ 40 °C	5 hrs 2 hrs 45’ 1 hr 35’	13 hrs 30’ 7 hrs 30’ 4	25 13 8	33 18 10	42 27 16	76 40 20
% bio-based Carbon content		GreenPoxy® 26 - 28 %					

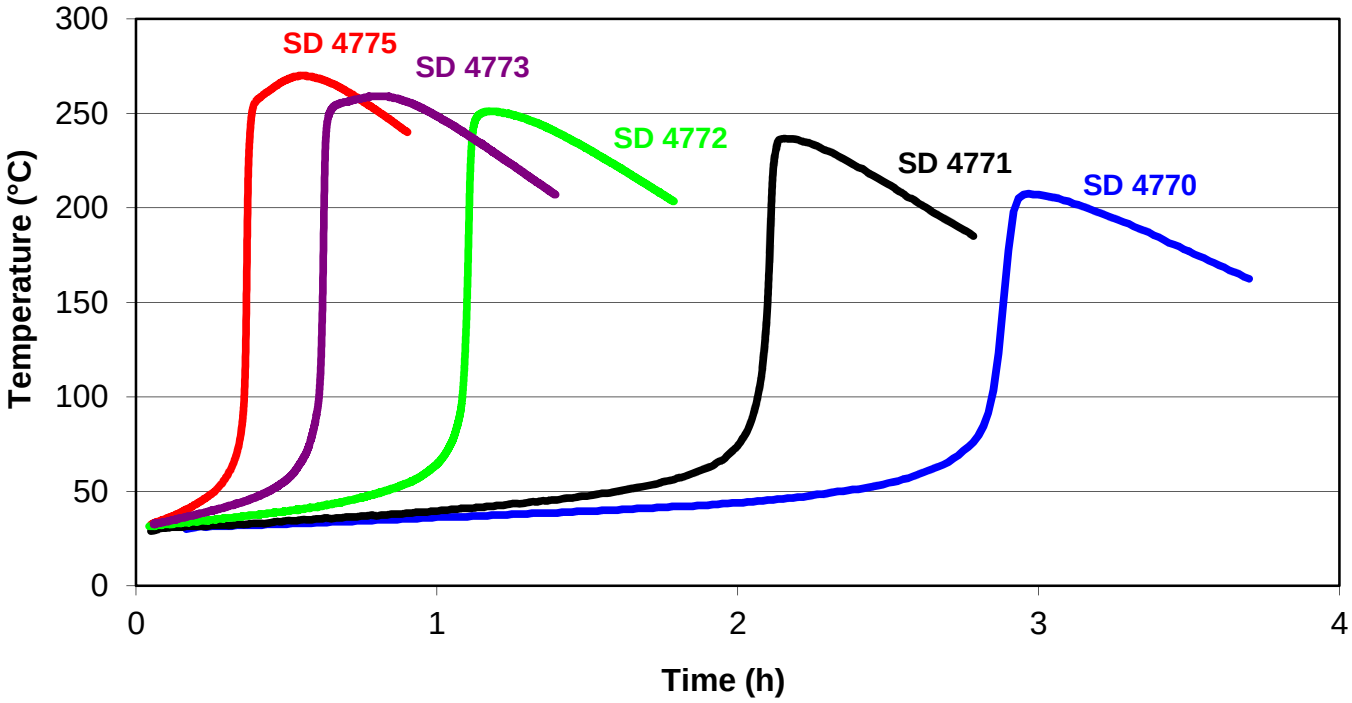
Reactivities on 500 g Mix

	GP33 / SD 4775	GP33 / SD 4773	GP33 / SD 4772	GP33 / SD 4771	GP33 / SD 4770
Exothermic temperature (°C):					
@ 20 °C	255	240	240	170	130
@ 30 °C	270	260	250	230	210
@ 40 °C	300	270	270	260	240
Time to reach exothermic peak:					
@ 20 °C	50’	1 h 25’	2 h 25’	6 h 50’	10 h 25‘
@ 30 °C	32’	46’	1 h 10’	2 h 15’	3 h
@ 40 °C	29’	30’	34’	1 h 20’	1 h 20’
Time to reach 50 °C:					
@ 20 °C	34’	1 h 10	2 h 10’	6 h 00	9 h
@ 30 °C	15’	26’	49’	1 h 40’	2 h 20
@ 40 °C	5’	8’	15’	35’	45’

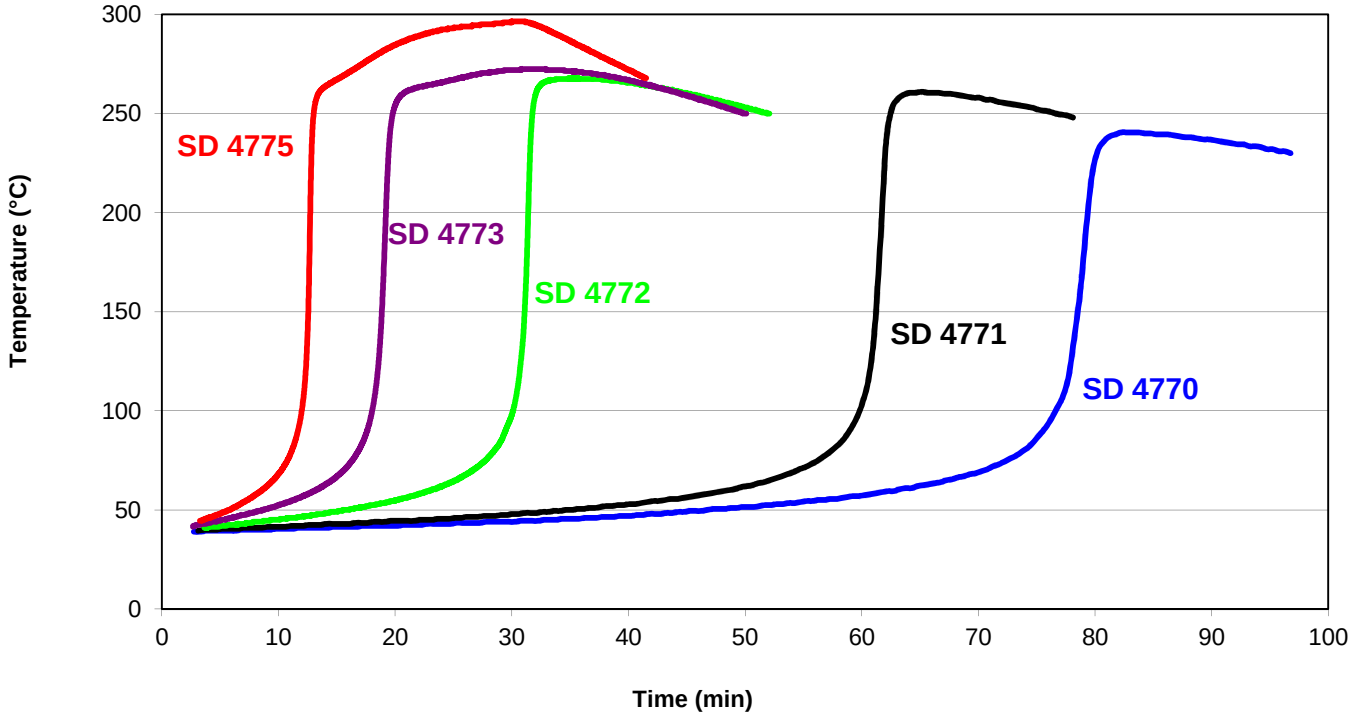
Pot Life 500 g @ 20 °C



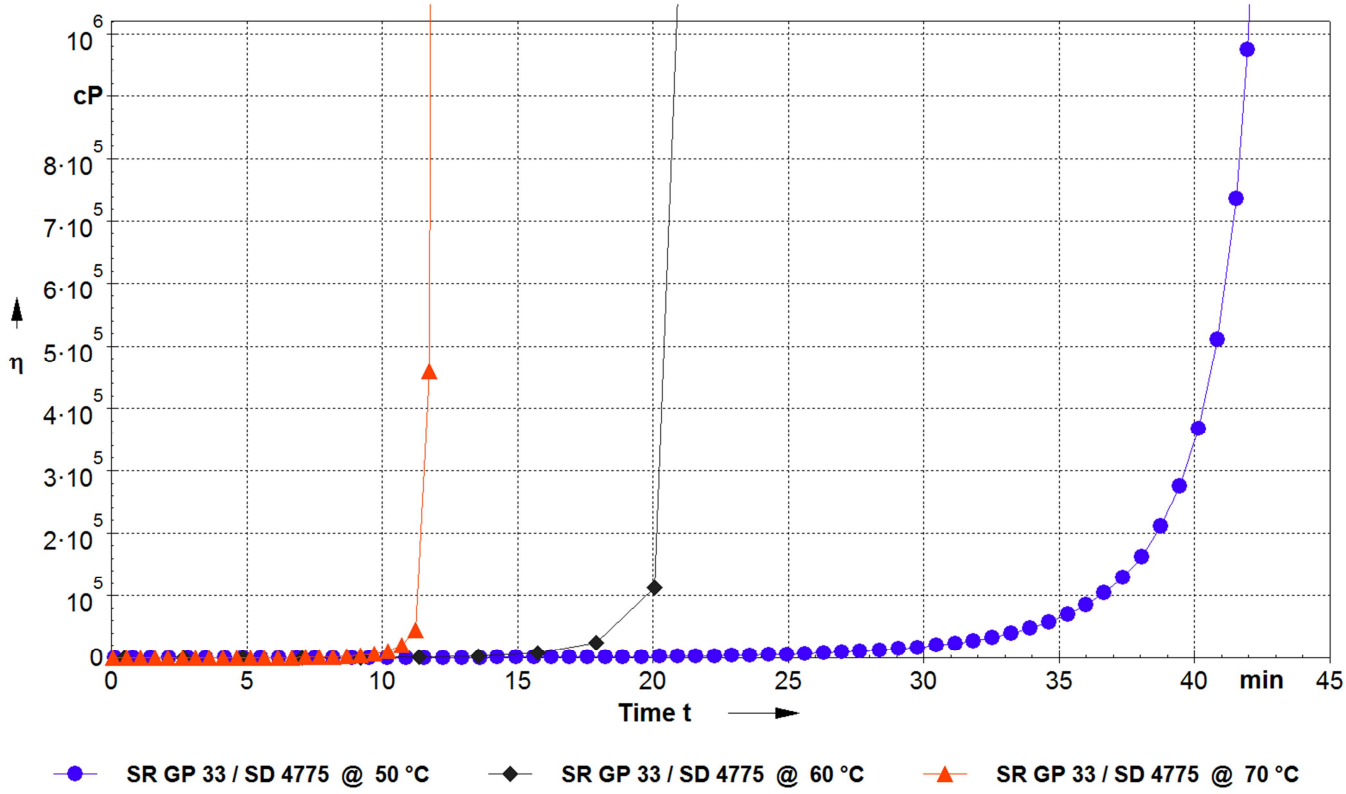
Pot Life 500 g @ 30 °C



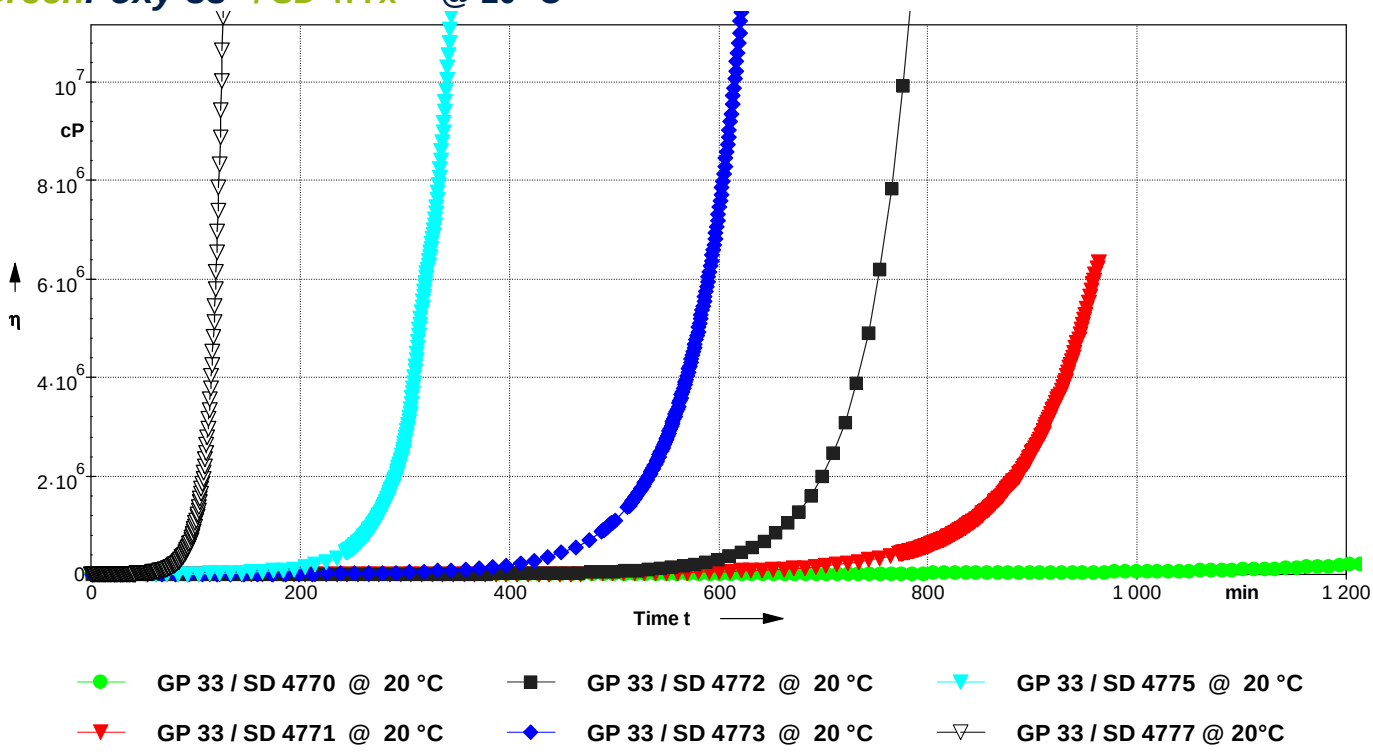
Pot Life 500 g @ 40 °C



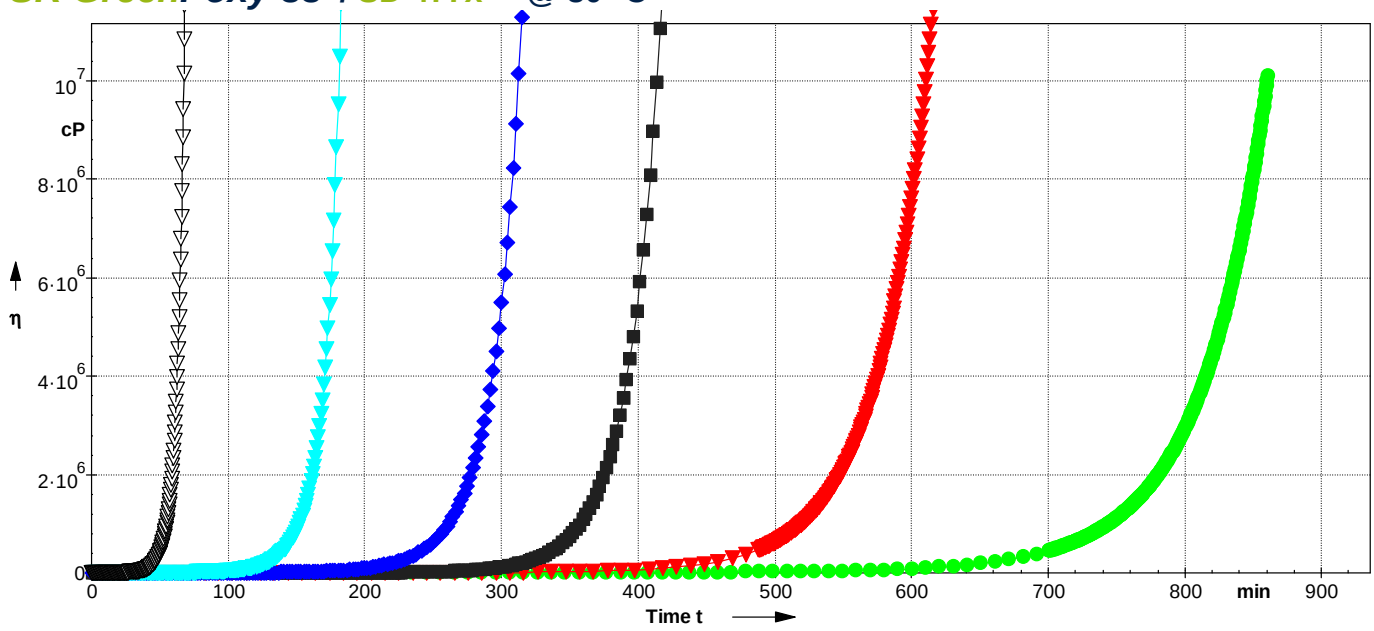
Reactivity – 1 mm film viscosity evolution with the temperature
SR GreenPoxy 33 / SD 4775 @ 50, 60 and 70 °C (Hot process)



SR GreenPoxy 33 / SD 477x @ 20 °C

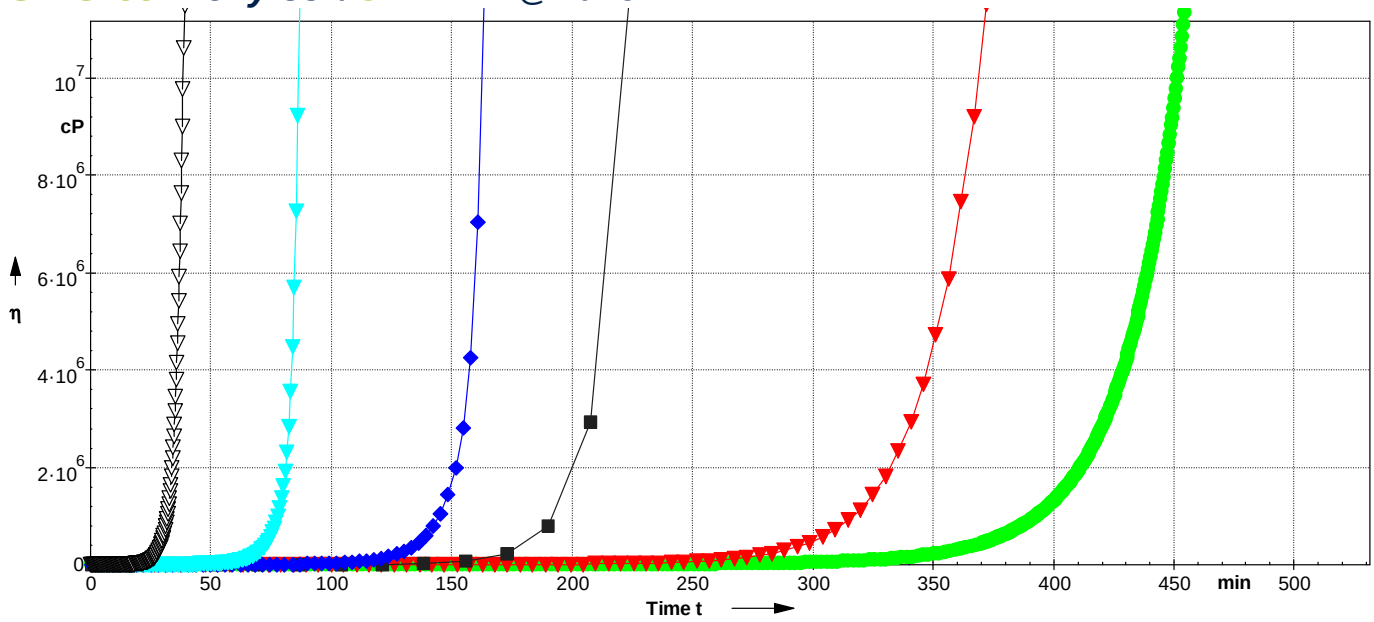


SR GreenPoxy 33 / SD 477x @ 30 °C



GP 33 / SD 4770 @ 30 °C
GP 33 / SD 4772 @ 30 °C
GP 33 / SD 4775 @ 30 °C
GP 33 / SD 4771 @ 30 °C
GP 33 / SD 4773 @ 30 °C
GP 33 / SD 4777 @ 30°C

SR GreenPoxy 33 / SD 477x @ 40 °C



GP 33 / SD 4770 @ 40 °C
GP 33 / SD 4772 @ 40 °C
GP 33 / SD 4775 @ 40 °C
GP 33 / SD 4771 @ 40°C
GP 33 / SD 4773 @ 40 °C
GP 33 / SD 4777 @ 40°C

Mechanical Properties Of Pure Resin

Systems		GP33 / SD 4777				GP33 / SD 4775		
Cure		14 days AT	Ambient + 24 hrs 40 °C	Ambient + 8 hrs 60 °C	Ambient + 4 hrs 80 °C	Ambient + 24 hrs 40 °C	Ambient + 8 hrs 60 °C	Ambient + 4 hrs 80 °C
Tension								
Modulus of elasticity	N/mm²	4300	4100	3800	3800	3400	3230	3050
Maximum resistance	N/mm²	72	82	82	81	82	78	75
Resistance at break		72	75	76	80	81	77	70
Elongation at max. resistance	%	2.3	3.5	4.3	4.4	3.9	4.9	5.0
Elongation at break	%	2.3	4.7	6.3	5.4	4.3	5.8	6.0
Flexion								
Modulus of elasticity	N/mm²	3500	3300	3200	3200	3400	3200	2900
Maximum resistance	N/mm²	120	127	131	133	127	127	125
Elongation at max. resistance	%	4.2	4.8	5.7	6.2	5.0	5.6	6.5
Shear strength	N/mm²	47	52	52	53	52	52	53
Compression								
Compression yield strength	N/mm²	109	110	110	110	110	107	104
Offset compression yield	%	11.5	12.1	13.5	14.7	7.2	8.5	10.3
Charpy impact strength								
Resilience	KJ/m²	47	57	33	42	25	25	23
Glass Transition								
DSC – T_{G1} Onset	°C	60	74	85	94	69	90	100
DSC – T_{G1} Onset max	°C				91			98

Mechanical Properties Of Pure Resin

Systems		**GP33 / SD 4773**				**GP33 / SD 4772**			
Cure		Ambient + 24 hrs 40 °C	Ambient + 20 hrs 50 °C	Ambient + 8 hrs 60 °C	Ambient + 4 hrs 80 °C	Ambient + 24 hrs 40 °C	Ambient + 20 hrs 50 °C	Ambient + 16 hrs 60 °C	Ambient + 8 hrs 80 °C
Tension									
Modulus of elasticity	N/mm²	3450	3200	3300	3100	3200	3200	3200	3100
Maximum resistance	N/mm²	80	77	78	74	56	75	80	77
Resistance at break		75	73	77	73	56	74	8	73
Elongation at max. resistance	%	4.0	4.4	4.3	4.8	1	2.1	3.6	3.7
Elongation at break	%	4.5	5.8	4.7	4.8	1	2.1	3.9	3.8
Flexion									
Modulus of elasticity	N/mm²	3500	3300	3100	2800	3300	3300	3200	3000
Maximum resistance	N/mm²	116	114	113	106	100	115	112	112
Elongation at max. resistance	%	4.6	5.0	5.7	6.1	3.7	5	5.3	5.6
Shear strength	N/mm²	50	50	52	51	51	52	54	50
Compression									
Compression yield strength	N/mm²	122	118	112	109	110	113	121	115
Offset compression yield	%	7.7	7.9	8.5	9.8	9.0	10.5	10.0	13.2
Charpy impact strength									
Resilience	KJ/m²	26	27	32	18	18	13	20	13
Glass Transition									
DSC – T_{G1} Onset	°C	68	81	87	96	67	73	82	90
DSC – T_{G1} Onset max	°C				95				90

Systems		**GP33 / SD 4771**			**GP33 / SD 4770**		
Cure		Ambient + 24 hrs 40 °C	Ambient + 8 hrs 60 °C	Ambient + 8 hrs 80 °C	Ambient + 24 hrs 40 °C	Ambient + 16 hrs 60 °C	Ambient + 8 hrs 80 °C
Tension							
Modulus of elasticity	N/mm²	3290	3110	2800	3100	2900	2800
Maximum resistance	N/mm²	73	74	74	69	76	74
Resistance at break		69	71	70	66	74	73
Elongation at max. resistance	%	3.2	4.2	5.4	3.2	4.7	5.3
Elongation at break	%	3.4	5.1	6.0	3.3	5.4	5.6
Flexion							
Modulus of elasticity	N/mm²	3250	3150	2800	3100	2800	2700
Maximum resistance	N/mm²	115	116	117	113	118	117
Elongation at max. resistance	%	4.4	5.3	6.2	4.3	5.7	6.5
Shear strength	N/mm²	48	48	49	49	50	50
Compression							
Compression yield strength	N/mm²	100	100	99	101	101	101
Offset compression yield	%	8.8	9.1	10.2	7.7	8.4	9.0
Charpy impact strength							
Resilience	KJ/m²	17	39	21	21	29	29
Glass Transition							
DSC – T_{G1} Onset	°C	71	89	103	66	87	93
DSC – T_{G1} Onset max	°C			101			95
DMTA – T_G Ult.	°C	113	113	113			

Tests carried out on samples of pure cast resin, without prior degassing, between steel plates.
Measures undertaken according to the following norms:

Tension:	ISO 527 - 2
Flexion:	ISO178
Charpy impact strength:	NF T 51-035
Shear Strength:	ASTM D 732 - 93
Compression:	ISO 604
Water absorption:	Internal. Polymerization according to cycle, machining, weighing, time spent in distilled water at 70 °C / 48 hours, weighing 1 hour after emerging,

Glass transition DSC:	ISO 11357-2: 1999 -5°C to 180 °C under nitrogen gas T_{G1} or Onset: 1st point at 20 °C/min	T_{G1} maximum or Onset : second passage
Glass transition DTMA:	ISO 11357-1 - T_G onset G' ASTM D4065 - T_G peak G''	Temperature ramp 0 °C to 180 °C @ 2°C/min

Physical tests according standard:

Gardner color:	NF EN ISO 4630	Visual method
Refractive index:	NF ISO 280	
Viscosity:	NF EN ISO 3219	Rheometer 50 mm, shear 10 s^{-1}
Density:	NF EN ISO 2811-1	Pycnometer
Gel time:	Cross G' G''	Rheometer CP50 - Shear rate 10 s^{-1}
Green Carbone content:	ASTM D6866-12 or XP CEN/TS 16640 Avril 2014	

LEGAL NOTES:
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