

SR **GreenPoxy 33** / SD 477X DNV-GL

Epoxy system for composites parts High bio-based carbon content



SR GreenPoxy 33 resin is outcoming from the latest innovations in bio-based chemistry. **SR GreenPoxy 33** is an epoxy resin which has 35% of its molecular structure coming from plant origin.

Designed for hand layup and under vacuum laminating, infusion (from 25 °C), RTM and filament winding.

		SD 4775	SD 4773	SD 4771
Reactivity level		Standard	Medium	Slow
Initial viscosity (mPa.s)	20 °C	1 575	820	510
	30 °C	540	485	250
Pot Life (500 g)	20 °C	23 min	01 h 05	06 h 00
	30 °C	13 min	30 min	01 h 40
Mixing ratio	By weight	100 / 27	100 / 27	100 / 27
	By volume	100 / 31	100 / 32	100 / 33
Maximum strength	N/mm ²	75	74	74
% Elongation at max strength	%	5	4,8	5,4
Tg max onset	°C	98	95	101
Gel Time (1 mm)	20 °C	05 h 40	09 h 30	20 h 40
	30 °C	02 h 55	04 h 50	10 h 40
Time to reach 400 mPa.s	20 °C	02 h 30	04 h 40	11 h 50
	30 °C	01 h 30	02 h 35	06 h 30
Demold time	20 °C	17 h 00	28 h 30	62 h 00
	30 °C	08 h 45	14 h 30	32 h 00

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.

SD 477x Hardeners:

Without classified Toxic products (T)

SD 4773, SD 4775 : Intermediate, medium hardener

SD 4771 : Ultra slow hardener

Profile:

Implementation from 15 °C and with a hygrometry of less than 70%.

Choose the hardener according to ambient temperature, implementation and size of the part to be made.

Cure at Ambient temperature and post cure at 40 to 100 °C

Applications:

Hand laminating, infusion, tooling, casting, laminates...



Epoxy resin SR GreenPoxy 33

Appearance		liquid
Color		colourless
Gardner color		≤ 3
Viscosity (mPa.s)	15 °C	6850 ± 1350
	20 °C	3410 ± 690
	25 °C	1770 ± 370
	30 °C	1100 ± 220
Density	20 °C	1,16
Bio-based Carbon content (%)		35
Storage (months)	23 °C	24

Hardener(s)

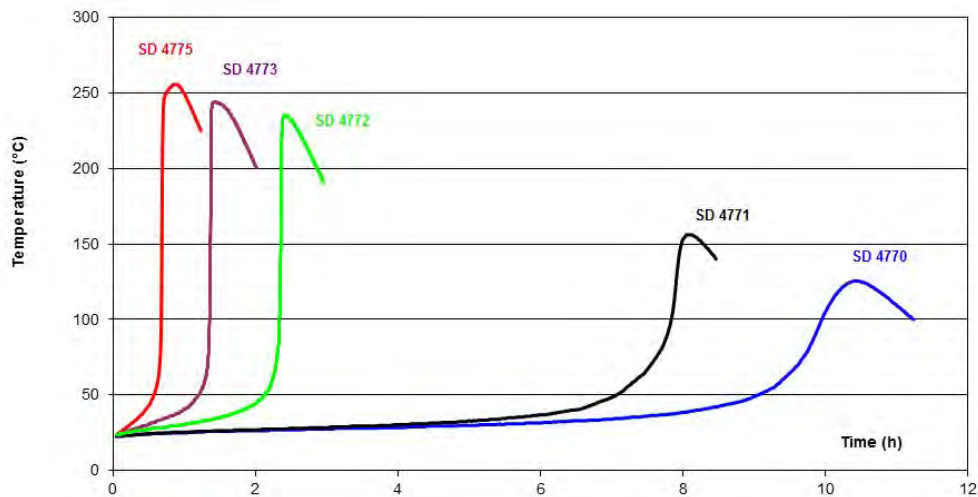
		SD 4775	SD 4773	SD 4771
Appearance		liquid	liquid	liquid
Color		light yellow	yellow	colourless
Gardner color		≤ 5	≤ 4	≤ 1
Reactivity level		Standard	Medium	Slow
Viscosity (mPa.s)	15 °C	200 ± 40	51 ± 10	13 ± 3
	20 °C	135 ± 30	41 ± 8	11 ± 2
	25 °C	95 ± 20	31 ± 6	9 ± 2
	30 °C	70 ± 15	24 ± 5	7 ± 1
Density	20 °C	1,00	0,98	0,94
Storage (months)	23 °C	24	24	24

Mixe(s) SR GreenPoxy 33 / SD 477x DNV-GL

		SD 4775	SD 4773	SD 4771
Appearance		liquid	liquid	liquid
Color		colourless	colourless	colourless
Mixing ratio				
	By weight	100 / 27	100 / 27	100 / 27
	By volume	100 / 31	100 / 32	100 / 33
Initial viscosity (mPa.s)	20 °C	1 575	820	510
	30 °C	540	485	250
Density	20 °C	1,12	1,12	1,11

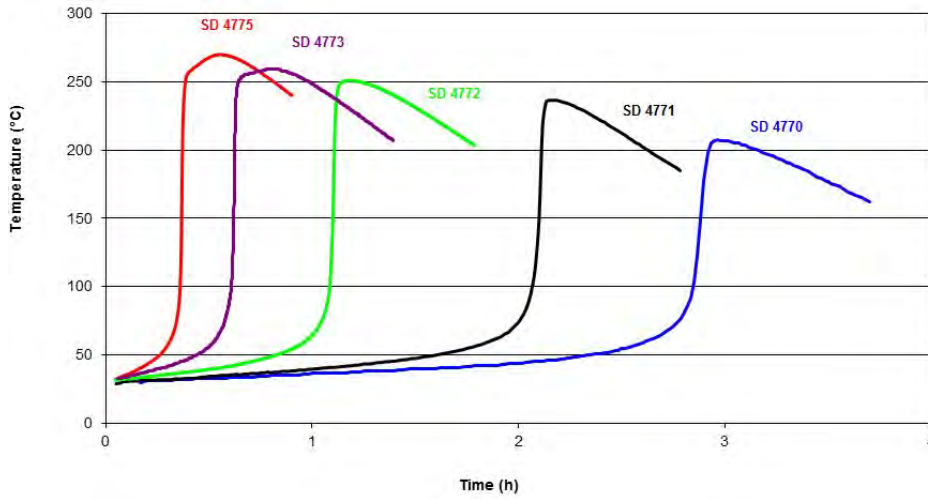
Reactivity 20 °C for 500 g SR GreenPoxy 33 / SD 477x DNV-GL

	SD 4775	SD 4773	SD 4771
Exothermic temperature (°C)	249	253	170
Exothermic peak time	30 min	01 h 25	06 h 50
Time to reach 50 °C	23 min	01 h 05	06 h 00



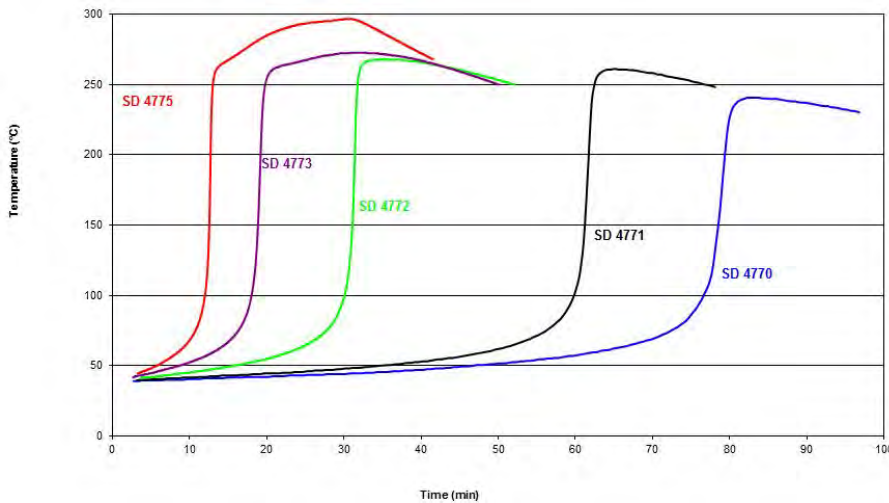
Reactivity 30 °C for 500 g SR GreenPoxy 33 / SD 477x DNV-GL

	SD 4775	SD 4773	SD 4771
Exothermic temperature (°C)	258	260	230
Exothermic peak time	22 min	55 min	02 h 15
Time to reach 50 °C	13 min	30 min	01 h 40



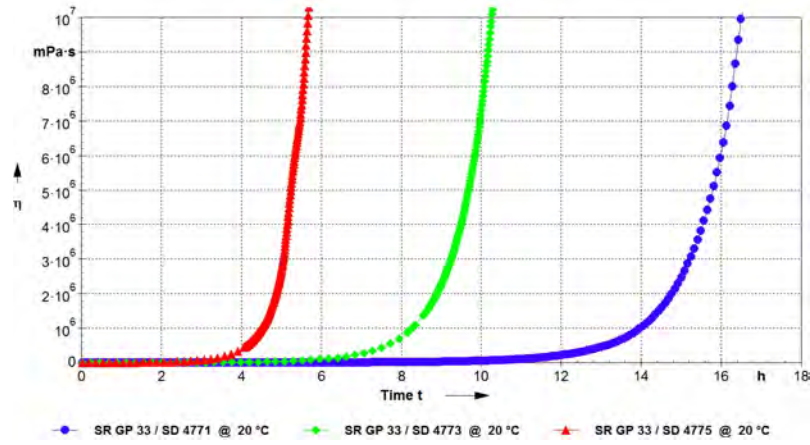
Reactivity 40 °C for 500 g SR GreenPoxy 33 / SD 477x DNV-GL

	SD 4775	SD 4773	SD 4771
Exothermic temperature (°C)	268	270	247
Exothermic peak time	10 min	40 min	01 h 00
Time to reach 50 °C	2 min	12 min	28 min

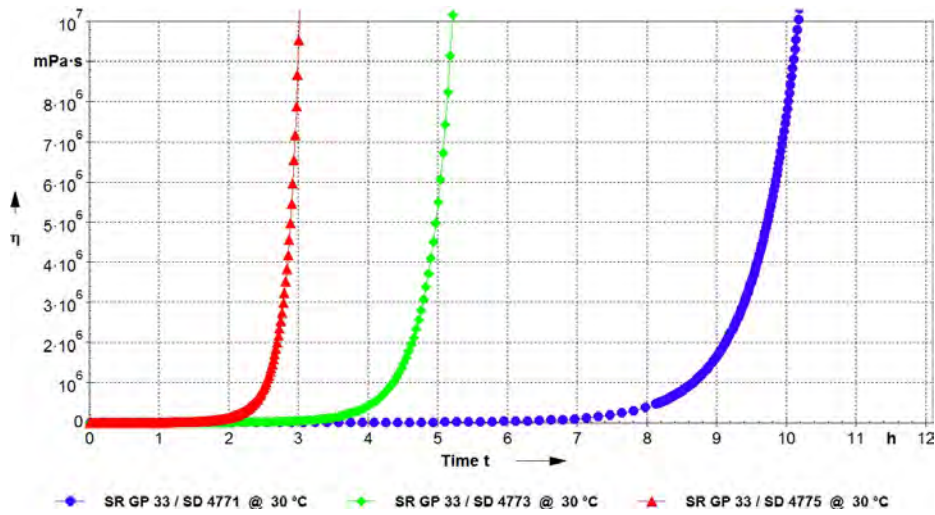


Reactivity on a 1 mm thick layer

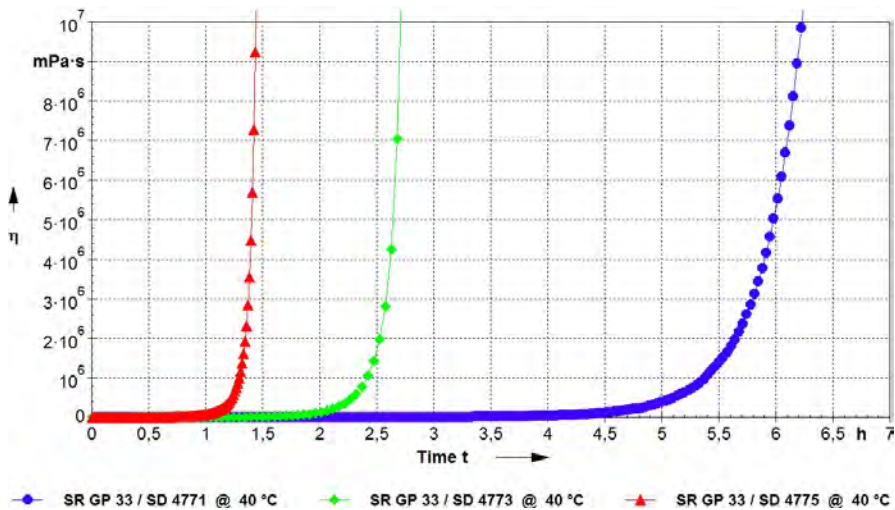
20 °C



30 °C



40 °C



Post-curing

The thermomechanical values of an epoxy system can be optimized by implementing a post-curing cycle. The Sicomin laboratory provides several predefined post cure cycles on its data sheets allowing users to compare systems. These experimental cycles are adaptable to your specific applications, taking the following parameters into account:

- Selected epoxy system (Tg max)
- Available heat source
- Room Dimension and Sampling
- Nature of the tooling (thermal conductivity of material)

Many systems can provide good mechanical properties after curing at room temperature and from 18°C for 24 to 48 hours before demoulding.

The mechanical properties progress very quickly with a slightly higher temperature of around 40°C for several hours.

Epoxy systems with high Tg and slow and extra-slow hardeners imperatively require post-curing at a higher temperature. It is possible to start the cycle as soon as the exothermic peak passes, but also to start post-curing later after assembly of the various components and before the finishing operations. If the nature of the models and tools is not suitable for high temperatures, we recommend carrying out the first stages up to the maximum admissible temperature then, after cooling and demoulding, continuing the cycle on a suitable former.

For a conventional epoxy system, we recommend carrying out a cycle in steps of 20°C for 4 hours.

Example for an epoxy system Tg max 100°C:

4 hrs at 40°C + 4 hrs at 60°C + 4 hrs at 80°C + cooling to room temperature before unmoulding.

There are many short cycle, high temperature epoxy systems that do not fit into this post-cure scheme (pultrusion, hot press, pre-preg). For these systems, initial curing provides maximum thermomechanical performance without post-curing.

We invite you to contact our technical department for your questions on this subject.

Mechanical properties on cast resin :

		SR GreenPoxy 33 / SD 4775			SR GreenPoxy 33 / SD 4773		
		24 h Ta + 24 h 40°C	24 h Ta + 16 h 60°C	24 h Ta + 8 h 80°C	24 h Ta + 24 h 40°C	24 h Ta + 16 h 60°C	24 h Ta + 8 h 80°C
Tensile							
Modulus	N/mm ²	3 400	3 200	3 050	3 450	3 300	3 100
Maximum strength	N/mm ²	82	78	75	80	78	74
Breaking Strength	N/mm ²	81	77	70	75	77	73
Elongation at max strength	%	3,9	4,9	5	4	4,3	4,8
Elongation at break	%	4,3	5,8	6	4,5	4,7	4,8
Flexion							
Modulus	N/mm ²	3 400	3 200	2 900	3 500	3 100	2 800
Maximum strength	N/mm ²	127	127	125	116	113	106
Breaking Strength	N/mm ²						
Elongation at max strength	%	5	5,6	6,5	4,6	5,7	6,1
Elongation at break	%						
Shear							
Breaking Strength	N/mm ²	52	52	53	50	52	51
Compression							
Modulus	N/mm ²						
Yield strength	N/mm ²	110	107	104	122	112	109
Offset compression yield	%	7,2	8,5	10,3	7,7	8,5	9,8
Charpy impact strength							
Resilience	kJ/m ²	25	25	23	26	32	18
DSC glass transition							
Tg onset	°C	69	90	100	68	87	96
Tg max onset	°C			98			95

These curing cycles are applied after a 24-hour hardening period at room temperature, allowing the reaction to freeze and exotherm beyond.

Mechanical properties on cast resin :

		SR GreenPoxy 33 / SD 4771		
		24 h Ta + 24 h 40°C	24 h Ta + 16 h 60°C	24 h Ta + 8 h 80°C
Tensile				
Modulus	N/mm ²	3 300	3 100	2 800
Maximum strength	N/mm ²	73	74	74
Breaking Strength	N/mm ²	69	71	70
Elongation at max strength	%	3,2	4,2	5,4
Elongation at break	%	3,4	5,1	6
Flexion				
Modulus	N/mm ²	3 250	3 150	2 800
Maximum strength	N/mm ²	115	116	117
Breaking Strength	N/mm ²			
Elongation at max strength	%	4,4	5,3	6,2
Elongation at break	%			
Shear				
Breaking Strength	N/mm ²	48	48	49
Compression				
Modulus	N/mm ²			
Yield strength	N/mm ²	100	100	99
Offset compression yield	%	8,8	9,1	10,2
Charpy impact strength				
Resilience	kJ/m ²	17	39	21
DSC glass transition				
Tg onset	°C	71	89	103
Tg max onset	°C			101

These curing cycles are applied after a 24-hour hardening period at room temperature, allowing the reaction to freeze and exotherm beyond.

Tests carried out on samples of pure cast resin, without prior degassing, between steel plates.

Measures undertaken according to the following norms:

Mechanical tests:

Tension:	NF EN ISO 527-2:2012
Flexion:	NF EN ISO 178:2011
Compression:	NF EN ISO 604:2004 or NF EN ISO 844:2014 (foam product)
Charpy impact strength:	NF EN ISO 179-1:2010
Shear Strength:	ASTM D732-17 (Punch Tool)
Interlaminar shrinkage strength:	ASTM D5528-13
Toughness (GIC et KIC) :	ISO 13586:2000

Water absorption: Internal. Polymerization according to cycle, machining, weighing, time spent in distilled water at 70 °C / 48 hours, weighing 1 hour after emerging,

Bonding Strength Double lap shear: ASTM D3528-96
 ADH = adhesive failure
 COH = cohesive failure
 TLC = thin-layer cohesive failure
 FT = fiber-tear failure.
 LFT = light-fiber-tear failure

Thermal tests:

Glass transition DSC: NF EN ISO 11357-2:2014 -5°C to 180 °C under nitrogen gas
 T_{G1} or Onset: 1st scan at 20 °C/min
 T_{G1} maximum or Onset: 2nd scan at 20 °C/min

Glass transition DTMA: Temperature ramp 0 °C to 180 °C @ 2°C/min under normal atmosphere
 NF EN ISO 11357-1:2016 T_g onset G'
 ASTM D4065-12 T_g peak G''

Physical tests:

Gardner color:	NF EN ISO 4630:2016	Visual method
Refractive index:	NF ISO 280:1999	
Viscosity:	NF EN ISO 3219:1994	Rheometer 50 mm, shear 10 s ⁻¹
Density on liquids:	ISO 2811-1:2016	Pycnometer
Density on solid:	NF EN ISO 1183-3:1999	Helium Pycnometer
Density on foam:	NF EN ISO 845:2009	
Gel time:	Cross G' G''	Rheometer CP50 - Shear rate 10 s ⁻¹
Green Carbone content:	ASTM D6866-16 or XP CEN/TS 16640 Avril 2014	

TA: Ambient temperature (20 to 25 °C)
 NC: No information Communicated
 NB: No Breaking (maximum flexion deformation : 15 %)

Table 1st page:

Pot Life:	Time to reach 50 °C or time limit for use
Gel time:	Intersection of tangents on the viscosity curve of 1 mm thick layer
Release time:	Time required to obtain sufficient mechanical strength to release
Minimum Vacuum Time:	Time in which vacuum can be applied (25000 mPa.s)
Maximum Vacuum time:	Limit time below which a vacuum can be applied (G'G'' crossing)
Optimum Infusion time:	Time to reach 400 mPa.s
Max Infusion Time:	Time to reach 25000 mPa.s
Vacuum cut-off time:	Time to reach G'G'' crossover + 20%

LEGAL NOTES:

Information given in writing or verbally, in the context of our technical assistance and our trials, does not engage our responsibility. Information is given in good faith based on SICOMIN's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with SICOMIN's recommendations. We advise users of SICOMIN products to check by some practical trials that they are suitable for the intended processes and applications. The customer's storage, the use, the implementation and the transformation of the supplied products are not under SICOMIN's control and entirely under the sole responsibility of the user.

SICOMIN reserves the right to change the properties of its products. All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data and tolerance may vary due to circumstances beyond our control.

If our responsibility should nevertheless be involved, it would be, for all the damages, limited to the value of the goods supplied by us and processed by the customer. We guaranty the non-reproachable quality of our products, in the general context of sales and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

Mix

SR GreenPoxy 33	Resin part + Hardener part (kg)	Resin part (kg)	Hardener part (kg)
SD 4775			
SD 4773			
SD 4771			