



SWANCOR HIGHPOLYMER CO., LTD.
 No. 9 Industry South 6 Road,
 Nantou City 54066, Taiwan
 Tel : +886 49 225 5420
 Fax : +886 49 225 1534
 E-mail : nantou@swancor.com.tw



SWANCOR (SHANGHAI) FINE CHEMICAL CO., LTD.
 No. 618 Songsheng Road,
 Songjiang Industrial Zone,
 Shanghai 201600, China
 Tel : +86 21 5774 6183
 Fax : +86 21 5774 6177
 E-mail : shanghai@swancor.com.cn



SWANCOR (TIANJIN) WIND BLADE MATERIALS CO., LTD.
 No. 6, Caiyun Street, Hangu Modern
 Industrial Park, Tianjin Economic-
 Technological Development Area,
 Tianjin 300480, China
 Tel : +86 22 5991 6567
 Fax : +86 22 5991 6568
 E-mail : tianjin@swancor.com.cn



SUNWELL (JIANGSU) CARBON FIBER COMPOSITE CO., LTD.
 No. 26, Xie xin Rd, Funing Economic Development
 Zone, Jiangsu 224400, China
 Tel : +86 515 6869 5998
 E-mail : service@swcfc.com.cn



Your trusted Partner in
Wind Blade Material Technology



www.swancor.com





About Swancor

Swancor is a young company but we are growing fast in several different business sectors. With a global view, Swancor anticipates becoming an admirable company, in energy saving and environmental protection fields. It is a long term task and requires persistence and endeavor. We have been accumulating knowledge from all aspects for our growth and we are working very hard to ensure that Swancor will be equipped with industry leading technology.

Swancor is committed to the industries and to achieve these goals in the near future.

蔡朝陽 Robert Tsai
SWANCOR Chairman

Corporate Policy

Prospect

Swancor is committed in becoming the respected composite material and energy development company in sustainable energy and environmental protection fields, and further more Swancor becoming well-known brand worldwide.

Company mission

Provide customers the highest value products and services in green energy and environmental protection fields.

Core value

Quality · Honesty · Innovation · Thrift

Management concept

Customer service is of utmost importance · Swancor strives for continuous growth · Employee share the enthusiasm and prides in the company · Environmental protection is our priority

Environmental safety&health policy

Program participation by every employee
Safety as top priority begets satisfaction
Best working environment at all times
Environmental protection-consciousness at all times



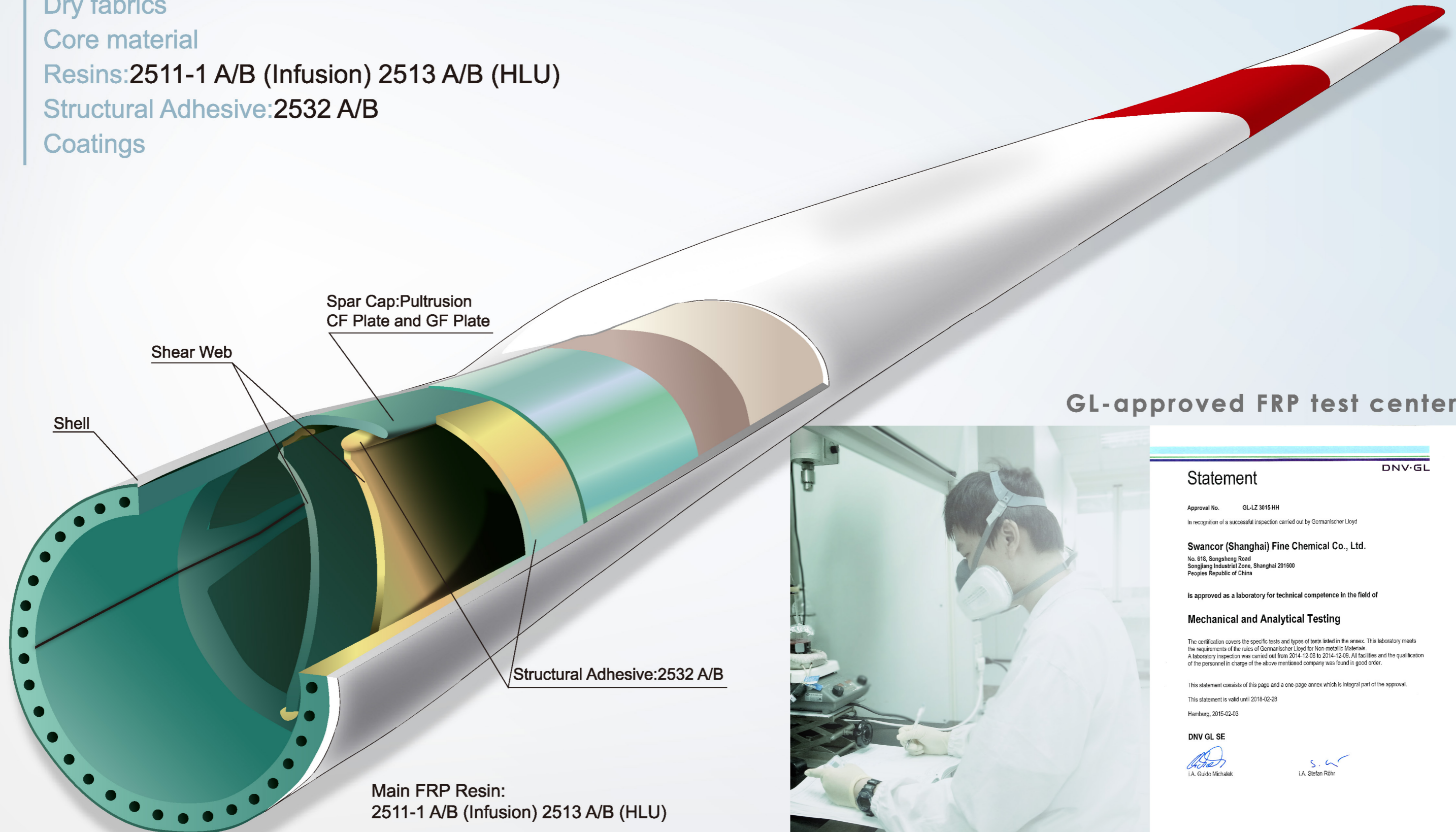
DNV-ISO 9001 2008

DNV-ISO 14001

DNV-OHSAS 18001

Expert on blade infusion process

- Dry fabrics
- Core material
- Resins: 2511-1 A/B (Infusion) 2513 A/B (HLU)
- Structural Adhesive: 2532 A/B
- Coatings



GL-approved FRP test center



Statement DNV GL

Approval No. GL-LZ 3015 HH
In recognition of a successful inspection carried out by Germanischer Lloyd

Swancor (Shanghai) Fine Chemical Co., Ltd.
No. 618, Songsheng Road
Songjiang Industrial Zone, Shanghai 201600
Peoples Republic of China

is approved as a laboratory for technical competence in the field of

Mechanical and Analytical Testing

The certification covers the specific tests and types of tests listed in the annex. This laboratory meets the requirements of the rules of Germanischer Lloyd for Non-metallic Materials. A laboratory inspection was carried out from 2014-12-08 to 2014-12-09. All facilities and the qualification of the personnel in charge of the above mentioned company was found in good order.

This statement consists of this page and a one-page annex which is integral part of the approval.
This statement is valid until 2018-02-28
Hamburg, 2015-02-03

DNV GL SE

 I.A. Guido Michalek  I.A. Stefan Röhr

DNV GL SE

SWANCOR 2511-1

Warm-curing Epoxy Resin System

Product Description

SWANCOR 2511-1A/BT/BM/BF/BS/BL is designed for the process of vacuum infusion (SCRIMP or RTM) which is composed of particular epoxy resin and hardener. That is especially suitable for wind blade manufacturer's use. Their main characters are low viscosity, long pot life, high HDT, superior immersed effect at glass fiber and carbon fiber.

Properties

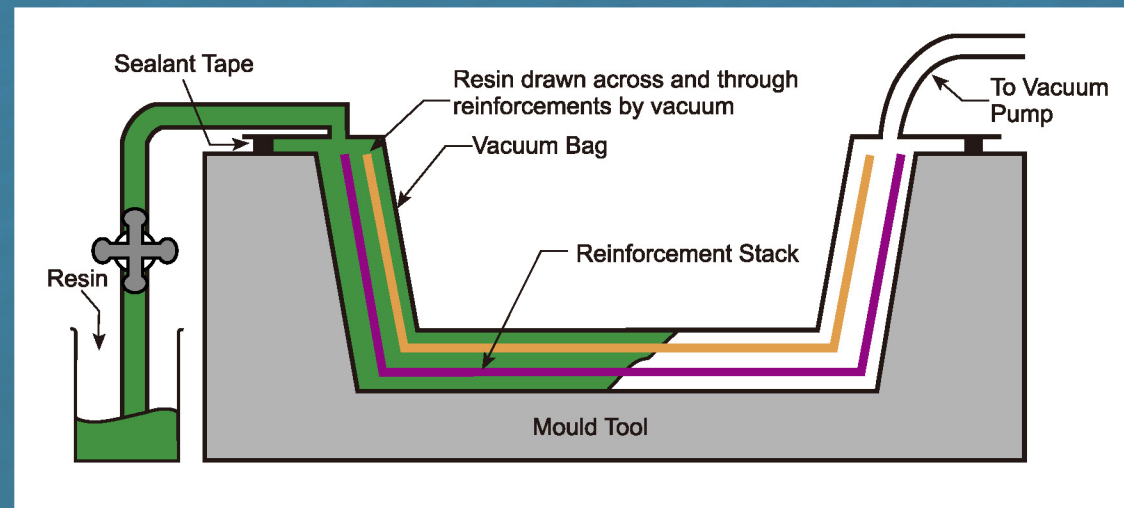
Item	2511-1A	2511-1BT	2511-1BM	2511-1BF	2511-1BS	2511-1BL
Appearance	Transparent Liquid	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue
Viscosity (25°C/77°F, cps)	900~1,400 (LVT#3-60rpm)	10~25 (LVT#1-60rpm)	5~20 (LVT#1-60rpm)	5~20 (LVT#1-60rpm)	5~20 (LVT#1-60rpm)	5~20 (LVT#1-60rpm)
Density (25°C/77°F, g/cm3)	1.1~1.2	0.9~1.0	0.9~1.0	0.9~1.0	0.9~1.0	0.9~1.0
Flash point (25°C/77°F)	>150°C/302°F	>120°C/248°F				
Shelf life (months)	24					
A/B ratio (weight)	100:30					
Initial Mix viscosity (25°C /77°F, cps)		250~350 (LVT#2-60rpm)	200~300 (LVT#2-60rpm)	200~280 (LVT#2-60rpm)	190~280 (LVT#2-60rpm)	180~250 (LVT#2-60rpm)
Exothermic peak time (28°C/82°F, 100g,mins)		85~125	170~250	220~300	280~360	310~410

Mechanical properties (sample thickness of neat resin:3.2mm or 4.0mm)

Item	2511-1A/BT	2511-1A/BM	2511-1A/BF	2511-1A/BS	2511-1A/BL	Method
Tensile strength(Mpa)	75~87	73~84	70~80	67~80	67~80	ASTM D638 or ISO 527
Tensile modulus(Mpa)	2,800~3,500	2,900~3,600	2,900~3,600	2,700~3,500	2,700~3,500	ASTM D638 or ISO 527
Flexural strength(Mpa)	125~155	110~130	110~140	110~140	110~140	ASTM D790 or ISO 178
Flexural modulus(Mpa)	2,800~3,600	2,900~3,400	3,000~3,500	2,800~3,600	2,700~3,400	ASTM D790 or ISO 178
Elongation at tensile strength (%)	5~8	5~8	5~8	4.5~8.5	4.5~8.5	ASTM D638 or ISO 527
Glass transition temperature (°C/°F)	85~95/185~203	85~95/185~203	85~95/185~203	80~90/176~194	80~90/176~194	DSC test ,10°C/50°F, min
Heat Distortion Temperature (°C/°F)	90~99/194~210	76~88/169~190	76~88/169~190	72~82/162~180	72~82/162~180	ASTM D648 or ISO 75-2

Curing condition: 24 hours at room temperature then 8 hours at 80°C/176°F

Use Infusion technique in manufacturing Wind Blades



SWANCOR 2511-1AL/BL

Warm-curing Long Potlife Epoxy Resin System

Introduction

SWANCOR 2511-1AL/BL is designed for the process of vacuum infusion (SCRIMP or RTM) which is composed of particular epoxy resin and hardener. It is especially suitable for wind blade manufacturing. The major features include low viscosity, long pot life, high HDT and wetting properties with glass fiber and carbon fiber.

Mixing Ratio

	SW2511-1AL:SW2511-1BL
Parts byweight	100:30±2
Parts by volume	100:36±2

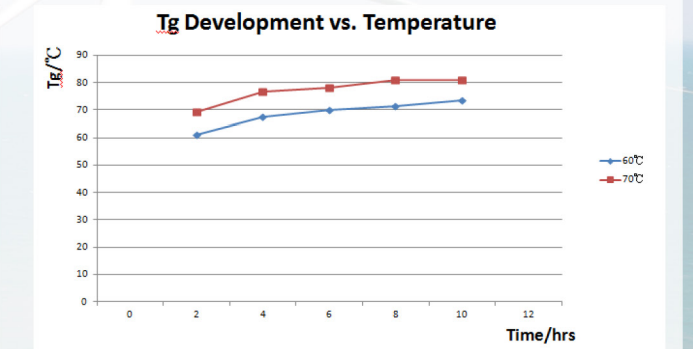
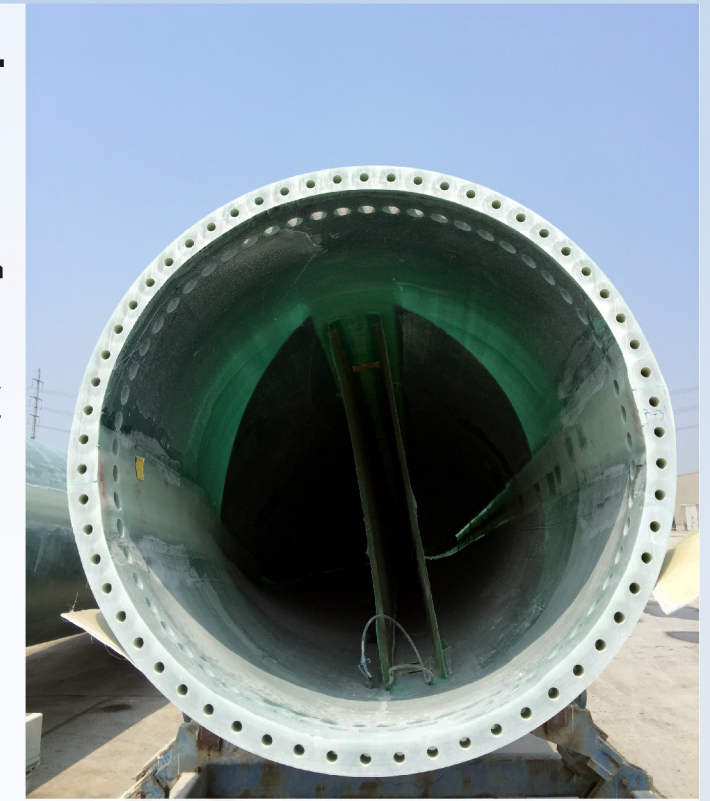
Physical Properties

Properties	Unit	2511-1AL	2511-1BL	Test Method
Appearance	NA	Transparent liquid	Blue liquid	NA
Viscosity(25°C)	cps	900~1400	5~20	ISO 3219
Density(25°C)	g/cm³	1.10~1.20	0.90~1.00	ASTM D891
Shelf Life	months	24	24	NA
Viscosity (25°C)	cps	190~270		LVT#2,60rpm
Exothermal Peak Time	min	400~490		100g,25°C
Exothermal Peak Temp.	°C	32~49		100g,25°C
Exothermal Peak Time	min	340~400		100g,28°C
Exothermal Peak Temp.	°C	38~59		100g,28°C
Overall Volume Shrinkage	%	<6.0		25°C

Mechanical Properties

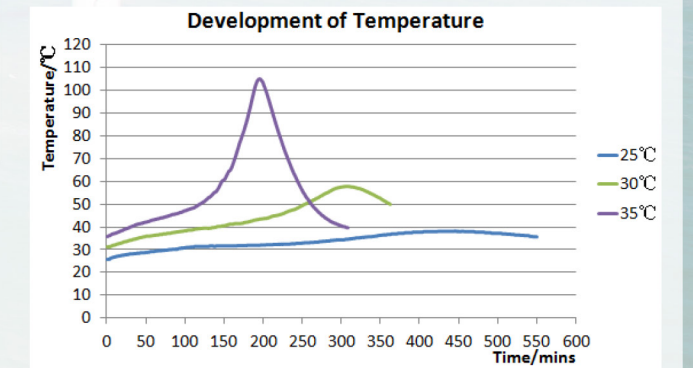
Properties	Unit	Value	Test Method
Tensile Strength	MPa	66~76	ASTM D638/ ISO 527-2
Tensile Modulus	MPa	>2700	
Elongation	%	>6.0	ASTM D790/ ISO 178
Flexural Strength	MPa	110~120	
Flexural Modulus	MPa	>2700	GB 2567
Impact Strength	KJ/m²	>70	
HDT	°C	70~80	ISO 75-2
Tg	°C	78~88	ASTM D3418/ ISO11357

Remark: 28°C>16hr + 70°C/10hrs for post-curing

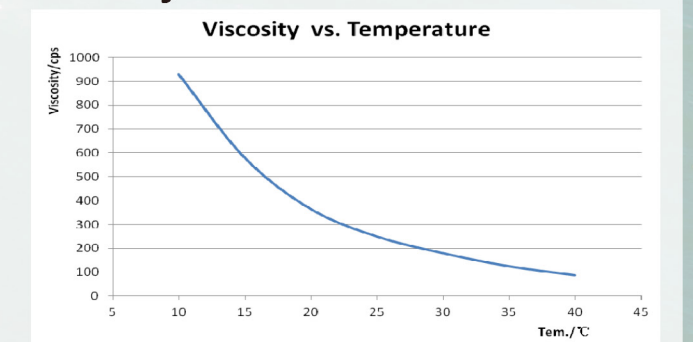


Remark: 28°C>16hr + 70 (or60)°C for post-curing.

Exothermal Life



Viscosity Curve



SWANCOR 2513-A/BR/BF/BS/BL

Hand Lay-Up epoxy resin system

Product Description

SWANCOR 2513-A/B is designed for the process of hand lay-up which is composed of particular epoxy resin and hardener. That is especially suitable for marine and other large structure use. Their main characters are suitable viscosity, moderate pot life, superior immersed effect at glass fiber and carbon fiber.

Resin in liquid properties :

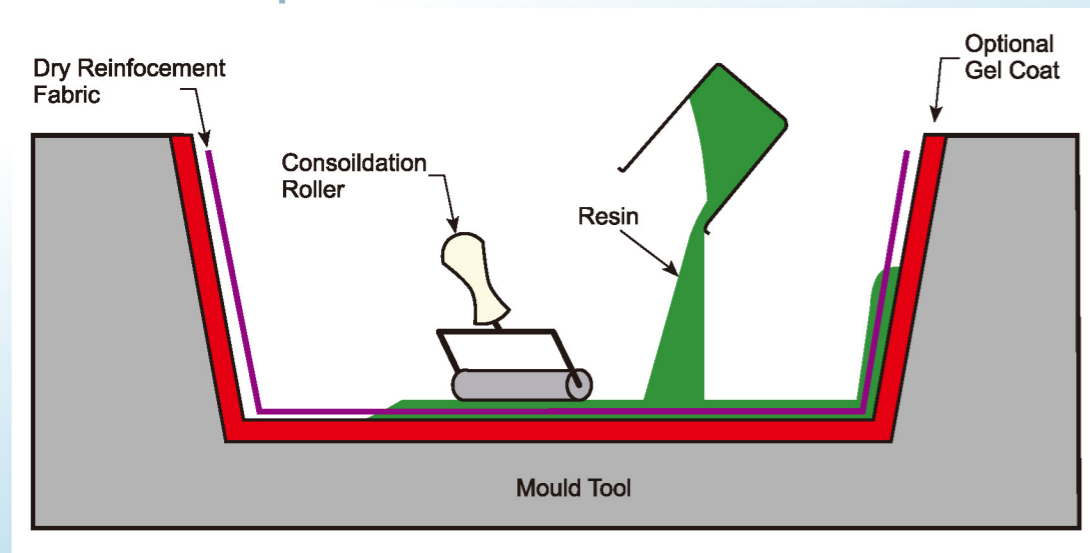
Items	SW 2513-A	SW 2513-BR	SW 2513-BF	SW 2513-BS	SW 2513-BL
Appearance	Clear and transparent liquid	Clear Blue Green Liquid	Clear Blue Liquid	Clear Blue Liquid	Clear Blue Green Liquid
Viscosity(cps,25 °C)	2,300~3,200 (LVT#4-60rpm)	65~100 (LVT#1-60rpm)	50~90 (LVT#1-60rpm)	20~60 (LVT#1-60rpm)	5~19 (LVT#1-60rpm)
Flash Point(°C)	>150°C	>120°C			
Density(g/cm ³ ,25 °C)	1.10~1.20	1.00~1.10	1.00~1.10	1.00~1.10	0.95~1.05
A/B ratio(weight)	100:30				
Initial Mix viscosity (cps,25°C)		800~1,000 (LVT#3-60rpm)	750~950 (LVT#3-60rpm)	400~600 (LVT#3-60rpm)	300~500 (LVT#3-60rpm)
Exothermic peak time (mins, 25°C , 60%RH /100g)		15~30	25~40	35~55	300~370

Mechanical properties (sample thickness of neat resin:3.2mm or 4.0mm)

Items	2513-A/ 2513-BR	2513-A/ 2513-BF	2513-A/ 2513-BS	2513-A/ 2513-BL	Standard or Method
Tensile Strength (Mpa)	80~95	70~85	70~85	70~85	ASTM D638 / ISO527
Tensile Modulus (Mpa)	3,200~3,800	2,800~3,700	2,800~3,700	2,800~3,400	ASTM D638 / ISO527
Elongation of Break(%)	>5	>5	>5	>5	ASTM D638 / ISO527
Flexural Strength(Mpa)	120~150	110~130	110~130	105~123	ASTM D790 / ISO 178
Flexural Modulus(Mpa)	3,300~3,900	2,900~3,700	2,900~3,700	2,900~3,700	ASTM D790 / ISO 178
Tg(°C)	85~100	77~92	80~95	70~85	ASTM D3418/ISO11357-2
HDT(°C)	82~93	75~85	75~85	68~79	ASTM D648 / ISO 75-2

*Curing Process = Room Temperature>16hrs + Post curing at t 80°C for 8hrs

Use HLU technique in Wind Blades

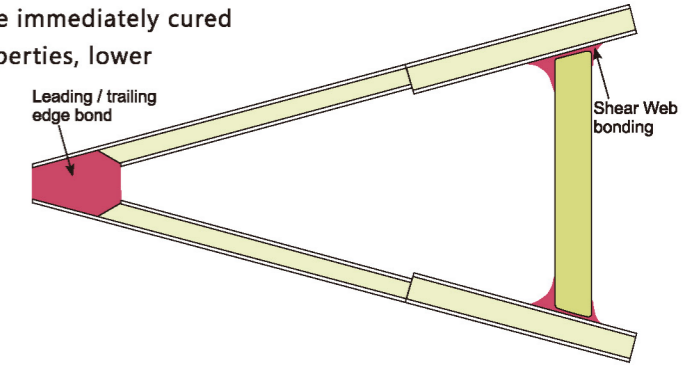
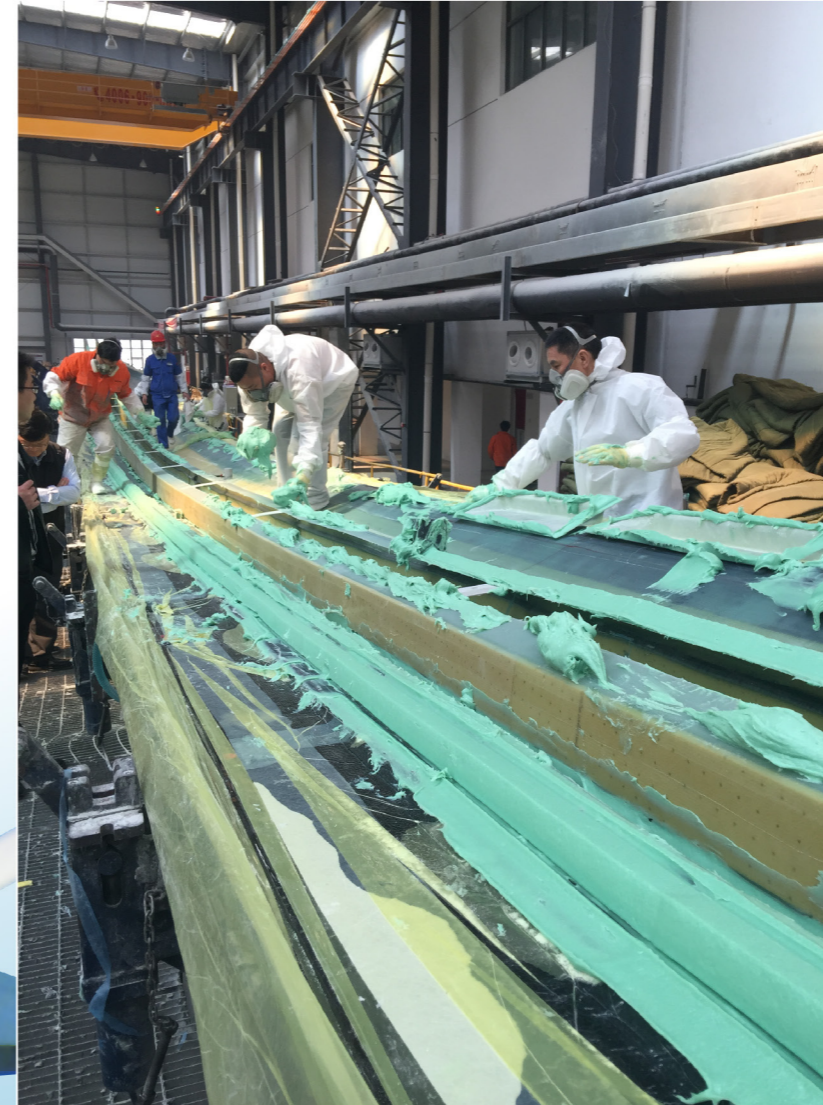


SWANCOR 2532-A/BS/BF

Structural Adhesive System

Product Description

SWANCOR 2532 is a two-component, solvent-free epoxy adhesive with a wide range of applications. It is suitable for bonding FRP laminates and metallic materials. The adhesive resin does not bleed out and crack even if the parts are immediately cured at high temperatures. SWANCOR 2532 has excellent fatigue properties, lower exothermal temperature and fast Tg build-up.



Schematic of Adhesive Bonding Applications in Wind Turbine Blades

Physical Properties

	SW 2532-A	SW 2532-BS	SW 2532-BF
Appearance	Yellow Paste	Blue Paste	Red Paste
Density [g/cm ³]	1.30~1.38	1.14~1.22	1.14~1.22
Viscosity at shear rate 100/s[Pa. s]	30~50	15~25	15~25
Density (Mixed) [g/cm ³]	1.20~1.30		
Density (Cured) [g/cm ³]	1.25~1.35		

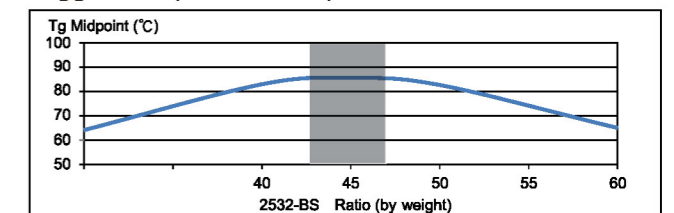
Mixing Ratio

	SW 2532-A : SW 2532-BS/BF
Parts by weight	100:45±2
Parts by volume	100:50±2

Please follow the mixing ratio stated carefully. Adding more or less hardener will not result in a faster or slower reaction, but in incomplete curing with limited performance, that cannot be corrected in any way.

Resin and hardener must be mixed carefully. Mix until no clouding is visible in the mixing container. Special attention must be paid to the walls and bottom of the mixing container.

Suggested operation temperature at 20~30°C

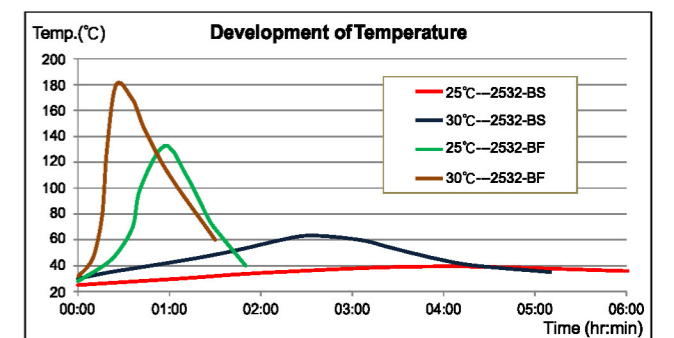


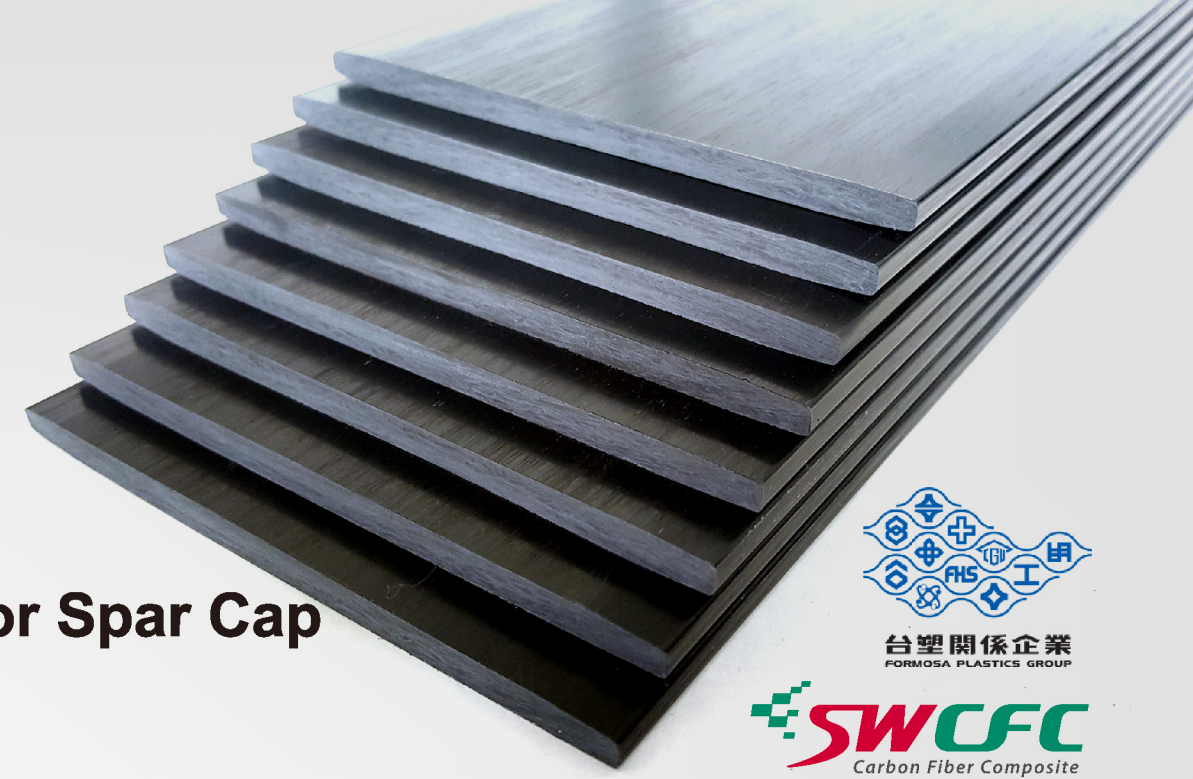
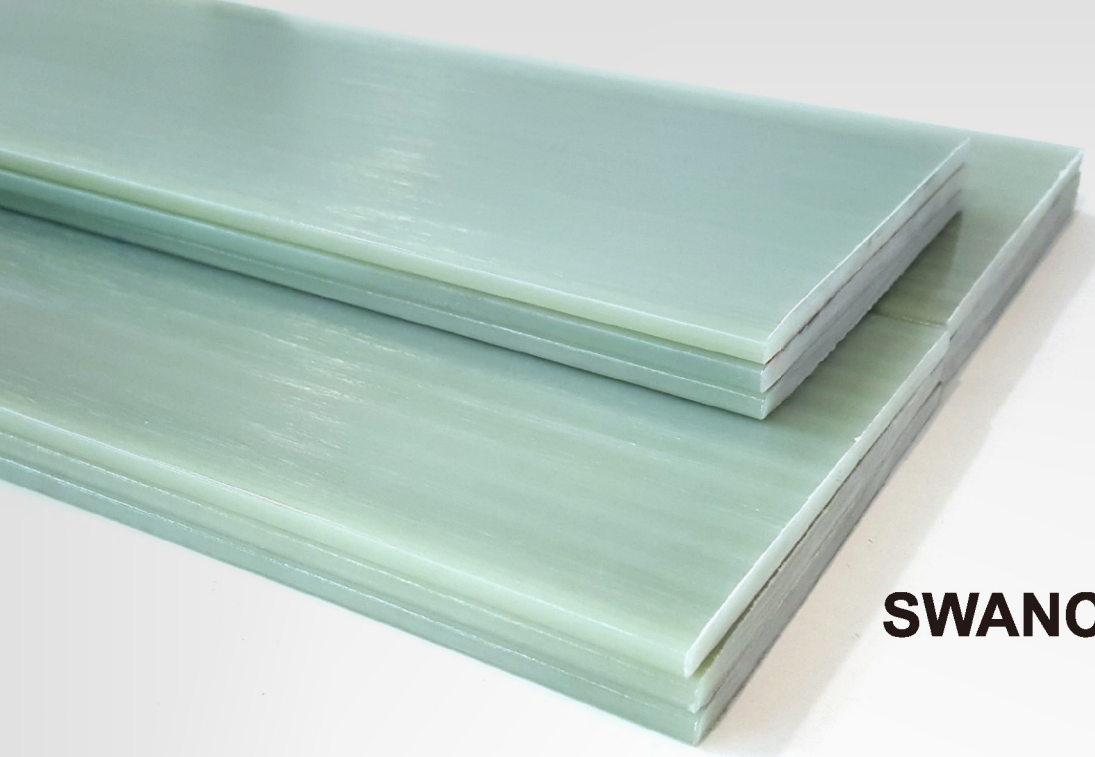
Curing: in oven for 10 hours at 70°C, DSC-measuring heat rate: 10 K/min

Exothermal Life

Test temperature	SW 2532-A/BS		SW 2532-A/BF	
	25°C	30°C	25°C	30°C
Exothermal Peak Time [min]	~240	~150	~60	~30
Exothermal Peak Temp. [°C]	~40	~65	~130	~180

Measuring Condition : 25°C / 30°C , Relative Humidity 50% , Sample Weight : 145g





SWANCOR Pultruded GF & CF Plates For Spar Cap

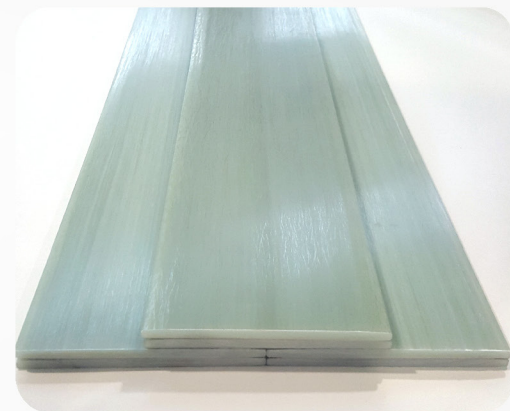
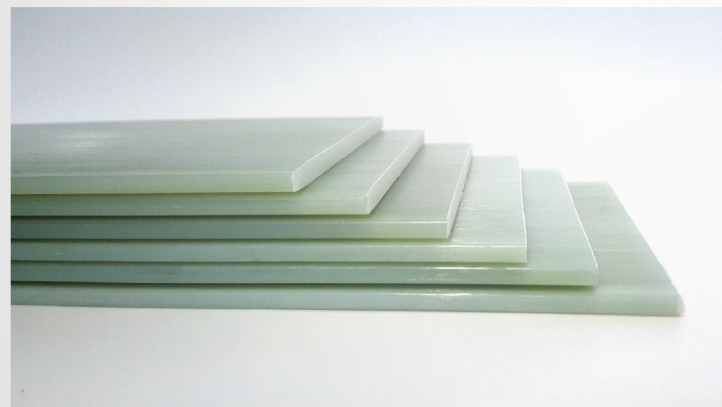


台塑關係企業
FORMOSA PLASTICS GROUP



DESCRIPTION

Pultrusion is a very cost-effective and continuous method to fabricate high fiber volume and performance composite materials. High strength glass fiber is fed into epoxy or vinyl ester resins using our special impregnation and curing process, to make glass fiber plates with various specifications and loadings for engineering applications such as wind blade spar caps. Comparing to other composite fabrication methods, in pultrusion process, excellent mechanical properties can be achieved during the high fiber alignments.



PERFORMANCE PROPERTIES

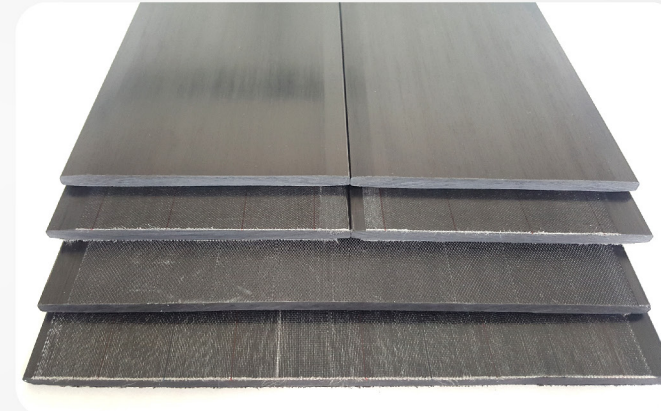
- High Strength and Stiffness
- Corrosion Resistant
- High Fiber Volume
- Low Void Content
- Locked in Filament Alignment

Test Items	Epoxy Resins	Vinyl Ester Resins	Test Standard
0° Tensile Strength (AVG.MPa)	1224.9	1087.4	EN ISO 527-5
0° Tensile Modulus (AVG.GPa)	55.1	55.5	
0° Tensile Strain (AVG.%) *	2.23	2.52	
0° Compression Strength (AVG.MPa)	1331.7	1342.4	ASTM 6641
0° Compression Modulus (AVG.GPa)	57.4	58.2	
0° Compression Strain (AVG.%) *	2.09	1.83	
90° Flexural Strength (AVG.MPa) *	113.0	48.3	EN ISO 14125
90° Flexural Modulus (AVG.GPa)	14.8	4.4	
0° Flexural Strength (AVG.MPa)	1191.8	1139.0	
0° Flexural Modulus (AVG.GPa)	56.3	54.1	
0° Flexural Strain (AVG.%) *	2.76	2.81	
0° Short Beam Shear Strength (MPa) *	66.5	59.4	ASTM D2344

DESCRIPTION

Pultrusion is a very cost-effective and continuous method to fabricate high fiber volume and performance composite materials. High performance PAN carbon fiber tows from Formosa is applied to manufacture FORMOSA TC-35R, which has the following characteristics:

- High modulus and stiffness
- High fatigue resistance
- Great dimensional stability
- Excellent compatibility and processability with epoxy resins



Formosa carbon yarn is the world's only which can manufacture from raw materials to carbonized fiber, and one of the few which have the capability to provide high performance large tow carbon fiber. Carbon fiber tows are fed into our special impregnation and curing process to make carbon fiber plates with various specifications for engineering applications such as wind blade spar caps. Comparing to other composite fabrication methods, in pultrusion process, excellent mechanical properties can be achieved during the high fiber alignments.

PERFORMANCE PROPERTIES

- High Strength and Stiffness
- Corrosion Resistant
- High Fiber Volume
- Low Void Content
- Locked in Filament Alignment

Test Items	Value	Test Standard
0° Tensile Strength (AVG.MPa)	1840.0	EN ISO 527 - 5
0° Tensile Modulus (AVG.GPa)	146.7	
0° Tensile Strain (AVG.%)	1.25	
0° Compression Strength (AVG.MPa)	859.5	EN ISO 14126
0° Compression Modulus (AVG.GPa)	123.0	
0° Compression Strain (AVG.%)	0.70	
90° Flexural Strength (AVG.MPa)	68.2	EN ISO 14125
90° Flexural Modulus (AVG.GPa)	7.5	
90° Flexural Strain (AVG.%)	0.91	
0° Flexural Strength (AVG.MPa)	1095.9	
0° Flexural Modulus (AVG.GPa)	124.9	
0° Flexural Strain (AVG.%)	0.88	EN ISO 14130
0° Short Beam Shear Strength (MPa) *	61.3	