

Bio-based Epoxy Resin for FRP Matrix

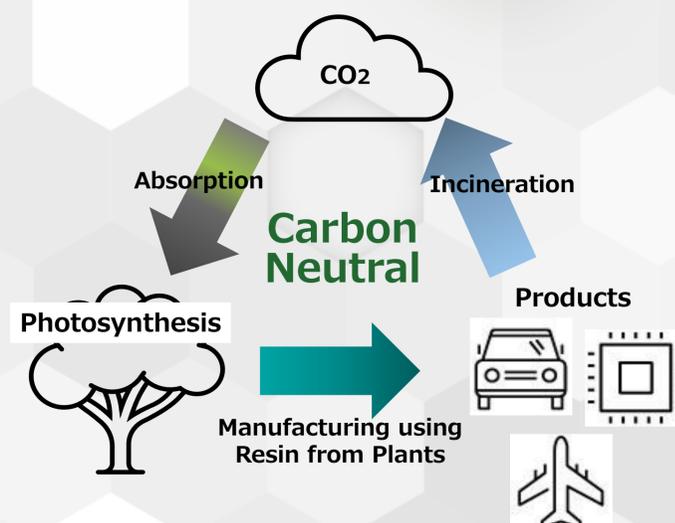
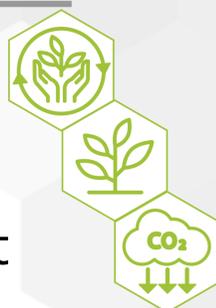
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Bio-based Epoxy Resin

- ✓ Sustainable
- ✓ Plant-based Resin
- ✓ Reduced Carbon Footprint



NAGASE Sustainable Activities

- ✓ up to 100% Bio-based Epoxy Resins
- ✓ up to 95% Bio-based FRP matrix resins and adhesive

Product Information of FRP Matrix Resins

High Bio content & High Performance

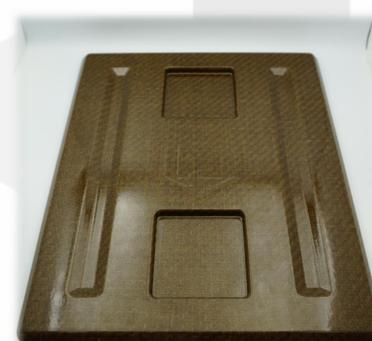
Product Name	ASA-8102	ASA-8103	ASA-8105	ASA-8107
Bio content	95%	78%	40%	78%
Features	High Stability	High Tg	Low Viscosity High Tg	Low Viscosity
Hardener	Amine catalyst	Amine	Acid anhydride	Amine
Package	One component	Two components	Two components	Two components
Mixing ratio <small>weight</small>	—	100 : 27	100 : 100	100 : 27
Applicable Process	VaRTM	VaRTM	VaRTM	VaRTM
	Pressure-RTM	Pressure-RTM	Pressure-RTM	Pressure-RTM
	Filament Winding	Filament Winding	Filament Winding	Filament Winding
	Pultrusion	Pultrusion	Pultrusion	Pultrusion
	Prepreg	Prepreg	Prepreg	Prepreg
Viscosity <small>25°C</small>	15,000 mPa·s	10,000 mPa·s	1,600 mPa·s	4,500 mPa·s
Gel time	15 min. <small>140°C</small>	18 min. <small>100°C</small>	17 min. <small>100°C</small>	4 min. <small>140°C</small>
Cure condition	140°C×3hr.	100°C×1hr. +150°C×2hr.	100°C×1hr. +160°C×1hr.	140°C×3hr.
Tg	90°C	145°C	170°C	130°C
Tensile Strength <small>25°C</small>	62 MPa	62 MPa	77 MPa	70 MPa
Tensile Modulus <small>25°C</small>	3,500 MPa	4,400 MPa	3,300 MPa	3,000 MPa
Elongation <small>25°C</small>	3.0 %	2.2 %	3.5 %	4.5 %



ASA-8102
Bio content : 95%



バイオマス
No.220319
Certification mark
by JORA



Natural-FRP
Natural Fiber
&
Bio-based Epoxy Resin

Bio-based Epoxy Resin for FRP Matrix

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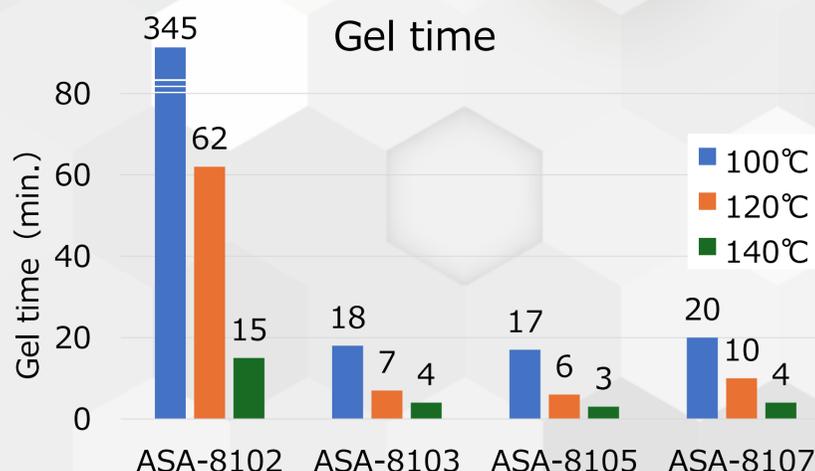
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Reactivity (Gel Time)

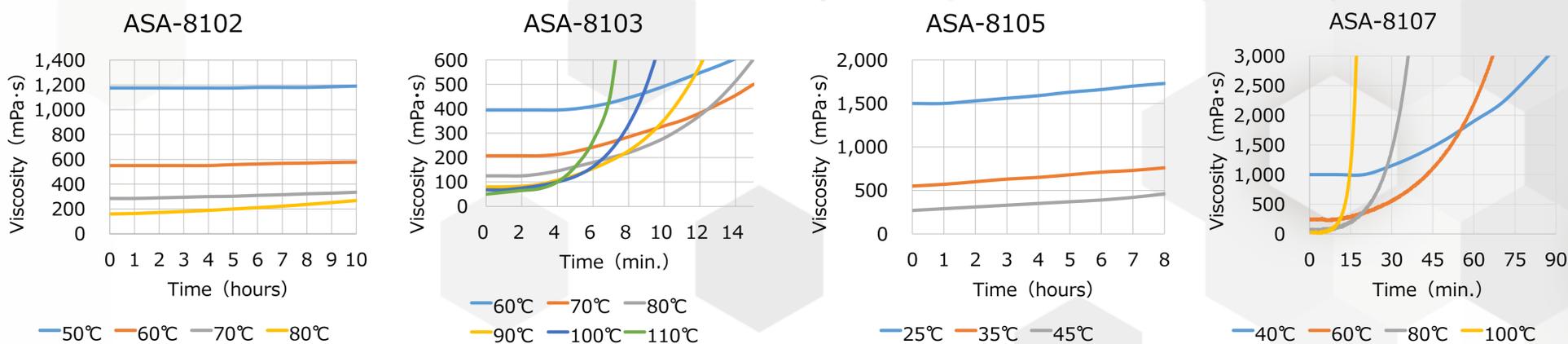
Gel time by temperature

Temp.	ASA-8102	ASA-8103	ASA-8105	ASA-8107
100°C	345 min.	18 min.	17 min.	20 min.
120°C	62 min.	7 min.	6 min.	10 min.
140°C	15 min.	4 min.	3 min.	4 min.



Impregnation (Viscosity curve)

Viscosity curve by temperature



Bio-Epoxy Adhesive for FRP Bonding

High adhesive strength at room temperature curing

Product Name	ASA-8101
Bio content	73%
Features	High adhesion R.T. curable High elongation
Hardener	Amine
Package	Two components
Mixing ratio _{weight}	100 : 35
Viscosity _{25°C}	4,000 mPa·s
Gel time _{25°C}	1hr.
Cure condition	25°C×24hr.
Tg	40°C
Tensile Strength _{25°C}	46 MPa
Tensile Modulus _{25°C}	2,700 MPa
Elongation _{25°C}	30 %

Multi-Material Bonding

Lap shear strength (MPa), 25°C

	Al	Steel	CFRP	Cu	Ni
Al	22	21	19	14	7
Steel		23	18	17	8
CFRP			17	14	7
Cu				14	7
Ni					8



Bonding Al and CFRP



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