SANHO CHEMICAL CO., LTD.
NO. 1, ZHONGSHAN S. RD., LUZHU DIST., KAOHSIUNG CITY, TAIWAN.
TEL：886-7-6962211~3 http：// www.sanho.com.tw
FAX：886-7-6976993 (Sales) E-mail：sanho@sanho.com.tw
FAX：886-7-6961782 (Export) E-mail：sanho@so-net.net.tw

FUJICURE FXR-1020

Fujicure FXR-1020 is not only a latent type epoxide curing agent but also a curing accelerator.

FXR-1020 contains in one single molecule the active hydrogen's portion as well as the functional groups which act as curing catalyst.

Fujicure FXR-1020 can be dispersed easily in epoxide resins, and the mixture shows good (＝long) storage stability (＝pot life,) at an ambient temperature. RXR-1020 can be cured at a relatively low temperature (＝by moderate heating,)

When added into other latent-type curing agent such as dicyandiamide, a small quantity of FXR-1020 can markedly decrease (＝lower,) tempera-ture of the curing cycle without losing the original good storage stability.

The cured products by FXR-1020 exhibit light color, good adhesion performance and superior mechanical properties so that a wide variety of applications are possible, such as adhesives, encapsulations, pottings and powder coatings.

1. Specifications：

Appearance：Slightly yellowish white powder in fine particle (By visual works)

Viscosity, mPa·s：1,200 ~ 2,500, at 25℃
(as 50% solution in xylene / isobutanol of 1/1 in weight)(By the Item 4.2 of JIS K7233：Cylinder Rotational Viscometer Method, or equivalent to ASTM D1545)

Color：5 max.(＝as 50% solution in isopropanol,)
(By the Helligevarnish Colormeter according to the Item 4.3 of JIS K5400, or equivalent to ASTM D1544)

Average particle size：Average 3.5 ~ 7.0μm in 50% cumulative volume (By Laser Diffraction method)

Amine value, mg. / KOH：235 ~ 275
(By Potentiometric tirtration method of the Item 4.1 of JIS K7237, or equivalent to ASTM D2896)

Softening point, ℃：115 ~ 130
(The Ring and Ball method of the Item 4.1 of JIS K7234)

Remarks：No equivalent designation of ASTM for Appearance, Average Particle Size and Softening Point.

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FUJICURE FXR-1020

2. Storage stability：

The change in viscosity during storage was measured at 25℃ for the resin composition of 100 phr(wt.) Bisphenol-A type liquid epoxide resin (epoxide equivalent weight 190, 1phr(wt.) Aerosil 300 and FXR-1020.

Multiple to initial viscosity

FXR-1020 content (phr)	Initial viscosity (mPa·s)	Storage temp.				
		Storage days	7 days	14 days	21 days	30 days
10	21350		1.09	1.11	1.12	1.14
15	24700		1.07	1.09	1.11	1.14
20	30250		1.06	1.08	1.10	1.14
25	35800		1.07	1.12	1.14	1.18
30	43200		1.13	1.15	1.18	1.24

Aerosil 300：Collidal silica.

3. Curing characteristics and storage stability.

Epoxide resin：Bisphenol-A type liquid resin (epoxide equivalent weight is 190).

Aerosil 300＝1 phr

Adding quantity of FXR-1020 phr	10	15	20	25	30
Flexural strength, kgf/mm^2					
80℃	8.6	12.2	12.4	10.9	10.8
100℃	13.3	12.9	12.8	12.3	12.3
120℃	12.9	12.0	11.9	12.0	11.8
Flexural modulus $\times 10^2$ kgf/mm^2					
80℃	4.7	5.0	4.9	4.8	4.8
100℃	4.9	4.5	4.5	4.5	4.5
120℃	4.6	4.3	4.2	4.2	4.2
Tensile shear strength, kgf/cm^2					
80℃, 1h cure	159	164	153	154	150
100℃, 1h cure	195	173	165	156	153
120℃, 1h cure	213	205	187	178	176
Boiling water absorption, % (1h, in the boiling water)					
80℃, 1h cure	0.54	0.50	0.55	0.55	0.60
100℃, 1h cure	0.46	0.45	0.46	0.52	0.60
120℃, 1h cure	0.44	0.34	0.38	0.45	0.49
Tg. (TMA method), ℃					
80℃, 1h cure	62.0	74.5	85.5	94.5	102.0
100℃, 1h cure	78.0	99.0	108.0	105.5	107.0
120℃, 1h cure	88.5	108.0	116.0	116.0	112.5

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FUJICURE FXR-1020

4. Curing properties.

Epoxy resin：bisphenol-A type liquid resin (epoxy equivalent weight 190)

	EX-1	EX-2	EX-3	EX-4	EX-5
Epoxy resin	100	100	100	100	100
FXR-1020	10	15	20	25	30
Aresoil 300	1	1	1	1	1
① Reaction start temp. (-1), ℃	73.0	72.0	70.0	71.0	69.0
□ Reaction start temp. (-2), ℃	91.0	89.0	89.0	89.0	88.0
□ Pead temp., ℃	106.0	104.0	103.0	100.0	99.0
② Class transition, ℃	91.5	111.0	116.0	112.5	108.0
④ Gel time, 80℃	15’ 34”	9’ 03”	5’ 52”	4’ 13”	4’ 00”
□ 100℃	5’ 00”	2’ 52”	2’ 10”	1’ 53”	1’ 48”
□ 120℃	2’ 09”	1’ 37”	1’ 09”	56”	54”

①：Estimated from DSC curve at 5℃/min.

②：Estimated from DSC curve at 5℃/min. for the sample heated at 5℃/min to 250℃.

③：Gel time of 0.5g sample on plate heated constantly at the designated temperature.

5-1. Acceleration effect of FXR-1000A to dicyandiamide (DICY).

Epoxy resin：bisphenol-A liquid resin (epoxy equivalent weight 190)

		EX-6	EX-7	EX-8	EX-9
Epoxy resin		100	100	100	100
DICY		8	8	8	8
FXR-1020		—	1	3	5
Aerosil 300		1	1	1	1
① Reaction start temp. (-1), ℃		156.0	129.0	87.0	78.0
② Reaction start temp. (-2), ℃		187.0	159.0	122.0	111.0
③ Peak temp. ℃		197.0	171.0	142.0	132.0
② Glass transition,, ℃		133.0	131.0	131.0	130.0
③ Gel time, 100℃		＞60’	＞60’	＞60’	29’ 22”
120℃		＞60’	＞60’	12’ 54”	6’ 05”
150℃		＞60’	6’ 55”	2’ 17”	1’ 00”
④ Storage stability, mPa·s					
40℃	0 day	19650	20200	22300	23400
	7 days	21600	22250	23800	25500
	14 days	22850	24000	25650	26450
	21 days	23200	24500	26500	27500
	30 days	24550	25300	27100	28750

① Estimated from DSC curve at 5℃/min.

② Estimated from DSC curve at 5℃/min. for the sample at 5℃/min. to 250℃.

③ Gel time of 0.5g sample on plate heated constantly at the designated temperature.

④ Measured at 25℃ the initial viscosity change while stored at 40℃

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FUJICURE FXR-1020

5-2. Accelerate effect of FXR-1020 to acid anhydride.
Acid anhydride; HN-2200 (Hitachi Chemical Co., Ltd. ; methyl ltetrahydro phtalic anhydride)

		EX-10	EX-11	EX-12	EX-13
Epoxy resin		100	100	100	100
HN-2200		85	85	85	85
FXR-1020		1	3	5	7
Aerosil 300		1	1	1	1
④ Reaction start temp. (-1), ℃		84.0	80.0	79.0	75.0
⑤ Reaction start temp. (-2), ℃		140.0	130.0	124.0	120.0
⑥ Peak temp. (-1), ℃		88.0	88.0	88.0	87.0
⑦ Peak temp. (-2), ℃		172.0	158.0	151.0	146.0
② Glass transition, ℃		54.5	91.0	112.0	122.5
③ Gel time, 100℃		＞60’	＞60’	42’ 19”	29’ 31”
120℃		＞60’	20’ 48”	11’ 49”	8’ 39”
150℃		14’ 35”	4’ 03”	2’ 33”	1’ 54”
④ Storage stability, mPa·s					
40℃	0 day	745	785	810	895
	1 day	855	890	970	1020
	7 days	1150	1210	1375	1515
	14 days	1410	1530	1930	2340
	21 days	1725	1980	2780	3165
	30 days	2080	2500	3400	4700
23℃	30 days	1290	1350	1450	1500

① Estimated from DSC curve at 5℃/min.
② Estimated from DSC curve at 5℃/min. for the sample at 5℃/min. to 250℃.
③ Gel time of 0.5g sample on plate heated constantly at the designated temperature.
④ Measured at 25℃ the initial viscosity change while stored at 40℃

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FUJICURE FXR-1020
【GEL SPEED】

Adding weight of A latent curing agent, phr		10	15	20	25	30
Curing temperature at 80℃	FXR-1020	715”	530”	435”	354”	339”
	P	1410”	976”	857”	678”	626”
Curing temperature at 100℃	FXR-1020	291”	225”	198”	137”	134”
	P	314”	241”	235”	214”	197”
Curing temperature at 120℃	FXR-1020	208”	150”	131”	125”	115”
	P	163”	140”	130”	127”	110”

Remark： P is a hardener supplied by other manufacturer.

80℃ cure：When employ FXR-1020 in your formulation as half phr over other supplyer’s P, FXR-1020 based resin mixture with epoxy resin can provide almost same gel time as that of P.

100℃：FXR-1020 cures faster than P.
Fujicure FXR-1020 cures faster at the curing temperature range of 80 ~ 100℃ than P.

In the same curing temperature range between 80~100℃, less and smaller phr. Of FXR-1020 than phr of P can gel in the same time as that of P.

FXR-1020 based cured product is quite transparent.

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THE LATENT CURING AGENT：
(FUJICURE FXR-1020 & FUJICURE FXR-1030)

PROPER SELECTION of THE REACTIVE DILUENT and ORGANIC SOLVENT.

REACTIVE DILUENT	**For FXR-1020**	**For FXR-1030**
＝Bigger molecular weight (REACTIVE DILUENT.) (Epolite 400E, 400P)	○	○
＝Smaller molecular weight (REACTIVE DILUENT). (Epolite 1600, 150NP)	×	○
BGE	×	×

Solvent.	**FXR-1020**	**FXR-1030**
＝Alcohol	×	×
＝Methyl Ethyl Ketone (＝MEK)	×	×
＝Butyl Cellosolve	×	×

Solvent		**FXR-1020**	**FXR-1030**
＝Aromatic hydrocarbon based solvent.	Even aromatic hydrocarbon based-solvent increase the initial viscosity of the one packed resin mixture upto more than double within 7 days if you store them at 40℃.	×	○
	Organic solvent is not proper to employ in the formulation when you store the one packed resin mixture at 40℃ for 30days.	×	○
＝Storage temperature at lower than 23℃	If store the one packed resin mixture at lower than 23℃. SOME SOLVENT may not increase the initial viscosity so badly. (Increase upto 1.3 ~ 1.5 times on the initial viscosity)	△	○
＝MEK	MEK-forumulated one packed resin mixture increase the initial viscosity critically (Do not formulate)even at storing temperature of the one packed resin mixture than 23℃)	×	40℃ for 30 days × 23℃ for 30 days ○
＝Butyl Cellosolve		×	× even at 23℃ for 30 days.

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STORAGE STABILITY OF ORGANIC SOLVENT FORMULATED FXR-1020 & FXR-1030

Organic Solvent	Latent Hardener	Initial Viscosity	Viscosity Increase	
			at 40℃, 30 days	at 23℃, 30 days
Toluene	FXR-1020	1,680 mPa·s	Hard Gel	1.4 times
	FXR-1030	1,770	1.6	1.3
Xylene	FXR-1020	2,100	Hard Gel	1.3
	FXR-1030	1,910	1.5	1.2
Pegasol R-100（＊）	FXR-1020	2,340	Hard Gel	1.1
	FXR-1030	2,610	1.3	
MEK	FXR-1020	980	Hard Gel	Hard Gel
	FXR-1030	970	8.6	1.3
MIBK	FXR-1020	1,450	Hard Gel	1.4
	FXR-1030	1,590	1.7	1.2
Cycol -hexanone	FXR-1030	3,900	0. 2	
Ethyl- Acetate	FXR-1020	1,150	Hard Gel	1.9
	FXR-1030	1,250	2.1	1.3
n-propyl acetate	FXR-1030	1,610	1.3	1.3
n-propyl acetate	FXR-1030	1,780	1.6	1.2

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STORAGE STABILITY OF ORGANIC SOLVENT FORMULATED FXR-1020 & FXR-1030

Organic Solvent	Latent Hardener	Initial Viscosity	Viscosity Increase	
			at 40℃, 30 days	at 23℃, 30 days
iso-amyl acetate	FXR-1030	2,260	1.5 times	1.2 times
Butyl Cellosolve	FXR-1030	2,660	Hard Gel	Hard Gel
Cellosolve Acetate	FXR-1020 FXR-1030	2,500 2,380	Hard Gel 1.4	1.3
Butyl-Carbitol-Acetate	FXR-1020 FXR-1030	3,700 3,440	Hard Gel 1.7	1.3 1.1
Diethylene-Glycol-Dimethylether	FXR-1020	1,950	Hard Gel	1.3

Butyl cellosolve＝ethylene glycol monobutyl ether.
Cellosolve acetate＝Ethylene glycol monomethyl ether acetate.
Butyl carbitol acetate＝Diethylene glycol monobutyl ether acetate.

(1) The formulation for this evaluation.
① Epoxy resin ：100phr (Liquid epoxy resin of Bisphenol-A, EEW＝190)
② Organic solvent ：10phr
① FXR-1020 or FXR-1030 ：20phr
① Aerosil-300：1phr

(2) Evaluated an increase of the initial viscosity of the formulated resin mixture of (1) above for 30 days at 40℃ and 23℃.

(3) Formulation procedure to make one packed resin mixture.
①：Mix and blend well of Epoxy resin, FXR-1020 (or FXR-1030) an Aerosil-300.
②：Solvent
After the procedure of ①, move to ② (①→②)

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APPLICATION FIELDS.

Latent curing agent：Fujicure FXR-1020 & FXR-1030

(1) Electricity and Electronics related fields.

= Sealing and encapsulation of "relay switch"
= Adhesive of LSI.
= Electro conductive adhesives.
= Encapsulation of LED.
= Encapsulation of semi conductor.
= Adhesives of printed circuit boad with PET film or aluminium sheet
= Sealing of liquid crystal panel.
= Adhesive of a small opening space in a circuit board.
= Temporary bonding of material.

(2) Mobil Industry field.

= Hem flange bonding.
= Co-bonding use with a spot welding.

(3) Others.

= Adhesives for a medical equipment parts.
= Bonding of a grindstone with metals.
= Pre-preg use for a glass cloth for sports airticles. (ex：snow board)

LATENT TYPE CURING AGENT
FUJICURE FXR-1020 & FUJICURE FXR-1030

	PATENT			CAS No	TSCA Inventory List.
	USA	JAPAN	EUROPE		
FUJICURE FXR-1020	◎	◎	△	—	Confidetially Listed
FUJICURE FXR-1030	◎	◎	△	—	Confidetially Listed

Curing ℃ for a reliable performance.	Solvent
FXR-1020 80~100℃	×
FXR-1030 100~120℃	○

COMPARISON DATA

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	Fujicure	Other supplyer		Fujicure
	FXR-1020	P	M	FXR-1030
Storage stability of a mixtured resin （＊）	○	○	◎	◎
Lower temperature cure of a mixtured resin （＊）	◎	○	×	×
Heat exothermic temperature in a curing process of a mixtured resin （＊）	○	×	◎	◎
Glass transition （TG）of a cured product.a	○	◎	△	○
Bending strength of a cured product.	◎	△	○	○
Adhesive strength of a cured product.	◎	△	◎	◎
Boiled water absorption rate of a cured product.	○	◎	△	△
Transparency of the cured product.	◎	×	○	◎
As a curing accelerator to Acid anhydride.	○	×	◎	○
As a curing accelerator to D. I. C. Y.	○	◎	△	○

（＊）Mixtured resin ：a mixture of FXR-1020 or FXR-1030 with an epoxy resin (Liquid, Bisphenol-A, EEW＝about 190)