T-1706 ver.6.0

Innovative Acid Anhydride Hardener

H-TMAn

Recommended Formulation
Technical Data Sheet

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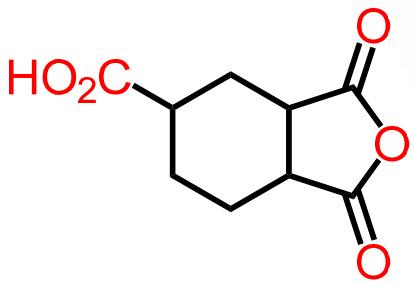
MITSUBISHI GAS CHEMICAL CO., INC.

Advantage of H-TMAn

- **High Tg**
- **Excellent Mechanical Properties**
- **UV-Resistance**
- **Strong Adhesive**

Properties of H-TMAn

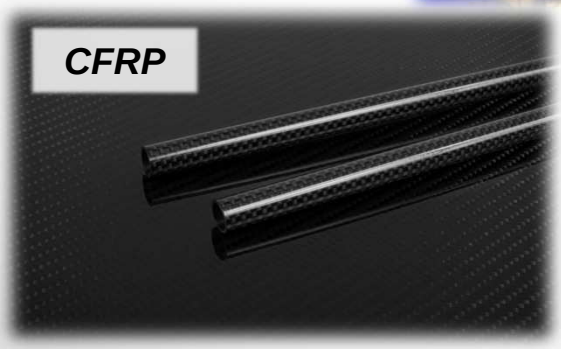
		H-TMAn
Appearance		Colorless Liquid
Density (150℃)		1.30 g/mL
Viscosity	80℃	4.10 Pa·s
	100℃	0.87 Pa·s
Weight loss initiation temperature		159.5℃



◆ Can be soluble in Me-HHPA, acetone, MEK, cyclopentanone, DMF and PGMEA.

Applications

LED



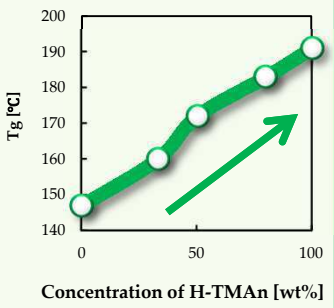
CFRP

High Performance Resin

Properties when combined with bis-phenolA type resin

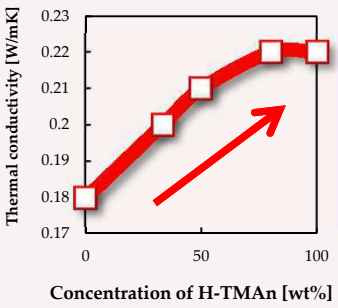
- It improves various properties when combined with Me-HHPA.
- Highlight formulation shows the best performance.

Hardener		1	2	3	4	5
H-TMAn (wt%)		0	**33**	**50**	80	100
Me-HHPA (MH-700G) (wt%)		100	**67**	**50**	20	0
Formulation Bisphenol A Type Epoxy Resin (EEW186) (g) Hardener (g)		 100 83	 100 66	 100 60	 100 52	 100 47
Equivalent Ratio		0.9	0.9	0.9	0.9	0.9
Acelerator		Phos.	Phos.	Phos.	Phos.	Phos.
Properties of resin system						
Visocosity (Pa・s/30℃)	0hr	0.51	2.6	5.8	37.7	68.7
	7hr /25℃	0.63	3.0	13.8.	68.8	25 / 40℃
Properties of cast sheets (curing condition: 120℃/3h + 150℃/2h)						
Weight Loss After Curing (%)		5	3	2	1	0
Pencil Hardness	JIS K 5600-5-4	H	3H	3H	3H	3H
Tg / TMA (℃)	JIS K 7197	147	160	172	183	191
CTE (ppm) 50℃/220℃	JIS K 7197	73/183	60/188	67/177	76/158	63/164
Thermal conductivity (W/mK) / 25℃		0.18	0.20	0.21	0.22	0.22
Tensile Shear strength(MPa) / 25℃	JIS K 6850	8.1	9.7	14.8	13.8	11.2
Flexural Modulus (GPa)	JIS K 6911	2.8	2.7	2.7	2.8	2.6
Flexural Strength (MPa)	JIS K 6911	124	120	118	116	119
Water Absorption (dipping、23℃/1week)		0.4%	0.6%	0.7%	0.9%	0.8%
Charpy Impact (KJ/m2)		14	22	26	36	25
Heat Shock Test (-40℃～100℃, 100cycle)		Cracking	-	-	-	No-cracking



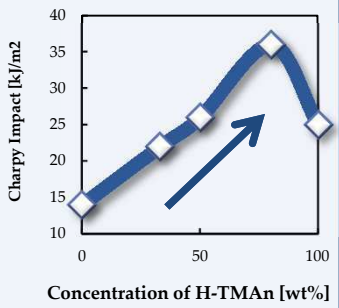
Tg

40℃ Better



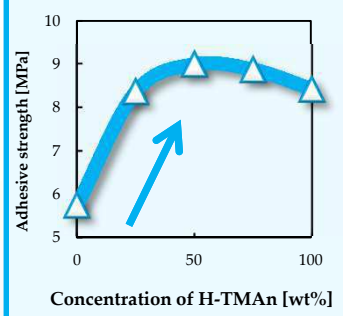
Thermal Conductivity

20% Better



Charpy Impact

2x Better

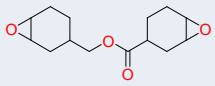
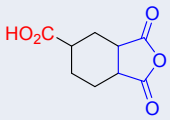
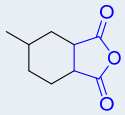
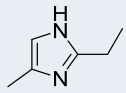


Adhesive to Aluminium

1.7x Better

1. CFRP Application

Composition and Properties of Hardeners

	Epoxy resin	Hardener①	Hardener②	Accelerator	Viscosity	Condition
Chemical structure	 Alicyclic epoxy resin viscosity(250mPa･s))	 **H-TMAn (MGC)**	 **Me-HHPA**	 2E4MZ	—	—
Recommended Formulation	100 g	45 g	45 g	0.16 g	1,200 mPa･s (@25℃)	100℃, 3hr ⇒ 150℃, 2hr
		(Viscosity of Hardener = 5,100 mPa・s, at 25℃)				
Comparison	100 g	—	110 g	0.16 g	—	120℃, 3hr ⇒ 150℃, 2hr

Various Applications

Curing Properties

- When blended with Me-HHPA, H-TMAn improves various properties.

HDT (Heat Deflection Temperature)

HDT ＋41℃

Compress Strength

Compress Strength 111%

Adhesive Strength to Carbon Fiber

Adhesive Strength 151%

Compress Strength of CFRP

CFRP Compress Strength 138%

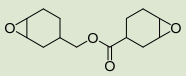
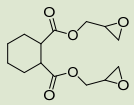
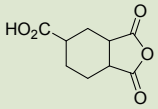
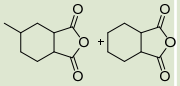
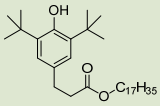
ILSS of CFRP

ILSS Strength 140%

ILSS … Interlaminar Shear Strength

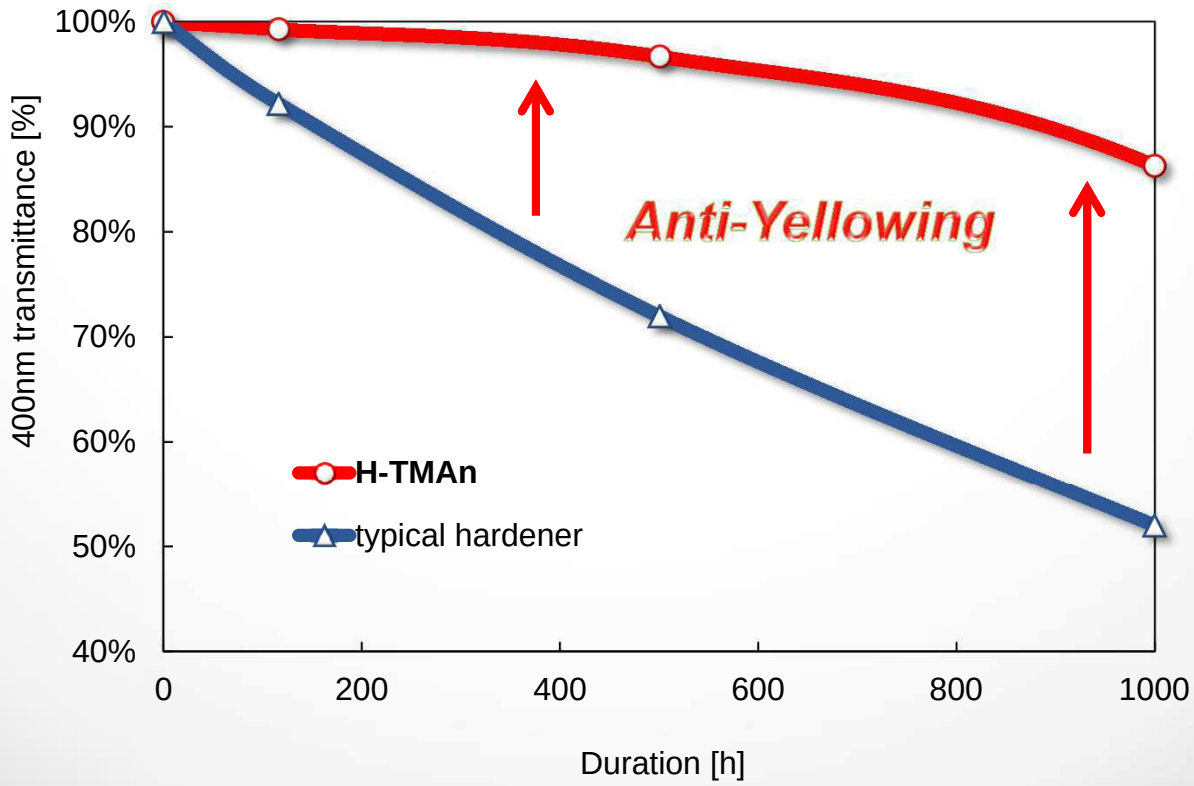
2. LED application

Formulations of H-TMAn

Epoxy Resin		Curing Agent		Additive		Equivalent
2021P	HHPA Type Epoxy	**H-TMAn**	MH700G	AO-50	U-cat 5003 (Phosphonium Salt)	—
48.0 g	20.6 g	**18.3 g**	12.2 g	0.79 g	0.22 g	0.5
					—	—

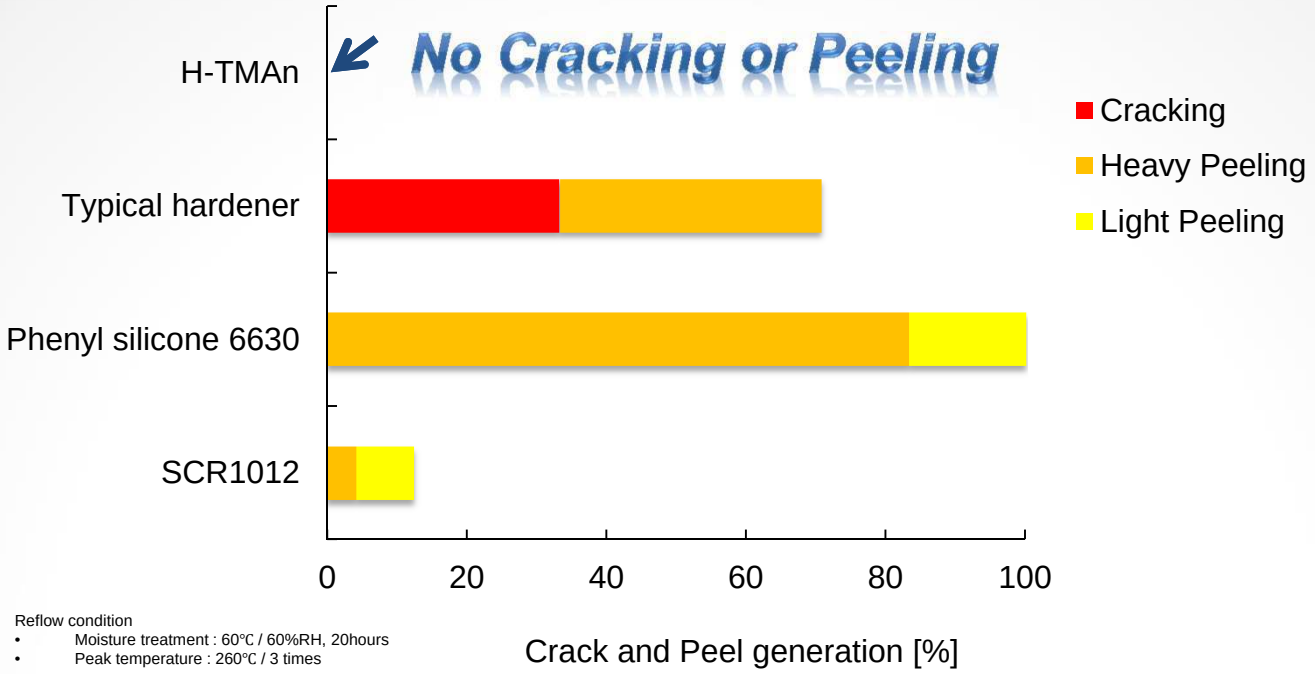
Thermal Aging Test (150℃/1000h)

➢ H-TMAn has **excellent Yellowing Resistance**.



Reflow test after moisture absorption (JEDEC Lv.4)

➢ H-TMAn has **excellent crack and peel resistance**.



Reflow condition
- Moisture treatment : 60℃ / 60%RH, 20hours
- Peak temperature : 260℃ / 3 times

Operating Test (85℃/60mA/1000h)

➢ H-TMAn has **excellent lumen maintenance**.

		Φv [lm] Initial	Φv [lm] After 1000h	Lumen maintenance factor
Epoxy type	**H-TMAn**	**2.06**	**1.65**	**80%**
	Typical hardener	1.86	1.30	70%
Silicon type	Phenyl silicone OE-6630	1.86	1.18	63%
	Modified silicone SCR-1016	1.72	1.11	65%