

Innovative Acid Anhydride Hardener

H-TMA_n

Recommended Formulation Technical Data Sheet



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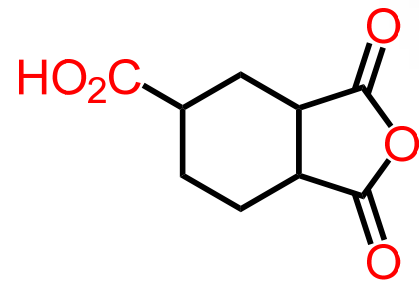
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Advantage of H-TMA_n

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

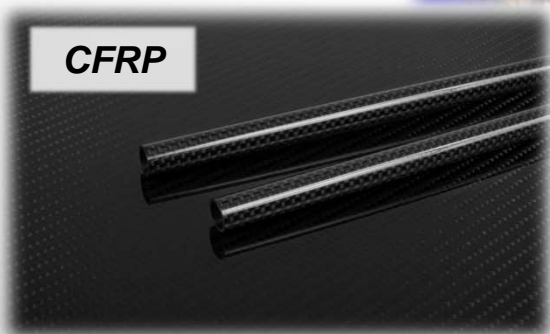
Properties of H-TMA_n

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



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

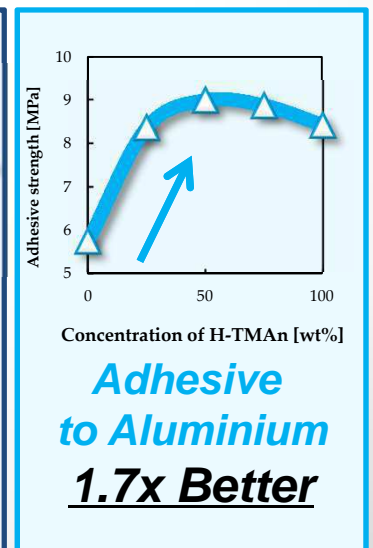
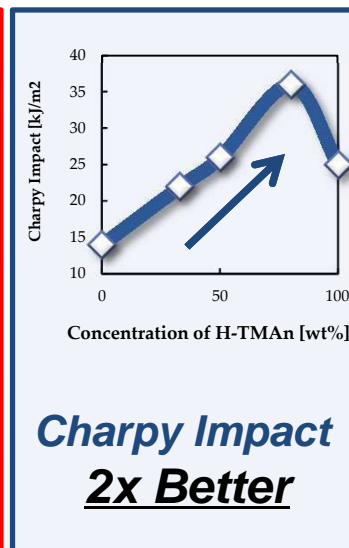
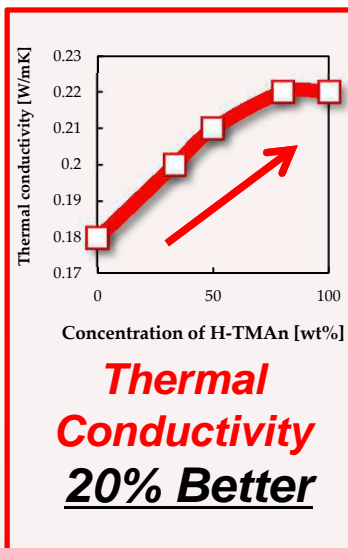
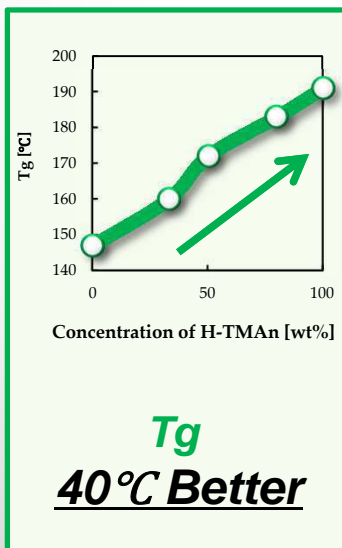
Applications



Properties when combined with bis-phenolA type resin

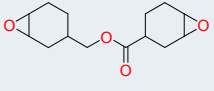
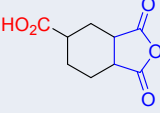
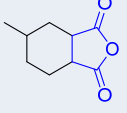
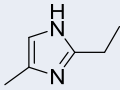
- It improves various properties when combined with Me-HHPA.
- Highlight formulation shows the best performance.

Hardener		1	2	3	4	5
H-TMA_n (wt%)		0	33	50	80	100
Me-HHPA (MH-700G) (wt%)		100	67	50	20	0
Formulation						
Bisphenol A Type Epoxy Resin (EEW186) (g)		100	100	100	100	100
Hardener (g)		83	66	60	52	47
Equivalent Ratio		0.9	0.9	0.9	0.9	0.9
Accelerator		Phos.	Phos.	Phos.	Phos.	Phos.
Properties of resin system						
Viscosity (Pa·s/30°C)	0hr	0.51	2.6	5.8	37.7	68.7
	7hr /25°C	0.63	3.0	13.8	68.8	25 / 40°C
Properties of cast sheets (curing condition: 120°C/3h + 150°C/2h)						
Weight Loss After Curing (%)		5	3	2	1	0
Pencil Hardness	JIS K 5600-5-4	H	3H	3H	3H	3H
T _g / TMA (°C)	JIS K 7197	147	160	172	183	191
CTE (ppm) 50°C/220°C	JIS K 7197	73/183	60/188	67/177	76/158	63/164
Thermal conductivity (W/mK) / 25°C		0.18	0.20	0.21	0.22	0.22
Tensile Shear strength(MPa) / 25°C	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°C/1week)		0.4%	0.6%	0.7%	0.9%	0.8%
Charpy Impact (KJ/m ²)		14	22	26	36	25
Heat Shock Test (-40°C~100°C, 100cycle)		Cracking	-	-	-	No-cracking



1. CFRP Application

Composition and Properties of Hardeners

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

Various Applications

H-TMAc shows excellent Mechanical Properties therefore is widely used in these CFRP applications...



Curing Properties

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

HDT (Heat Deflection Temperature)



HDT
+41°C

Compress Strength



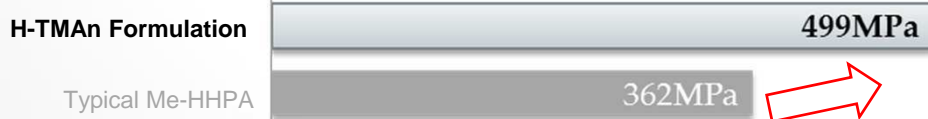
Compress
Strength
111%

Adhesive Strength to Carbon Fiber



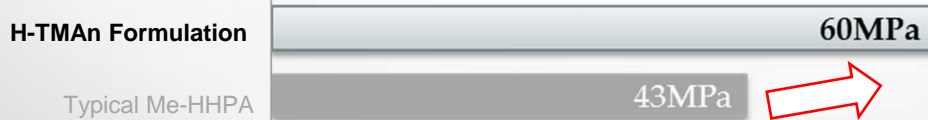
Adhesive
Strength
151%

Compress Strength of CFRP



CFRP
Compress
Strength
138%

ILSS of CFRP

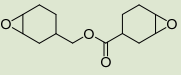
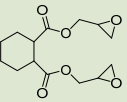
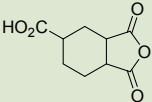
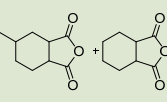
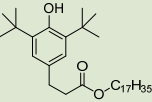


ILSS
Strength
140%

ILSS ... Interlaminar Shear Strength

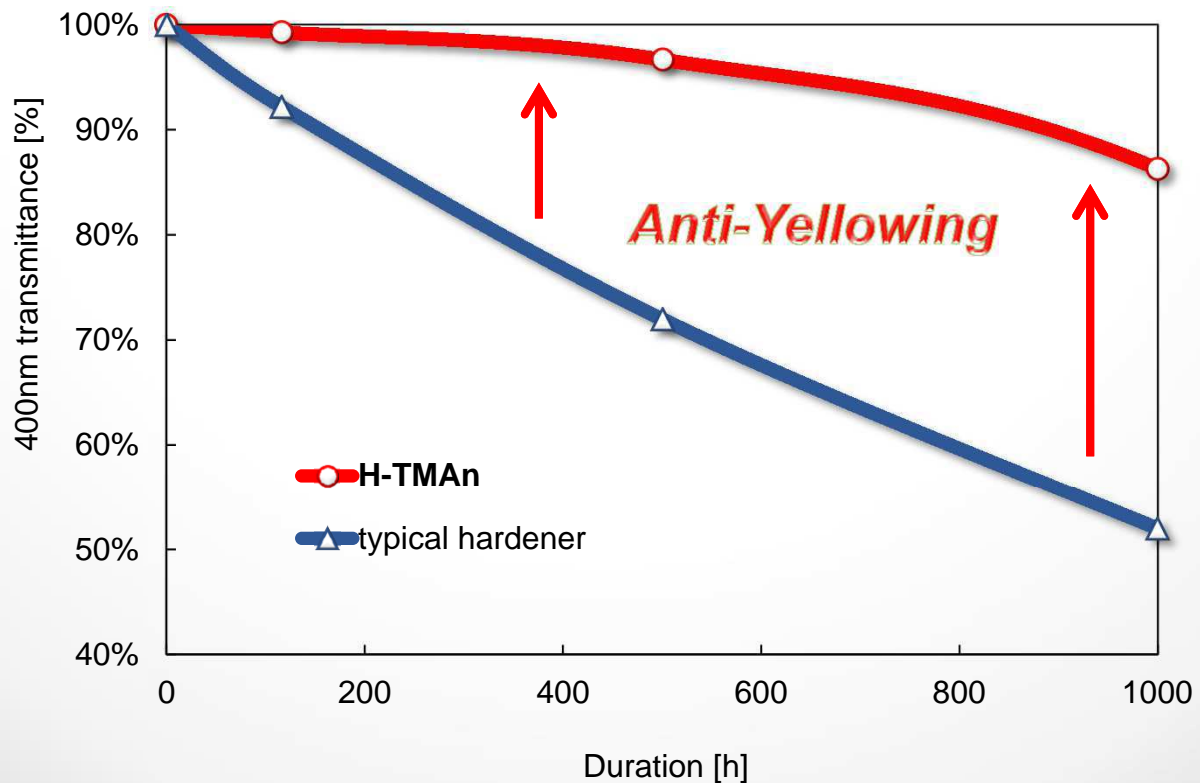
2. LED application

Formulations of H-TMAAn

Epoxy Resin		Curing Agent		Additive		Equivalent
2021P	HHPA Type Epoxy	H-TMAAn	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
					—	—

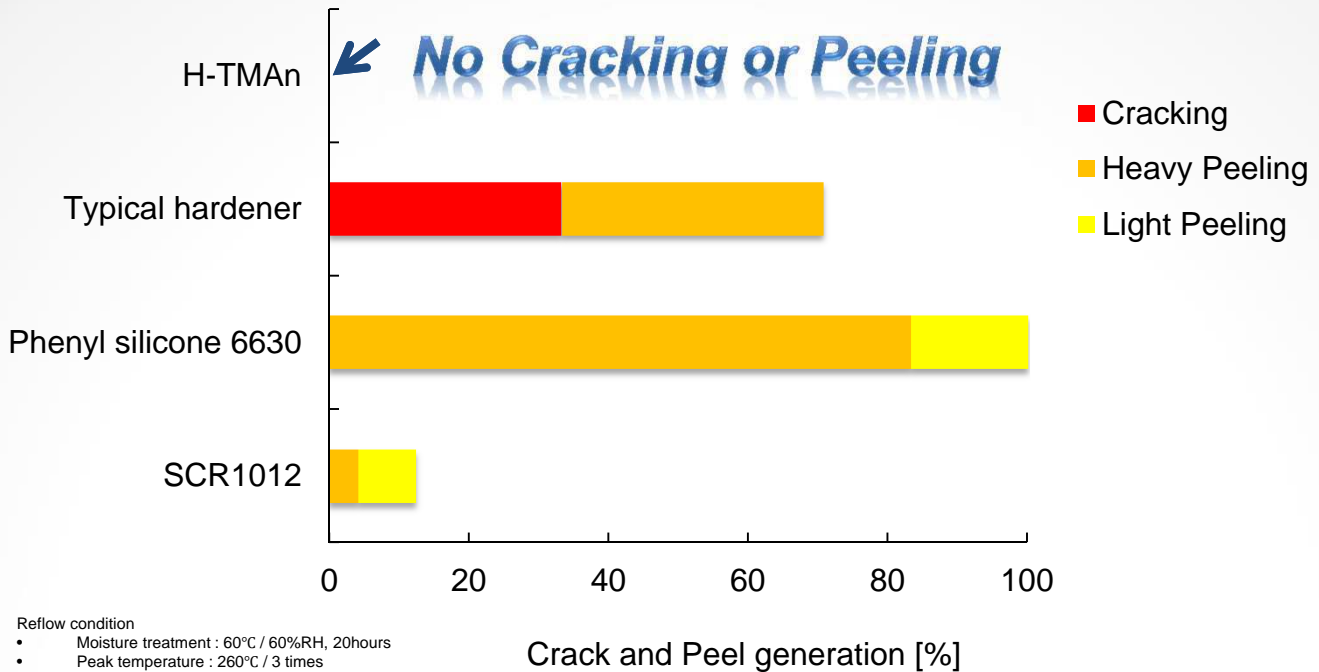
Thermal Aging Test (150°C/1000h)

➤ H-TMAAn has **excellent Yellowing Resistance**.



Reflow test after moisture absorption (JEDEC Lv.4)

➤ H-TMAAn has **excellent crack and peel resistance.**



Operating Test (85°C/60mA/1000h)

➤ H-TMAAn has **excellent lumen maintenance.**



		Φ_v [lm] Initial	Φ_v [lm] After 1000h	Lumen maintenance factor
Epoxy type	H-TMAAn	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%

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry, no matter how small, should be recorded to ensure the integrity of the financial data. This includes not only sales and purchases but also expenses and income. The document provides a detailed explanation of how to categorize these transactions and how to use a double-entry system to maintain the accounting equation. It also discusses the importance of regular reconciliations to identify and correct any errors or discrepancies in the records.

The second part of the document focuses on the preparation of financial statements. It outlines the steps involved in calculating the net income for the period and how to present this information in a clear and concise manner. It also discusses the importance of providing a clear and accurate description of the company's financial position and performance. The document provides a detailed explanation of how to calculate and present the various components of the financial statements, including the balance sheet, income statement, and statement of cash flows.

The final part of the document discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information. It emphasizes that the accounting system should be designed to provide a clear and accurate picture of the company's financial performance and position. It also discusses the importance of regular reconciliations and the role of the accounting system in identifying and correcting any errors or discrepancies in the records.