Non-haloganated BT Materials

These are halogen free materials for PWB use. The halogen free materials achieve a flammability rating of UL94V-0 without using halogens, antimony, or phosphorus compound. The substitution of an inorganic filler as the flame retardant, has the additional benefits of improving the small hole CO_2 laser drilling properties, and lowering the CTE.

Copper Clad Laminates	Prepregs	CCL Thickness	Prepreg Thickness
CCL-HL832NX type A Series	GHPL-830NX type A Series	0.03, 0.04, 0.05, 0.06, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.6, 0.7, 0.8	0.02 ~ 0.1

Features

CCL-HL832NX Type A / GHPL-830NX Type A is a halogen free BT material for IC plastic packages.
These are suitable for lead-free reflow process, because of good heat resistance, high stiffness, and low CTE.

Typical applications

These have been used for various applications as the de facto standard of halogen free materials for IC plastic packages.
CSP, BGA, Flip Chip Package, SiP, Module, etc.

Non-haloganated Low CTE BT Materials

Copper Clad Laminates	Prepregs	CCL Thickness	Prepreg Thickness
CCL-832NS Series	GHPL-830NS Series	0.03, 0.04, 0.05, 0.06, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8	0.015 ~ 0.1
CCL-832NS type LC Series	GHPL-830NS type LC Series	0.03, 0.04, 0.05, 0.06, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4	0.015 ~ 0.1

Features

Low CTE and low shrinkage which are effective to reduce the warpage of substrate for IC package.
Show superior heat resistance after moisture absorption because of low moisture absorption.
Suitable for coreless process, because of low resin shrinkage of prepregs.
30um copper clad laminate and 15um prepreg are available.
Low CTE glass is applied to HL832NS type LC and it achieves lower CTE and high stiffness.

Typical applications

These have been used for various applications as the de facto standard of low CTE, halogen free materials for IC plastic packages.
CSP, BGA, Flip Chip Package, Coreless, SiP, Module, etc.

Adoption examples

Application Processor, Baseband, PMIC, DRAM, Flash Memory, PA, RF Module, ECU for Automotive, Various Sensor (MEMS, Optical, Fingerprint), etc.

Copper Clad Laminates	Prepregs	CCL Thickness	Prepreg Thickness
CCL-832NSR type LC Series	GHPL-830NSR typeLC Series	0.03,0.04,0.05,0.06,0.1,0.15, 0.2,0.25,0.3,0.4	0.02 ~ 0.045
CCL-HL832NSR Series	GHPL-830NSR Series	0.03, 0.04, 0.05, 0.06, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4	0.02 ~ 0.08

Features

Ultra low CTE and low shrinkage which are effective to reduce the warpage of substrate for IC package.
Suitable for coreless process, because of low resin shrinkage of prepregs.

Typical applications

Coreless, SiP, Module, CSP, BGA, Flip Chip Package, etc.

Adoption examples

Application Processor, Mobile DRAM, RF Module, etc.

Copper Clad Laminates	Prepregs	CCL Thickness	Prepreg Thickness
CCL-832NSF type LC Series	GHPL-830NSF type LC Series	0.03, 0.04, 0.05, 0.06, 0.08, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4	0.015 ~ 0.1
CCL-HL832NSF Series	GHPL-830NSF Series	0.03, 0.04, 0.05, 0.06, 0.1, 0.15, 0.2, 0.25, 0.4	0.015 ~ 0.1

Features

Supre ultra low CTE and low shrinkage which are effective to reduce the warpage of substrate for IC package.
High glass transition temperature
High stiffness
Suitable for coreless process, because of low resin shrinkage of prepregs.

Typical applications

These have been used for various applications, mainly Flip Chip Package, because of their super ultra low CTE, high Tg, high stiffness.
Suitable for the applications which requires high heat resistance such as automotive use.
Flip Chip Package, Coreless, CSP, BGA, SiP, Module, etc.

Adoption examples

Application Processor, Baseband, GPU, DRAM, Flash Memory, ECU for Automotive, Various Sensor (Fingerprint, CMOS) , LED, etc.

Copper Clad Laminates	Prepregs	CCL Thickness	Prepreg Thickness
CCL-HL832NSA type LC Series	GHPL-830NSA type LC Series	0.04 ~ 0.4	0.025 ~ 0.08

Features

These are the latest materials for low CTE, low shrinkage, and high Tg.
Effective to reduce the warpage of substrate for IC package.

Typical applications

Suitable for Flip Chip package, because of low CTE, high Tg performance.
Flip Chip Package, CSP, BGA, etc.

Adoption examples

Application Processor, GPU, etc.

Copper Clad Laminates	Prepregs	CCL Thickness	Prepreg Thickness
-	GHPL-830SR type LC Series	-	0.015 ~ 0.08
-	GHPL-830SR Series	-	0.015 ~ 0.08

Features

These materials focus on coreless process.
Show stress relaxation performance during coreless process, and also have low CTE and low shrinkage.
Effective to reduce the warpage of coreless substrate for IC package.

Typical applications

Coreless, CSP, BGA, Flip Chip Package, etc.

Adoption examples

Application Processor, Mobile DRAM, etc.

Low Transmission Loss, Low CTE, Non-halogenated BT Laminates

Copper Clad Laminates	Prepregs	CCL Thickness	Prepreg Thickness
CCL-HL972LF type LD Series	GHPL-970LF type LD Series	0.04 ~ 0.8	0.02 ~ 0.1
CCL-HL972LFG type LD Series	GHPL-970LFG type LD Series	0.04 ~ 0.5	0.025 ~ 0.1
CCL-HL972LFG Series	GHPL-970LFG Series	0.04 ~ 0.5	0.025 ~ 0.1

Features

Low transmission loss materials for high frequency, high speed signal use.
Achieved low Dk and low Df, as well as keeping high heat resistance, low CTE, low shrinkage, and high peel strength with copper, equivalent to conventional BT laminates.
PCB makers can apply the same manufacturing process as conventinal BT laminates.
Suitable for multi-layers and coreless process, because of excellent formability and low shrinkage.
Low profile copper foils, which is effective to decrease transmission loss, can be applied, because of high peel strength with copper as well as low Dk and Df properties.

Typical applications

High frequency, High speed signal devices.
SiP, Module, CSP, BGA, Flip Chip Package, Coreless, etc.

Adoption/Evaluation examples

RF module for 5G smartphone, Base station (Antenna module for small cell, Power amplifier board) , Millimeter-wave radar, Optical transmission module for data center and HPC, Measuring equipments, etc.

Typical properties of Materials

Item	Measurement Method		Unit	HL832NX (A)	HL832NS	HL832NS type LC	HL832NSR
Dielectric Constant		1GHz	-	4.9	4.4	4.0	4.5
		5GHz	-	4.8	4.3	3.9	4.4
		10GHz	-	4.7	4.3	3.9	4.4
Dissipation Factor		1GHz	-	0.011	0.006	0.006	0.008
		5GHz	-	0.011	0.008	0.007	0.011
		10GHz	-	0.012	0.008	0.008	0.012
Insulation Resistance		C-96/20/65	Ω	$10^{15\text{-}16}$	$10^{15\text{-}16}$	$10^{15\text{-}16}$	$10^{15\text{-}16}$
Surface Resistance		C-96/20/65	Ω	$10^{15\text{-}16}$	$10^{15\text{-}16}$	$10^{15\text{-}16}$	$10^{15\text{-}16}$
Volume Resistivity		C-96/20/65	Ω·cm	$10^{15\text{-}16}$	$10^{16\text{-}17}$	$10^{16\text{-}17}$	$10^{16\text{-}17}$
Flexural Strength			MPa	450	490	750	550
Flexural Modulus			GPa	28	27	30	30
Tensile Strength			MPa	270	290	400	280
Young's Modulus			GPa	28	27	30	30
Glass Transition Temp.	**DMA**		ºC	230	255	255	230
	TMA		ºC	200	230	230	210
Cofficent of Thermal Expansion	**X,Y**	α1	ppm/ºC	14	10	7	8
	X,Y	α2	ppm/ºC	5	3	3	3
Peel Strength		12μm	KN/m	0.85	1.0	1.0	1.0
Flame Resistance		E-168/70	-	V-0	V-0	V-0	V-0
Density			g/cm^3	2.1	1.9	1.9	2.0
Specific heat			J/kg·K	1.00	1.00	0.95	0.95
Thermal Conductivity			W/m*K	0.8	0.6	0.6	0.7
Poissin's ratio			-	0.19	0.18	0.18	0.18
Moisture absorption		85 ºC/85RH% 168h	%	0.44	0.31	0.30	0.32

Typical properties of Materials

Item	Measurement Method		Unit	HL832NSR type LCA	HL832NSF	HL832NSF typeLCA	HL832 NSA typeLCA
Dielectric Constant		1GHz	-	4.1	4.4	4.0	4.0
		5GHz	-	4.0	4.4	4.0	4.0
		10GHz	-	4.0	4.3	3.9	3.9
Dissipation Factor		1GHz	-	0.008	0.006	0.006	0.005
		5GHz	-	0.011	0.008	0.008	0.007
		10GHz	-	0.012	0.008	0.008	0.007
Insulation Resistance		C-96/20/65	Ω	10^{15-16}	10^{15-16}	10^{15-16}	10^{15-16}
Surface Resistance		C-96/20/65	Ω	10^{15-16}	10^{15-16}	10^{15-16}	10^{15-16}
Volume Resistivity		C-96/20/65	Ω·cm	10^{16-17}	10^{16-17}	10^{16-17}	10^{16-17}
Flexural Strength			MPa	670	510	600	420
Flexural Modulus			GPa	33	32	34	31
Tensile Strength			MPa	420	290	390	350
Young's Modulus			GPa	33	32	34	31
Glass Transition Temp.	DMA		ºC	230	300	300	>350
	TMA		ºC	210	270	270	270
Cofficent of Thermal Expansion	X,Y	α1	ppm/ºC	4.5	5	3	1
	X,Y	α2	ppm/ºC	2	3	2	0.5
Peel Strength		12μm	KN/m	1.0	0.8	0.8	0.6
Flame Resistance		E-168/70	-	V-0	V-0	V-0	V-0
Density			g/cm^3	2.0	2.0	2.0	2.0
Specific heat			J/kg·K	0.95	0.9	0.9	0.9
Thermal Conductivity			W/m*K	0.7	0.7	0.7	0.7
Poisson's ratio			-	0.18	0.19	0.18	0.15
Moisture absorption		85 ºC/85RH% 168h	%	0.32	0.35	0.35	0.39

Typical properties of Materials

Item	Measurement Method		Unit	HL972LF typeLD	HL972LFG	HL972LFG typeLD	GHPL-830SR	GHPL-830SR typeLC
Dielectric Constant		1GHz	-	3.5	4.0	3.5	3.9	3.7
		5GHz	-	3.5	3.9	3.5	3.8	3.6
		10GHz	-	3.4	3.8	3.4	3.7	3.5
Dissipation Factor		1GHz	-	0.003	0.003	0.002	0.009	0.009
		5GHz	-	0.004	0.004	0.002	0.01	0.01
		10GHz	-	0.004	0.004	0.002	0.011	0.011
Insulation Resistance		C-96/20/65	Ω	10^{15-16}	10^{15-16}	10^{15-16}	10^{15-16}	10^{15-16}
Surface Resistance		C-96/20/65	Ω	10^{15-16}	10^{15-16}	10^{15-16}	10^{15-16}	10^{15-16}
Volume Resistivity		C-96/20/65	Ω·cm	10^{16-17}	10^{16-17}	10^{16-17}	10^{16-17}	10^{16-17}
Flexural Strength			MPa	370	450	440	420	490
Flexural Modulus			GPa	25	23	21	21	22
Tensile Strength			MPa	220	210	210	290	300
Young's Modulus			GPa	25	23	21	21	22
Glass Transition Temp.	DMA		ºC	270	215	215	195	195
	TMA		ºC	240	200	200	160	160
Cofficent of Thermal Expansion	X,Y	α1	ppm/ºC	10	11	10	8.3	6.3
	X,Y	α2	ppm/ºC	4	4	4	3	2
Peel Strength		12μm	KN/m	0.7	0.7	0.7	1.0	1.0
Flame Resistance		E-168/70	-	V-0	V-0 rating	V-0 rating	V-0 rating	V-0 rating
Density			g/cm^3	1.9	1.8	1.8	1.8	1.8
Specific heat			J/kg·K	0.9	0.95	0.95	0.9	0.9
Thermal Conductivity			W/m*K	0.6	0.6	0.6	0.7	0.7
Poisson's ratio			-	0.2	-	-	0.21	0.21
Moisture absorption		85 ºC/85RH% 168h	%	0.35	0.27	0.27	0.25	0.25

※MGC also has halogen free materials, CCL-HL820 and CCL-HL820WDI.
*1: Please refer to URL on the right, regarding UL certification of flame resistance.[UL Certification]
*2: Typical properties of 45um prepreg.

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