

CYTEC



CYMEL® Resins

For Coating and
Specialty Applications

This brochure provides product characteristics, compositional information and brief general comments on the use of CYMEL® resins used in industrial coatings. Cytec is a leading global supplier of crosslinking agents and offers a broad line of CYMEL resins based on melamine, urea, benzoguanamine and glycoluril. These resins are used in many industrial finishes, including high solids solvent-based and waterborne coatings.

Cytec's expertise in crosslinking technology is part of our corporate heritage and the foundation to our leadership in supplying the market for amino resins.

Cytec's goals in research and development

Several factors drive Cytec's research and development efforts. Cytec focuses on gaining a fundamental understanding of the technical challenges encountered by our customers as they work towards improving their formulations. Cytec also focuses on offering solutions quickly and cost-effectively. Equally important is our commitment to developing new products that fulfill long-standing needs of the industries we serve and helping those industries advance technologically. Our technical specialists routinely visit customer locations, worldwide, to assist them in resolving problems and accelerating development of better products.

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Highly Methylated Melamine Resins

Highly methylated melamine resins consist of commercial versions of hexamethoxymethylmelamine (HMMM). They differ primarily in their degree of alkylation and monomer content. All are efficient crosslinking agents for hydroxyl, carboxyl and amide functional polymers. The practical equivalent weight for most of the resins is 130-180. Advantages are low VOCs; high film flexibility and toughness when used with inherently flexible backbone resins; excellent formulation stability, especially in waterborne systems formulated at a pH of 8-9; good mar resistance; and good intercoat adhesion properties. As typical with melamine resins, all are low in color and color development, have excellent exterior durability and good heat resistance. Because of their high extent of alkylation, the resins in

this series require the addition of a strong acid catalyst for acceptable cure response when baked at 125-150°C. Typically, 0.2- 0.4% p-toluene sulfonic acid based on total binder solids is recommended. The optimum concentration of acid catalyst depends on the basicity of the other components in the formulation and should be determined experimentally. Using a blocking amine for the acid catalyst and adding a stabilizing alcohol to the formulation can enhance formulation stability.

Methylated High Imino Melamine Resins

Methylated high imino melamine resins are partially methylated and highly alkylated. These characteristics result in resins containing a significant concentration of alkoxy/imino or high NH functionality. The advantages are fast cure response at 120-150°C without the need for strong acid catalysts, fast cure response in waterborne formulations, high film hardness, and low formaldehyde release on cure. In addition to reacting with hydroxyl, carboxyl and amide functionality on polymers, these resins also self-condense readily. Therefore, their practical equivalent weight is typically 180-240. They too, can be stabilized by adding amine and stabilizing alcohol to the formulation. Compared to their highly alkylated counterparts, the imino resins usually result in slightly less flexible coatings and slightly higher VOCs when used in solvent-based systems.

Partially Methylated Melamine Resins

Partially methylated melamine resins are highly methylated and partially alkylated. They cure well at 125-150°C without the need to add a strong acid catalyst. The acidity of most polymers used in thermoset coatings is sufficient to catalyze their reaction. Their film performance properties are similar to those of the high imino resins in the previous category. In addition to reacting with the hydroxyl, carboxyl and amide functionality of polymers they, too, can self-condense readily. Their practical equivalent weight is also 180-240. As with all melamine resins, they can be stabilized by adding amine and stabilizing alcohol to the formulation. The major limitation of these products is high formaldehyde release on baking, primarily due to their high free methylol content.

High Solids Methylated Melamine Resins

Product Name	Former Name	Non Volatile % 45°C for 45'	Solvent	Monomer Content % approx.	Viscosity G-H 25°C	Viscosity mPa.s. 25°C	Viscosity mPa.s. 23°C	Density Lbs/Gal approx.	Density Kg/M ³ approx.	Flashpoint °C	Water Solubility	Xylene Solubility	Comments
Highly Methylated Melamine Resins													
CYMEL 300	—	98 minimum	—	76	Waxy solid	—	—	10.0	1200	>100	Insoluble	Complete	Closest in composition to HMMM in product line.
CYMEL 303LF	—	98 minimum	—	59	Y-Z2	2600-5000	3000-6000	10.0	1200	>100	Insoluble	Complete	FF specification <0.3%.
CYMEL 303 ULF	—	98 minimum	—	59	Y-Z2	2600-5000	—	10.0	1200	>100	Insoluble	Complete	FF specification <0.1%.
High Imino Resins													
CYMEL 323	—	78-82	iso-Butanol	58	Y-Z3	—	2500-7500	9.3	1120	33	Complete	Partial	Very fast cure response. Does not require a strong acid catalyst. Low HCHO release.
CYMEL 325	—	78-82	iso-Butanol	46	X-Z1	2000-4800	2500-4500	9.4	1120	37	Partial	Partial	Fast cure response. Does not require a strong acid catalyst. Low HCHO release.
CYMEL 327	—	88-92	iso-Butanol	60	Z2-5	5500-11500	5100-16000	9.8	1180	444	Complete	Partial	Does not require a strong acid catalyst. Fast cure plus good stability.
CYMEL 328	—	83-87	Water	55	—	—	1000-3000	—	1230	94	Complete	Insoluble	Similar in composition to CYMEL 327 resin, but supplied in water.
CYMEL 385	—	76-81	Water	63	U-W	600-1000	1000-1600	10.4	1250	>100	Complete	Insoluble	Very fast cure in WB. Does not require a strong acid catalyst. Low HCHO release.
Partially Methylated Melamine Resins													
CYMEL 370	—	86-90	iso-Butanol	40	Z2-5	—	5100-10200	9.8	1180	46	Partial	Partial	General purpose melamine resin. Fast cure. Does not require a strong acid catalyst.
CYMEL 373	—	83-87	Water	50	Y-Z2	—	2500-6000	10.5	1260	>100	Complete	Insoluble	Similar performance to CYMEL 370 resin, but supplied in water.
CYMEL 380	—	76-82	iso-Butanol	40	V-Z	—	—	9.6	—	46	Partial	Partial	Same composition as CYMEL 370 resin, but supplied at lower solids and viscosity.

Highly Alkylated Melamine Resins

The highly alkylated melamine resins in this category are similar to the commercial versions of hexamethoxy-methylmelamine (HMMM) except for the type of alkylation alcohol. The resins contain combinations of methoxy sites and longer chain length alkoxy sites (ethoxy, n-butoxy or iso-butoxy). They also differ from each other in their degree of alkylation and monomer content. Longer chain length alkoxy sites impart lower viscosity, improved flow and leveling, and intercoat adhesion. All of the resins in the series are efficient crosslinking agents for hydroxyl, carboxyl and amide functional polymers. The practical equivalent weight for most is 140-200. Other advantages are low VOCs; high film flexibility and toughness when used with inherently flexible backbone resins; excellent formulation stability, especially in waterborne systems at a pH of 8-9 and good

mar resistance properties. Because of their high extent of alkylation, the resins in this series require the addition of a strong acid catalyst for acceptable cure response when baked at 125-150°C. Typically, 0.2-0.4% p-toluene sulfonic acid based on total binder solids is recommended. The optimum concentration of acid catalyst depends on the basicity of the other components in the formulation and should be determined experimentally. The use of a blocking amine for the acid catalyst and the addition of a stabilizing alcohol to the formulation should enhance formulation stability.

High Imino Melamine Resins

The high imino melamine resins in this category are similar to those in the high imino methylated melamine series in that they are partially methylated and highly alkylated. They differ from methylated melamine resins in the type of alkylation alcohol, and they contain combinations of methoxy sites and n-butoxy sites. The butoxy sites impart improved flow and leveling and intercoat adhesion properties. As in the methylated series, their composition contains primarily alkoxy/imino or alkoxy/NH functionality. The advantages are fast cure response at 120-150°C without the need for strong acid catalyst addition; fast cure response in waterborne formulations; high film hardness; and low formaldehyde release on cure. In addition to reacting with hydroxyl, carboxyl and amide functional polymers, the resins also self-condense readily. Therefore, their practical equivalent weight is typically 200-250. They, too, can be stabilized by amine and stabilizing alcohol addition to the formulation.

High Solids Mixed Ether Melamine Resins

Product Name	Former Name	Non Volatile % 45°C for 45'	Solvent	Alkoxy Ratio approx.	Monomer Content % approx.	Viscosity G-H 25°C	Viscosity mPa.s. 25°C	Viscosity mPa.s. 23°C	Density Lbs/Gal approx.	Density KgM ₃ approx.	Flashpoint °C	Comments
Highly Alkylated Melamine Resins												
CYMEL 1130	—	96 minimum	—	Me/nBu = 3/1	36	Z-Z2	2700-4900	3000-6000	9.4	1130	>100	Used in e-coat and high solids coatings.
CYMEL 1133	—	98 minimum	—	Me/nBu = 1/1	64	S-W	700-1500	1750-1950	9.0	1080	>100	Used in high solids coatings. Good film flexibility and recoat adhesion.
CYMEL 1141	—	83-87	iso-Butanol	Me/isoBu = 3/2	30	W-Y	—	1400-3000	9.0	1080	33	Carboxy functionality. Excellent adhesion to metals.
CYMEL 1161	—	98 minimum	—	Me/isoBu = 3/1	75	U-X	1000-1800	1050-2000	9.2	1130	>100	Excellent intercoat adhesion. Low VOCs.
CYMEL 1168	—	98 minimum	—	Me/isoBu = 1/1	65	X-Z1	2200-3800	2000-4500	8.9	1080	>100	Methylated-isobutylated version of CYMEL 1133 resin. Excellent intercoat adhesion.
High Imino Melamine Resins												
CYMEL 202	—	80-94	n-Butanol	Me/hBu = 3/2	52	Z-Z3	2800-6000	2500-7500	9.3	1090	>100	Low MW resin. Good balance of reactivity, film flex properties and humidity resistance.

n-Butylated Melamine Resins

n-butylated resins in this category are very polymeric in nature. They differ in extent of methylation, butylation and polymerization. In general, higher extents of methylation and butylation result in more hydrophobic resins with lower viscosities, higher stability, slightly higher film flexibility, film gloss and adhesion but slower cure response. Higher extents of polymerization result in faster film property development but also in higher viscosities, and therefore higher VOCs. None of the resins in this category require the addition of a strong acid catalyst for adequate cure at 125-150°C. Usually, the acidity of the other resin components in the formulation results in sufficient catalysis. In addition to reacting with hydroxyl, carboxyl and amide functionalities on polymers, these resins self-condense readily. Their practical equivalent weight is typically 220-280 on a solids basis. High concentrations of the melamine resins in the formulation result in high film hardness and improved exterior durability but, possibly, lower film flexibility and lower adhesion properties. They, too, can be stabilized by adding amines and stabilizing alcohol to the formulation.

Highly n-Butylated Melamine Resins

Highly butylated melamine resins are similar to the commercial versions of hexamethoxymethylmelamine (HMMM), except they are n-butylated. They also are slightly more oligomeric than their methylated counterparts. The butylation or butoxy sites impart improved flow and leveling and intercoat adhesion properties. However, cure response is slower than that of the resins in the methylated category. Yet, highly butylated melamine resins, are efficient crosslinking agents for hydroxyl, carboxyl and amide functional polymers. The practical equivalent weight is 160-220. Other advantages are high film flexibility and toughness when used with inherently flexible backbone resins; excellent formulation stability; and good mar resistance properties. Because of their high extent of alkylation, the resins require the addition of a strong acid catalyst for acceptable cure response when baked at 125-150°C. Typically 0.2-0.4% p-toluene sulfonic acid based on total binder solids is necessary. The optimum concentration of acid catalyst depends on the basicity of the other components in the formulation and should be determined experimentally. The use of a blocking amine for the acid catalyst and the addition of a stabilizing alcohol to the formulation should enhance formulation stability.

n-Butylated High Imino Melamine Resins

Butylated high imino melamine resins are similar to those in the high imino methylated melamine series; they are partially methylated and highly alkylated. They differ from the high imino methylated melamine resins in that they are n-butylated. The butoxy sites impart improved flow and leveling and intercoat adhesion properties. As in the methylated series, their composition contains primarily alkoxy/imino or alkoxy/NH functionality. The advantages are fast cure response at 120-150°C without the need to add a strong acid catalyst; high film hardness; and low formaldehyde release on cure. In addition to reacting with hydroxyl, carboxyl and amide functionality on polymers, the resins self-condense readily. Therefore, their practical equivalent weight is typically 160-220. They can be stabilized by the addition of an amine and a stabilizing alcohol to the formulation.

iso-Butylated Melamine Resins

The iso-butylated melamine resins in this category are similar to polymeric n-butylated resins and differ only in that they are "iso" rather than "n"-butylated. It is generally believed that iso-butylated melamine resins cure faster than n-butylated resins, although differences in extent of methylation, alkylation and polymerization are believed to be more significant factors with respect to cure response. The comments made previously concerning the n-butylated resins also apply to the iso-butylated resins.

Butylated Melamine Resins

Product Name	Former Name	Non Volatile %	Solvent	Viscosity G-H 25°C	Viscosity mPa.s. 25°C	Viscosity mPa.s. 23°C	Density Lbs/Gal approx.	Density Kg/M3 approx.	Hydrocarbon Tolerance approx.	Acid Number Minimum	Flashpoint °C	Comments
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n-Butylated Melamine Resins

MELMAC® 243-3	—	60-64 (3)	Aromatic Naptha	V-Y	—	—	8.65	—	350 (6)	0-1.5	52	Good compatibility and solvent tolerance.
CYMEL 247-10	—	62-66 (3)	n-Butanol	U-W	700-1600	—	8.65	—	1000 (6)	1.0 max	1.0 max	Excellent compatibility, flow and leveling.

Highly n-Butylated Melamine Resins

CYMEL 1156	—	96 minimum (1)	—	Z1-Z3	2800-5600	3800-7500	8.7	8.7	—	—	>100	Good resistance properties when cured adequately. Very hydrophobic.
CYMEL MB-94	—	94-97 (1)	n-Butanol	Y-Z1	—	2400-3800	8.7	—	—	—	64	Improves the water resistance of UF wood finishes. Very hydrophobic.

n-Butylated High Imino Melamine Resins

CYMEL 1158	—	78-82 (1)	n-Butanol	Z-Z3	3000-7000	3000-7000	8.8	8.8	400 (4)	—	47	High solids. Fast cure response. Low HCHO release.
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iso-Butylated Melamine Resins

CYMEL MI-97-IX	Dynomin MI-97-IX	68-72 (2)	iso-But, Xylene	P-T	—	480-760	—	1010	>200 (5)	1-3	33	Very fast curing. Good compatibility.
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(1) = Foil solids 45° at 45°C
 (2) = Pan solids 60° at 100°C
 (3) = Pan solids 120° at 105°C

(4) = Naptha tolerance
 (5) = HC tolerance, mls of 150 octane tolerated by 10g of resin @ 25°C
 (6) = HC tolerance, lbs of heptane/toluene (3/1) tolerated by 100 lbs of resin @ 25°C

Methylated Resins

Methylated urea resins were designed for waterborne and solvent-based formulations for interior and non-UV resistant applications. They differ from each other primarily in their extent of methylation and methylation. As with other amino resins for coatings, higher extents of alkylation result in improved compatibility with most binders, improved stability; and better flow and leveling, but slower cure response. None of these resins require the addition of a strong acid catalyst for acceptable cure response at 125°C. The acidity of the other components in a formulation usually is sufficient for catalysis. For very low temperature cure systems, those for wood finishes, for example, a 2-component formulation is necessary. In such formulations, the acid catalyst is added to the fully-formulated system just prior to use. If the bake temperature is around 70°C, a concentration of 1-2% on total binder solids of a strong or weak acid is recommended. In general, urea resins react with the hydroxyl, carboxyl and amide functional sites on polymers, but they also have a high tendency for self-condensation. Their practical equivalent weight is in the range of 180-260. The use of a blocking amine for the acid catalyst and the addition of a stabilizing alcohol to the formulation enhances formulation stability. The latter approach is recommended for 2-component formulations.

Butylated resins

The one resin in this category, CYMEL U-80 resin, is similar in composition to several of the methylated resins, except that its alkylation alcohol is n-butanol. This resin is also recommended for interior and non-UV resistant coatings; it is used primarily in solvent-based systems. It is very hydrophobic and stable but slower curing than its methylated counterparts. A strong acid catalyst is recommended for acceptable cure response at 125°C. Other formulation details are the same as those given for methylated resins.

High Solids Urea Resins

Product Name	Former Name	Non Volatile %	Solvent	Viscosity G-H 25°C	Viscosity mPa.s. 25°C	Viscosity mPa.s. 23°C	Density Lbs/Gal approx.	Density Lbs/Gal approx.	Flashpoint °C	Water Solubility	Xylene Solubility	Comments
Methylated Resins												
CYMEL U-64	Beetle or UFR 64	88-94 (1)	isopropanol	V-Y	1200-2500	—	9.8	—	26	Complete	Partial	Similar performance to CYMEL U-65 resin only lower HCHO release.
CYMEL U-65	Beetle or UFR 65	96 minimum (1)	—	Z3-6	3800-5600	—	10.3	—	>100	Complete	Partial	Good compatibility and cure response.
CYMEL UM-15	Dynomin UM-15	96 minimum (1)	—	—	—	6800-17000	—	1200	76	Complete	Partial	Good compatibility and cure response.
Butylated Resins												
CYMEL UM-80	Beetle or UFR 80	96 minimum (1)	n-Butanol	X-Z1	120--3400	1700-4500	8.9	1100	>100	Insoluble	Complete	Very hydrophobic. Excellent water resistance properties when cured properly.

(1) = Foil solids 45° at 45°C
 (2) = Pan solids 120° at 105°C

n-Butylated Urea Resins

The urea resins in this category are all partially n-butylated and very polymeric in nature. They differ in extent of methylation, butylation, and polymerization. In general, higher extents of methylation and butylation result in more hydrophobic resins with lower viscosities, higher stability, and slightly higher film toughness, film gloss and adhesion but slower cure response. Higher extents of polymerization result in faster film property development but also in higher viscosities and, therefore, higher VOCs. None of the resins require the addition of a strong acid catalyst for adequate cure at 125°C. Usually, the acidity of the other resin components in the formulation is

sufficient for catalysis. In addition to reacting with hydroxyl, carboxyl and amide functional polymers, the resins also self-condense readily. Their practical equivalent weight is typically 220-300 on a solids basis. High concentrations of the urea resins in the formulation result in high film hardness, but, possibly, lower film toughness and lower adhesion properties. They can be stabilized by amine and stabilizing alcohol addition to the formulation. As with other urea resins, they are recommended for interior, non-UV resistant applications. The most typical applications are interior container coatings and 2-component solvent-based wood finishes. In the latter application, the acid catalyst is added to the fully-formulated system just prior to use. A concentration of 1-2% on total binder

solids of a strong or weak acid is recommended for systems that require low bake temperatures - typically less than 70°C.

iso-Butylated Urea Resins

The iso-butylated urea resins in this category are similar to the polymeric n-butylated resins, except that they are iso-butylated rather than n-butylated. It is generally believed that iso-butylated urea resins cure faster than n-butylated resins, although differences in extent of methylation, alkylation and polymerization are believed to be more significant factors with respect to cure response. Iso-butylated urea resins perform in much the same way as n-butylated urea resins. That is, high concentra-

tions of these resins in the formulation result in high film hardness, but, possibly, lower film toughness and lower adhesion properties. Iso-butylated resins can be stabilized by adding amine and stabilizing alcohol to the formulation. They are recommended for interior and non-UV resistant applications, as well.

Butylated Urea Resins

Product Name	Former Name	Non Volatile %	Solvent	Viscosity G-H 25°C	Viscosity mPa.s. 25°C	Viscosity mPa.s. 23°C	Density Lbs/Gal approx.	Density Kg/M3 approx.	Hydrocarbon Tolerance approx.	Acid Number Minimum	Flashpoint °C	Comments
n-Butylated Urea Resins												
CYMEL U-21-511	Beckamine 21-511	58-62 (2)	n-But, Ethanol	K-N	—	—	8.55	—	200 (10)	2-5	32	Exempt solvent version of CYMEL U-21-510 resin.
CYMEL U-93-210	Beckamine 93-210	60-64 (2)	n-But, Xylene	V-Y	—	—	8.65	—	250 (10)	2-5	35	Good compatibility, low viscosity. Suitable for epoxy systems.
CYMEL U-216-10-LF	Beetle or UFR 216-10	58-62 (3)	n-Butanol	S-V	—	—	8.65	—	350 (7)	0.5-2	45	CYMEL U-216 resin supplied in n-butanol.
CYMEL U-227-8	Beetle or UFR 227-8	49-55 (3)	n-But, Xylene	X-Z1	—	1700-4500	8.4	1000	100 (7)	1-4	22	General purpose butylated urea formaldehyde resin.
CYMEL U-1050-10	Beetle or UFR 1050-10	58-62 (3)	n-Butanol	Z-Z2	—	—	8.4	—	100 (7)	1-4	41	CYMEL U-1050 resin supplied in n-butanol.
CYMEL U-1052-8	Beetle or UFR 1052-8	54-58 (3)	n-But, Xylene	R-U	—	—	8.65	—	350 (7)	2-2.7	34	Fast-curing, compatible resin. Suitable for epoxy systems.
CYMEL U-1054	Beetle or UFR 1054	58-62 (3)	n-But, Ethanol	U-Z1	—	—	8.8	—	16 (9)	5-7	33	Fast-curing, compatible resin. Suitable for epoxy systems.
CYMEL UB-25-BE	Dynomin UB-25-BE	61-65 (5)	n-But, Ethanol	U-Y	—	1000-3000	—	1020	15 (9)	1.5-3.5	27	Fast-curing resin for wood finishes and general metals.
CYMEL UB-30-B	Dynomin UB-30-B	63-67 (5)	n-Butanol	Z5-6	—	13000-25000	—	1030	15 (9)	1-3	37	Fast-curing resin for wood finishes and general metals.
iso-Butylated Urea Resins												
CYMEL U-662	Beetle BE 662	58-62 (4)	iso-But, Xylene	—	1000-2000	1200-2400	—	1010	16 (8)	0.75-1.5	25	Medium-high reactivity. Recommended for wood finishes. Low HCHO emission.
CYMEL U-663	Beetle BE 663	60-64 (4)	iso-Butanol	—	2000-4000	2400-4500	—	1000	27 (8)	0.75-1.5	30	Medium-high reactivity. Recommended for wood finishes. Low HCHO emission.
CYMEL U-1051	Beetle or UFR 1051	58-62 (3)	iso-But, Xylene	X-Z1	—	—	8.45	—	200 (7)	2-10	27	Fast cure and excellent compatibility.
CYMEL UI-19-I	Dynomin UI-19-I	61-64 (5)	iso-Butanol	Z4-5	—	8700-16000	—	1020	9 (9)	0.5-2	34	Fast curing resin for wood finishes. Low formaldehyde emission.
CYMEL UI-21E	Dynomin UI-21-E	76-80 (5)	Ethanol	Y-Z1	—	—	—	1010	6 (9)	0-1	25	Good cure speed. General purpose resin.
CYMEL UI-27-EI	Dynomin UI-27-EI	58-62 (5)	Ethanol, iso-But	K-O	—	350-600	—	1010	15 (9)	1-3	24	Good cure speed. Compatible with nitrocellulose systems.
CYMEL UI-38-I	Dynomin UI-38-I	67-71 (5)	iso-Butanol	Z4-6	—	12000-20000	—	1030	20 (9)	2-4	38	Used in primers and topcoats for metal substrates. High resistivity.

(1) = Foil solids 45° at 45°C (2) = Pan solids 90° at 105°C (3) = Pan solids 120° at 105°C (4) = Pan solids 120° at 120°C (5) = Pan solids 60° at 100°C (6) = Pan solids 90° at 90°C (7) = HC Tolerance, lbs of heptane/toluene (3/1) tolerated by 100 lbs of resin solution at 25°C (8) = ASTM Tolerance, cc of solvent tolerated by 5g of resin at 20°C (9) = HC Tolerance, mls of iso-octane tolerated by 10g of resin at 25°C (10) = Mineral Spirits Tolerance

Benzoguanamine Resins

Benzoguanamine resins are similar to melamine-based resins in that they, too, are triazine based, but in this instance, the triazine has a benzene group substitution. Therefore, they are less functional than melamine-based resins, and are not UV resistant. Benzoguanamine resins are noted for their enhanced film flexibility, or toughness, and for their chemical resistance. They are typically used in primers, container coatings, and appliance finishes. Usually, highly alkylated, monomeric benzoguanamine resins result in higher film flexibility than that which can be achieved with other types of resins, but they also require the addition of a strong acid catalyst for adequate cure at temperatures greater than 125°C. Their practical equivalent

weights are slightly higher than the practical weights of their melamine counterparts and range from 160-220. The less alkylated polymeric resins only require the acidity of the other components in the formulation to cure adequately at greater than 125°C, but they have higher VOCs in a solvent-based formulation. Their practical equivalent weights are also slightly higher than those of their melamine counterparts and range from 200-260 on a solids basis. The use of a blocking amine and the addition of a stabilizing alcohol to the formulation should enhance formulation stability.

Glycoluril Resins

Glycoluril resins are similar to their melamine resins counterparts in that they, too, are based on a ring structure, glycoluril. Similar to benzoguanamine resins, they are less functional than melamine resins but are UV resistant and can be used in exterior coatings. Their advantages are film toughness and flexibility, ability to adhere to metals, and low formaldehyde release on curing. There are two categories in the product line, unalkylated methylol glycoluril resins, and those which are highly alkylated. CYMEL 1172 is unalkylated, and was designed for water-based coatings with low temperature cure performance properties. The highly alkylated resins, CYMEL 1170 and CYMEL 1171 resins, were designed to replace HMMM where there is a desire to improve film flexibility. The same comments concerning highly alkylated monomeric melamine resins also apply to the alkylated glycoluril resins.

Benzoguanamine and Glycoluril Resins

Product Name	Former Name	Non Volatile % 45°C for 45'	Solvent	Alkoxy Ratio approx.	Viscosity G-H 25°C	Viscosity mPa.s. 25°C	Viscosity mPa.s. 23°C	Density Lbs/Gal approx.	Density Kg/M ₃ approx.	Flashpoint °C	Water Solubility	Xylene Solubility	Comments
Benzoguanamine Resins													
CYMEL 1123	—	98 minimum (1)	—	Me/Eth = 55/45	Z1-4	—	3800-10200	9.7	1170	>100	Insoluble	Complete	Methylated, ethylated, highly monomeric resin. Strong acid catalyst required. Excellent film flex.
CYMEL 5010	—	64-68 (2)	n-But, Xylene	n-Butyl	G-M	—	—	—	1050	27	Insoluble	Complete	n-Butylated, polymeric general purpose resin.
Glycoluril Resins													
CYMEL 1170	—	98 minimum (1)	n-Butanol	n-Butyl	Z-22	—	3000-6000	8.9	1070	>100	Insoluble	Complete	Highly butylated, highly monomeric resin. Very hydrophobic. Excellent film flex.
CYMEL 1171	—	90 minimum (1)	n-Butanol	Me/Eth = 1/1	Z1-3	—	3800-7500	10.0	1200	66	Complete	Partial	Highly methylated-ethylated, monomeric resin. WB or solvent-based finishes. Low formaldehyde emissions.
CYMEL 1172	—	43-47 (2)	Water	Unalkylated	—	—	>50	10.1	1210	>100	Complete	Insoluble	Unalkylated resin for WB finishes. Fast curing.

(1) = Pan solids 120° at 120°C

(2) = Foil solids 45° at 45°C

(3) = Pan solids 120° at 105°C

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