CYTEC

CYMEL®
Amino Resin Crosslinkers for the Coating Industry

Product and Application Guide

Europe, Middle East and Africa

Total Solutions Provider

Cytec Industries is one of the world's leading specialty chemicals and materials technology companies. Our focus is on creating advanced technological solutions in global markets, including aerospace, coatings, mining and plastics.

Commitment to Responsible Care®

Cytec subscribes to the principles of Responsible Care and is an active member of the American Chemistry association. We are implementing an ISO based environmental and Responsible Care management system at all our sites worldwide. The system, known as RC, brings rigor to our commitment to safety, health and the environmental continuous improvement, as well as legal compliance and governance.

Committed to Compliance

Cytec has an active strategy to comply with the 2007 Registration, Evaluation, Authorisation and Restriction of Chemical substances (aka REACH). The aim of REACH is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. We are working with our suppliers and customers to comply with the requirements and continue to ensure that our products are meeting our customer's needs.

Innovative Technology

Cytec's products are innovative and diverse, and can help coating manufacturers realize the competitive advantages of environmental compliance, while also meeting their needs for:

- Improved performance (scratch/stain/corrosion resistance, and adhesion)
- Greater ease of application (required cure response)
- Better finishes (gloss/matte, texture, and specialty)

Broad Product Portfolio

We offer an extensive selection of performance-driven products, including low volatile organic compounds (VOC) and hazardous air pollutant substance-free (HAPS) technologies, for existing and emerging markets:

- Industrial
- Architectural/Construction
- Automotive/Transportation
- Wood/Paper
- Plastic
- Opto-electronics
- Graphic Arts
- Packaging/Adhesives

Our product portfolio is inclusive:

- UV/EB energy curable resins
- Liquid coating resins
  - – Waterborne
  - – High solids
  - – Solvent-borne
- Amino crosslinkers
- Powder coating resins
- Coating additives

Global Technical Support

Through our manufacturing facilities, technology and distribution centers, we are able to provide responsive service on a consistent global basis, and to help our customers identify and profit from emerging opportunities.

Introduction

This brochure provides product characteristics, composition information and general guidance on the use of CYMEL® resins for industrial coatings. **Cytec** Industries Inc. is a leading global supplier of crosslinking resins and offers a broad line of CYMEL resins based on melamine, urea, benzoguanamine and glycoluril. Amino crosslinking resins are widely used in the industrial thermosetting coating market, due to the excellent balance of economical cost and cured film characteristics. Amino crosslinker resins are complex mixtures with different functional sites and molecular species synthesized through the condensation of formaldehyde with an amine and the subsequent alkylation of the resulting methylol groups with an alcohol.

The degree of alkylation and extent of methylolation of these resins varies depending on the process used to prepare them. For that reason we use in this brochure the terminology highly-alkylated, partially-alkylated and high imino crosslinker resins. The type of alkylation alcohol can have a significant effect on the final crosslinker properties. For that reason you will find in our product portfolio several amino crosslinker resin types with different degrees of desired hydrophobicity, from methylated and mixed ethers to butylated ones.

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

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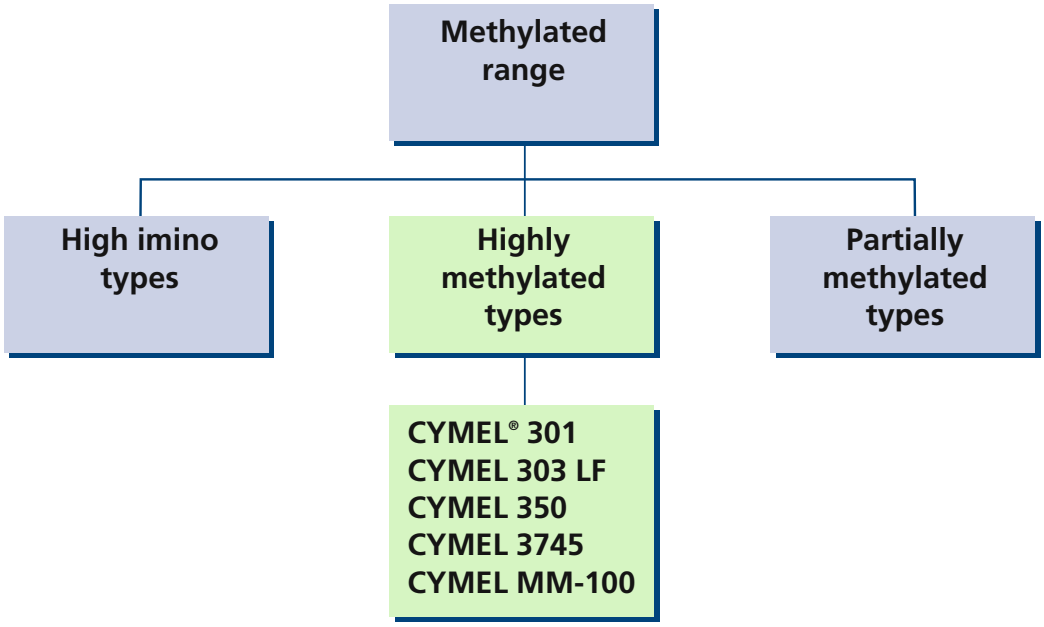
6 Highly methylated Melamine Crosslinker Range

These crosslinkers differ primarily in monomer content, and consequently in molecular weight distribution. They are described as monomeric in nature with primarily methoxymethyl functional sites. They react by specific acid catalysis with a low tendency for self-condensation reactions that improves the flexibility of the cured film. A strong acid catalyst is required to obtain high performance such as high weight retention, excellent film flexibility and resistance properties.



Important Characteristics

- Solvent-free
- Excellent storage stability
- Wide compatibility
- Low formaldehyde release upon cure
- Very high weight retention
- Potential for high crosslink density
- Excellent film flexibility
- Very good resistance properties
- Very good exterior durability

Recommended Application Areas

- Coil coatings
- Paper coatings
- Metal decorating coatings
- Waterborne coatings
- High solids coatings
- General industrial coatings
- Container coatings
- Automotive coatings

Highly methylated melamine crosslinkers are known for high quality performance and low weight loss during the baking conditions

CYMEL 301	Slightly higher in degree of alkylation and lower in viscosity compared to CYMEL 303 LF resin. The resin is supplied as a liquid but is sensitive for crystallization at lower temperatures.
CYMEL 303 LF	Cytec's most versatile highly methylated melamine resin for high quality industrial coating formulations.
CYMEL 350	Lower in degree of methylation compared to CYMEL 303 LF resin which makes the CYMEL 350 resin water soluble.
CYMEL 3745	Slightly lower in degree of methylation compared to the CYMEL 303 LF resin which makes the CYMEL 3745 resin easier to handle in water based formulations.
CYMEL MM-100	More oligomeric and some NH functionality compared to the CYMEL 303 LF resin which makes the CYMEL MM-100 resin slightly more reactive and sensitive for self-condensation reactions.

Product Characteristics

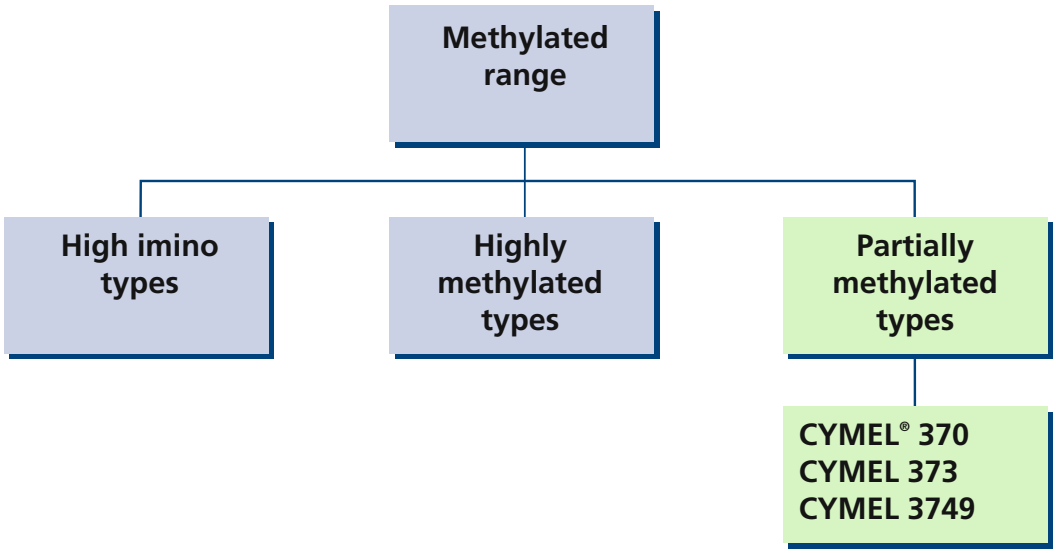
Products	Solids (Foil) %	Viscosity mPa.s 23°C	Free HCHO %	Typical monomer %	Water dilution	Std. solvent tolerance	Stoichiometry	
							F	Me
CYMEL 301	≥98	1550–4500	<0.5	68	<1	>50	5.9	5.2
CYMEL 303 LF	≥98	3000–6000	<0.25	59	<1	>100	5.8	5.0
CYMEL 350	≥97	5100–16000	<2.5	68	>150	>20	5.9	4.4
CYMEL 3745	≥98	2500–7500	<0.7	63	<2	>50	5.8	4.9
CYMEL MM-100	≥98	10000–25000	<0.5	45	<1	>50	5.5	4.7

Comparison tables: Highly and partially methylated melamine resins

Properties	Highly methylated	Partially methylated
Solids/viscosity		
Cure response		
Film hardness		
Solvent resistance		
Wetting, flow, leveling		
Film flexibility		
Exterior durability		
Formulation stability		
Humidity resistance		
Weight retention/VOC		
Applications	**Highly methylated**	**Partially methylated**
Coil coatings		
Automotive coatings		
High solids coatings		
Waterborne coatings		
Paper coatings		
Container coatings		

8 Partially methylated Melamine Crosslinker Range

These crosslinkers differ primarily in their degree of alkylation, solvent composition and non volatile/viscosity relationship. They are oligomeric in nature with main functionalities being methoxymethyl and methylol. They react by general acid catalysis with a high tendency for self-condensation reactions that improve the reaction speed but limit the flexibility of the cured films. The degree of polymerization has a significant effect on their compatibility with organic solvents and backbone polymers. Higher oligomeric amino resins are less compatible. Under normal baking conditions an external catalyst is usually not required to obtain fast curing coating systems with good resistance properties.



Important Characteristics

- High solids
- Good compatibility
- No catalyst required
- High tendency to self-condensation reactions
- Fast reaction speed
- Fast cure in waterborne systems
- Good film hardness development
- Good exterior durability
- Good water solubility

Recommended Application Areas

- Waterborne coatings
- Metal decorating coatings
- General industrial coatings
- Hydroxyl functional latex systems

Partially methylated melamine crosslinkers are known for higher solids and water solubility properties compared to their butylated equivalents

CYMEL 370	For fast cure, medium to high solids and waterborne industrial coating formulations.
CYMEL 373	For fast cure waterborne industrial coating formulations. CYMEL 373 resin is delivered in water.
CYMEL 3749	For medium fast curing, medium to high solids and waterborne industrial coating formulations.

Product characteristics

Products	Solvents	Solids (Foil) %	Viscosity mPa.s 23°C	Free HCHO %	Typical monomer %	Water dilution	Xylene dilution	Stoichiometry	
								F	Me
CYMEL 370	iso-butanol	86–90	5100–10200	<3.5	42	>15	>30	5.0	3.3
CYMEL 373	water	83–87	2500–6000	<1.5	50	>400	–	4.8	2.4
CYMEL 3749	iso-butanol	79–83	3000–6000 *)	<1.0	40	>15	>50	5.1	3.6

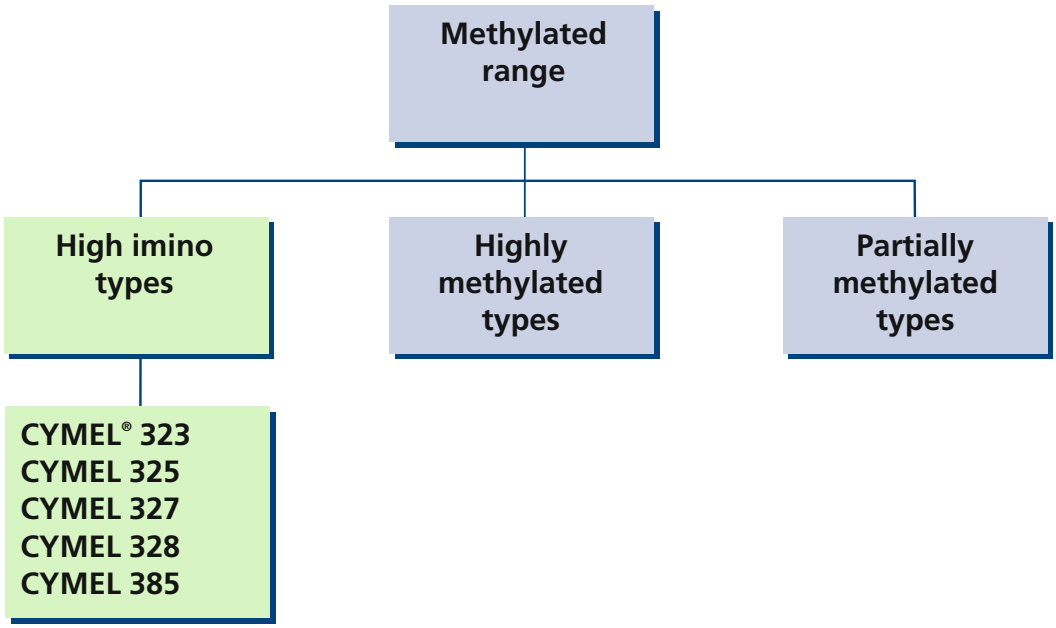
*) At 25 °C

Comparison tables: Partially methylated and partially butylated melamine resins

Properties	Partially methylated	Partially butylated
Solids/viscosity		
Cure response		
Film hardness		
Solvent resistance		
Wetting, flow, leveling		
Adhesion properties		
Exterior durability		
Formulation stability		
Humidity resistance		
Weight retention/VOC		
Applications	**Partially methylated**	**Partially butylated**
High solids coatings		
Waterborne coatings		
Automotive coatings		
Container coatings		
General industrial coatings		
Paper coatings		
Textile coatings		

10 Methylated high Imino Melamine Crosslinker Range

These crosslinkers have a low methylol and a high imino content and can be described as oligomeric in nature with main functionalities, methoxymethyl and imino. They react according to general acid catalysis with a high tendency towards self-condensation reactions that improve the reaction speed but limit the flexibility of the cured films. These methylated high imino melamine resins have a low tendency towards demethylolation reactions and consequently they release very low amounts of formaldehyde upon curing. Under normal baking conditions an external catalyst is usually not required to obtain fast curing and good resistant coating systems. These high imino methylated melamine resins are excellent replacements for partially butylated and partially methylated melamine resins due to higher solids, lower formaldehyde release and faster cure.



Important Characteristics

- Medium to high solids
- Good compatibility
- No catalyst required
- Low temperature cure
- Very fast reaction speed
- Very fast cure in waterborne systems
- High weight retention
- Low formaldehyde release upon cure
- Good resistance properties
- Good exterior durability

Recommended Application Areas

- Automotive coatings
- Metal decorating coatings
- Coil coatings
- General industrial coatings
- Medium to high solids coatings
- Waterborne coatings
- Low temperature cure coatings
- Paper coatings

High imino methylated melamine crosslinkers are known for fast reaction speed and low formaldehyde emission during the baking process

CYMEL 323	For low temperature baking formulations with low formaldehyde release.
CYMEL 325	For very fast curing coating formulations with improved formulation stability compared to the CYMEL 323 resin.
CYMEL 327	For fast curing coating formulations with improved formulation stability and film flexibility properties compared to the CYMEL 325 resin.
CYMEL 328	For fast curing waterborne coating formulations. CYMEL 328 resin has a rather limited storage stability.
CYMEL 385	For low cure hydroxyl functional latex systems and as a non woven binder. It is important to bear in mind that CYMEL 385 resin has a limited storage stability.

Product characteristics

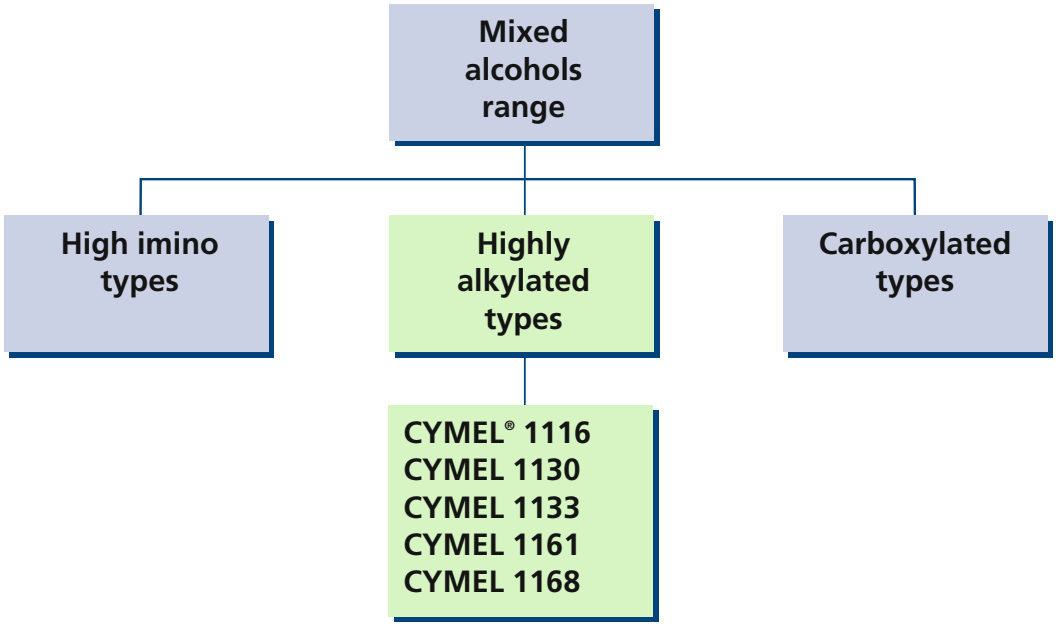
Products	Solvents	Solids (Foil) %	Viscosity mPa.s 23°C	Free HCHO %	Typical monomer %	Water dilution	Xylene dilution	Stoichiometry	
								F	Me
CYMEL 323	iso-butanol	78–82	2500–7500	<1.0	58	>200	>20	3.9	2.9
CYMEL 325	iso-butanol	78–82	2500–4500	<1.3	46	>30	>20	4.1	3.0
CYMEL 327	iso-butanol	88–92	5100–16000	<1.3	60	>400	>40	4.3	3.2
CYMEL 328	water	83–87	1000–3000	<0.7	55	>400	--	4.3	3.2
CYMEL 385	water	76–80	1000–1600	<0.5	60	>400	--	3.3	1.6

Comparison tables: Methylated high imino and partially methylated melamine resins

Properties	Methylated high imino	Partially methylated
Cure response		
Film hardness		
Lower formaldehyde release		
Weight retention/VOC		
Lower temperature cure		
Popping resistance		
Applications	**Methylated high imino**	**Partially methylated**
Low temperature cure coatings		
Medium solids coatings		
Automotive coatings		
Container coatings		
Textile coatings		
Paper coatings		

12 Highly alkylated Mixed Ether Melamine Crosslinker Range

These crosslinkers differ primarily in the nature of their alkylation alcohols and consequently in their hydrophobicity. They are monomeric in nature with the main functionality alkoxymethyl. They react according to specific acid catalysis with a low tendency for self-condensation that enhances the flexibility of the cured film. When a strong acid catalyst is used high performance is obtained, including high weight retention, excellent flexibility and good resistance properties. Depending on the specific application conditions or film requirements, one mixed ether crosslinker may be preferred over another in order to obtain the best balance of properties.



Important Characteristics

- Solvent-free
- Excellent storage stability
- Wide compatibility
- Strong acid catalyst required
- Excellent electrodeposition properties
- Excellent wetting of metal substrates
- High weight retention
- Low formaldehyde release upon cure
- Excellent adhesion properties
- Excellent film flexibility
- Very good resistance properties

Recommended Application Areas

- Automotive coatings
- Container coatings
- Anodic electrodeposition coatings
- General industrial coatings
- High solids coatings
- Metal decorating coatings
- Primer formulations
- Printing inks

Highly alkylated mixed ether melamine crosslinkers are known for their hydrophobic nature compared to their methylated equivalents

CYMEL 1116	For anodic electrodeposition formulations.
CYMEL 1130	For anodic electrodeposition formulations with improved electrodeposition properties and recommended for high solids coating formulations.
CYMEL 1133	For anodic electrodeposition formulations with improved throwing power properties and recommended for high solids coating formulations.
CYMEL 1161	Designed for high solids coating formulations with improved adhesion properties.
CYMEL 1168	For high solids coating formulations with improved adhesion and resistance properties.

Product characteristics

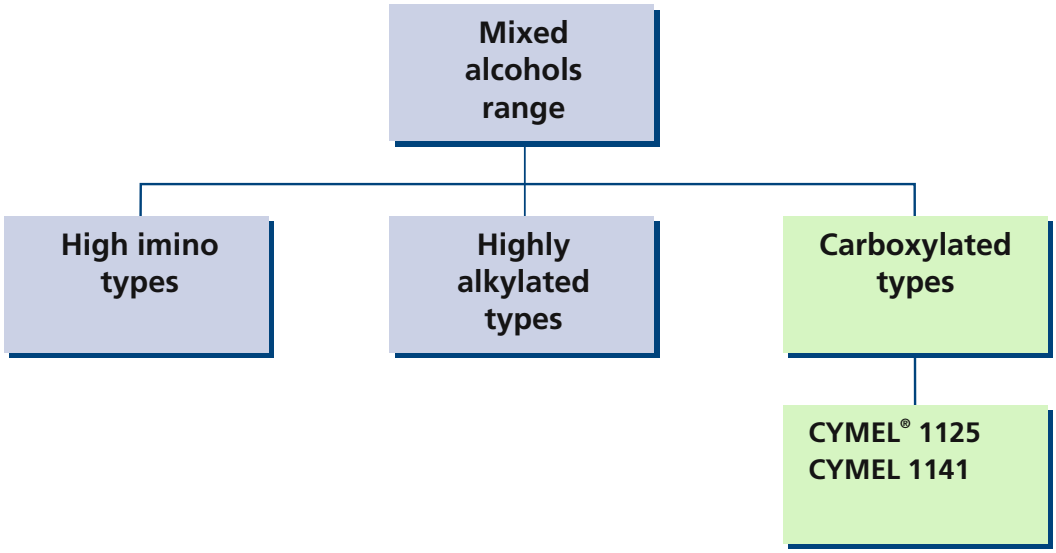
Products	Solids (Foil %)	Viscosity mPa.s 23°C	Free HCHO %	Typical monomer %	Naphtha tolerance	Stoichiometry				
						F	Me	Et	n-Bu	i-Bu
CYMEL 1116	≥98	1050–3000	<0.3	58	>5*	5.9	2.6	2.6	–	–
CYMEL 1130	≥96	3000–6000	<0.5	40	>800	5.7	3.8	–	1.4	–
CYMEL 1133	≥98	750–1950	<0.5	60	>1400	5.8	2.9	–	2.3	–
CYMEL 1161	≥98	1050–2000	<0.15	75	>1400	5.8	4.0	–	–	1.3
CYMEL 1168	≥98	2000–4500	<0.15	65	>1400	5.9	2.4	–	–	2.7

*) Heptane tolerance

Comparison tables: Highly methylated and highly alkylated mixed ether melamine resins

Properties	Highly methylated	Highly alkylated mixed ether
Solids/viscosity		
Cure response		
Film hardness		
Electro deposition properties		
Wetting, flow, leveling		
Adhesion properties		
Exterior durability		
Formulation stability		
Humidity resistance		
Weight retention/VOC		
Applications	**Highly methylated**	**Highly alkylated mixed ether**
Electrodeposition coatings		
Automotive coatings		
Primer formulations		
High solids coatings		
Container coatings		
Coil coatings		
Waterborne coatings		

14 Highly alkylated Carboxylated Crosslinker Range



CYMEL 1141 resin is a highly alkylated mixed ether carboxylated melamine resin and was developed primarily for electrodeposition primer formulations requiring high corrosion resistance. It is an efficient crosslinking resin for hydroxyl, carboxyl or amide functional polymers and is also reactive with cationic resins. The structure of CYMEL 1141 resin lends itself to superior corrosion and chemical resistance and the carboxy modification provides superior adhesion to metal substrates. CYMEL 1141 resin contains chelating groups which can form coloured compounds with heavy metal ions such as iron and zinc.

CYMEL 1125 benzoguanamine crosslinker is a highly alkylated mixed ether carboxylated benzoguanamine resin. This carboxyl modified amino crosslinker was developed primarily for electrodeposition primer formulations requiring high corrosion and detergent resistance. It is an efficient crosslinking resin for hydroxyl, carboxyl or amide functional polymers and is also reactive with cationic resins. The structure of CYMEL 1125 resin offers superior detergent and chemical resistance and the carboxy modification provides outstanding adhesion to metal substrates. CYMEL 1125 resin contains chelating groups which can form coloured compounds with heavy metal ions such as iron and zinc. CYMEL 1125 resin is not suitable for outdoor applications because of the limited UV-light resistance of benzoguanamine resins.

Important Characteristics

- Carboxyl functional
- High solids
- Stable under acid conditions
- Reactive with cationic polymers
- High weight retention
- Excellent adhesion to metal substrates
- Excellent corrosion resistance
- Very good resistance properties

Application Areas

- Cathodic electrodeposition coatings
- Anodic electrodeposition coatings
- Primer formulations

Carboxyl modified highly alkylated amino crosslinkers are known for very good adhesion and corrosion resistance properties

CYMEL 1125	For electrodeposition and primer formulations requiring very good adhesion, corrosion and detergent resistance properties.
CYMEL 1141	For electrodeposition and primer formulations with good adhesion and corrosion resistance and improved outdoor durability compared to the CYMEL 1125 resin.

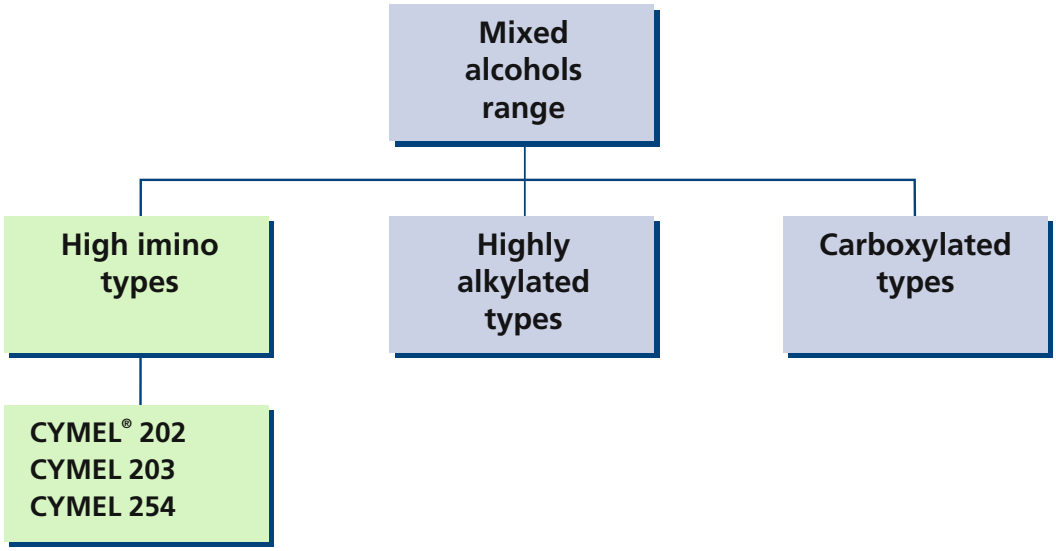
Product characteristics

Products	Solvents	Solids (Foil) %	Viscosity mPa.s 23°C	Free HCHO %	Typical monomer %	Stoichiometry			
						F	Me	Et	i-Bu
CYMEL 1125	2-butoxy ethanol	87–91	5000–17000	0.2	14	3.8	1.9	1.4	–
CYMEL 1141	iso-butanol	83–87	1400–3000	<0.9	30	5.7	2.5	–	2.3

Comparison tables: Highly alkylated carboxylated amino resins

Properties	CYMEL 1125 Benzoguanamine	CYMEL 1141 Melamine
Cure response		
Formulation stability		
Exterior durability		
Adhesion properties		
Film hardness development		
Detergent resistance		
Corrosion resistance		
Applications	**CYMEL 1125 Benzoguanamine**	**CYMEL 1141 Melamine**
Anodic electrodeposition coatings		
Cationic electrodeposition coatings		
Primer formulations		

16 High Imino Mixed Ether Melamine Crosslinker Range



The main difference between these crosslinkers is in the difference of the degree of methoxy and butoxy functionality, and consequently their hydrophobicity. They are oligomeric in nature and the main functionalities are alkoxymethyl and imino. They react by general acid catalysis, with a strong tendency to self-condensation that improves reaction speed, but limits the flexibility of the cured films. Under normal baking conditions an external catalyst is usually not required to obtain fast curing and good resistance properties. Depending on the specific application conditions or film requirements, one mixed ether crosslinker may be selected over another to obtain the best balance of properties.

Important Characteristics

- Medium to high solids
- Good compatibility
- No catalyst required
- Good wetting of metal substrates
- Fast reaction speed
- Low formaldehyde release upon cure
- Very good adhesion properties
- Good humidity resistance
- Good exterior durability

Application Areas

- Automotive coatings
- Container coatings
- Dipping enamels
- General industrial coatings
- Metal decorating coatings
- Primer formulations
- Waterborne coatings

High imino mixed ether melamine crosslinkers are known for fast cure, low formaldehyde emission during baking conditions and improved hydrophobic behaviour compared to methylated resins

CYMEL 202	For fast curing medium solids solvent or waterborne industrial coating formulations with good adhesion and humidity resistance properties.
CYMEL 203	For fast curing solvent or waterborne industrial coating formulations with improved film appearance properties.
CYMEL 254	For medium solids industrial coating formulations with improved adhesion and water resistance properties.

Product characteristics

Products	Solvents	Solids (Foil) %	Viscosity mPa.s 23°C	Free HCHO %	Typical monomer %	Xylene dilution	Stoichiometry		
							F	Me	n-Bu
CYMEL 202	n-butanol	80–84	2500–7500	<1.2	40	>150	4.0	1.6	1.1
CYMEL 203	n-butanol	70–74	400–800	<1.0	35	>300 *)	4.1	1.4	2.0
CYMEL 254	n-butanol	83–87	1400–3000	<0.6	49	>150	4.2	2.1	1.1

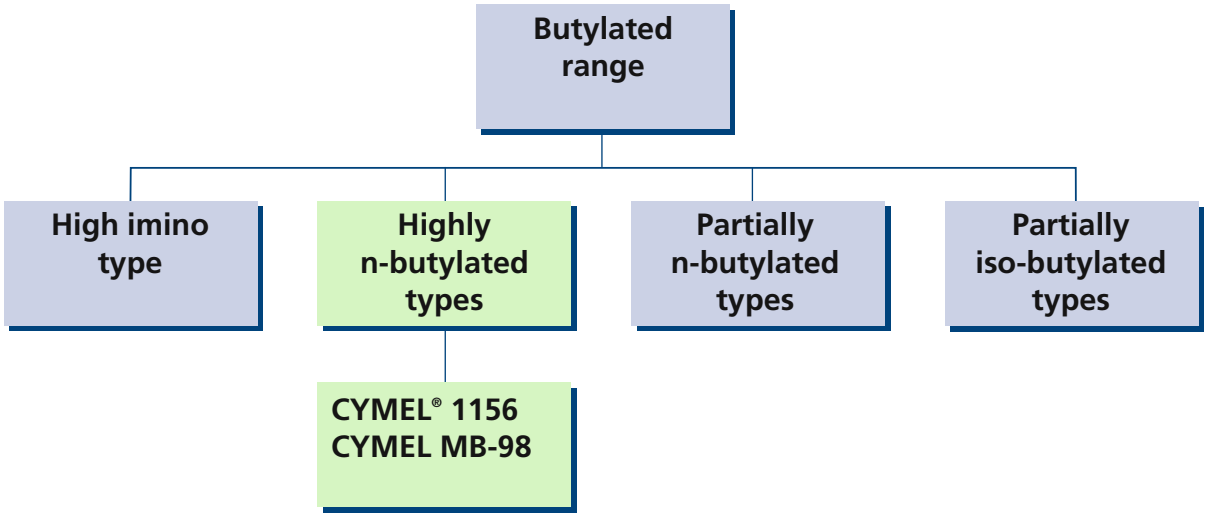
*) Standard solvent tolerance

Comparison tables: High imino mixed ether melamine resins

Properties	Methylated	Methylated/Butylated	Butylated
Cure response			
Film hardness developement			
Corrosion resistance			
Exterior durability			
Wetting, flow, leveling			
Adhesion properties			
Humidity resistance			
Weight retention/VOC			
Salt spray resistance			
Applications	**Methylated**	**Methylated/Butylated**	**Butylated**
Low temperature cure coatings			
Medium solids coatings			
Primer formulations			
Automotive coatings			
Container coatings			
General industrial coatingss			

Highly n-butylated Melamine Crosslinker Range

These crosslinkers differ primarily in their degree of alkylation and molecular weight distribution, and are oligomeric in nature with main functionalities butoxymethyl and methylol. They react by specific acid catalysis with a low tendency for self-condensation. A strong acid catalyst is required to obtain high performance. These butylated melamine resins have better adhesion to relatively unclean substrates than methylated melamine resins, and provide better intercoat adhesion and adhesion to metal substrates.



Important Characteristics

- High solids
- Excellent storage stability
- Excellent solubility
- Strong acid catalyst required
- Excellent electrodeposition properties
- Good wetting of metal substrates
- Good adhesion properties
- Good corrosion resistance
- Good humidity resistance

Recommended Application Areas

CYMEL 1156

- Anodic electrodeposition coatings
- General industrial coatings
- Metal decorating coatings
- Primer formulations

CYMEL MB-98

- Acid curing coatings

Highly butylated melamine crosslinkers are known for high solids and their hydrophobic nature

CYMEL 1156	For industrial coating formulations where improved flow and adhesion properties are required.
CYMEL MB-98	For acid curing wood coating formulations where improved resistance properties are required.

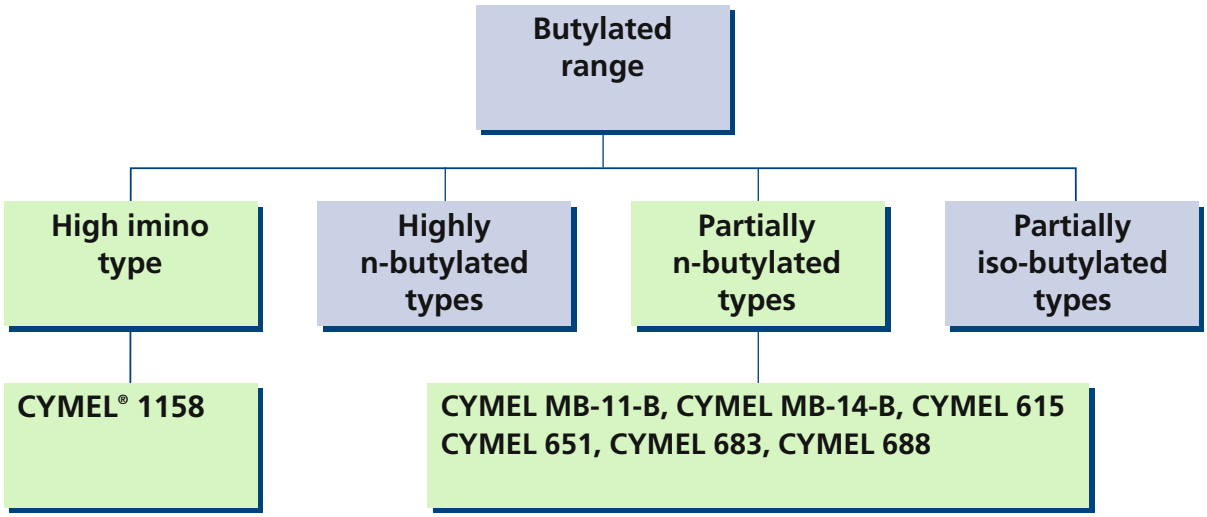
Product characteristics

Products	Solids (Foil) %	Viscosity mPa.s 23 °C	Free HCHO %	Typical monomer %	iso-octane tolerance	Stoichiometry	
						F	n-Bu
CYMEL 1156	>96	3800–7500	<0.5	30	>200	6.0	4.1
CYMEL MB-98	>95	1700–4500	<0.2	22	>200	5.6	4.7

Comparison tables: Highly butylated and methylated melamine resins

Properties	CYMEL 303 LF	CYMEL 1156
Humidity resistance		
Salt spray resistance		
Wetting, flow, leveling		
Adhesion properties		
Solvent resistance		
Film hardness development		
Cure response		
Weight retention/VOC		
Applications	**CYMEL 1156**	**CYMEL MB-98**
Acid curing coatings		
Force drying finishes		
Electrodeposition coatings		
Primer formulations		

N-butylated high Imino and partially n-butylated Melamine Crosslinker Range



Partially n-butylated melamine crosslinkers differ primary in the degree of alkylation and molecular weight distribution, and are polymeric in nature with mainly butoxymethyl and methylol functionalities. They react by general acid catalysis with a strong tendency for self-condensation that improves the reaction speed, but limits the flexibility of the cured film. Under normal baking conditions an external catalyst is usually not required to obtain fast curing and good resistance properties.

Important Characteristics

- Good compatibility
- High tendency to self-condensation reactions
- No catalyst required
- Good wetting of metal substrates
- Good reaction speed
- Excellent adhesion properties
- Good film hardness
- Good resistance properties

Additional Characteristics for CYMEL 1158

- High solids formulations
- Low formaldehyde release during cure
- Low blistering tendency
- Good exterior durability

Better hydrocarbon solvent tolerance usually means there will be improved compatibility with a wider range of primary film formers. Melamine resins with a lower hydrocarbon solvent tolerance are generally faster curing and yield better film hardness.

CYMEL 1158 is known as a higher imino containing butylated melamine resin. This crosslinker is oligomeric in nature with main functionalities butoxymethyl and imino. This higher imino containing butylated melamine resin provides faster cured films with less formaldehyde release upon cure compared to the partially n-butylated or partially iso-butylated melamine resins.

Recommended Application Areas

- Acid curing coatings
- Automotive coatings
- Container coatings
- Dipping enamels
- General industrial coatings
- Metal decorating coatings
- Primer formulations
- Wood coatings

Conventional butylated melamine resins are polymeric in nature and provide formulations with very good reaction speed

CYMEL MB-11-B	For general industrial baking applications and specially metal decorating formulations.
CYMEL MB-14-B	For general industrial baking applications specially dipping applications.
CYMEL 615	For general industrial baking applications and special drum coating formulations.
CYMEL 651	For general industrial baking applications with improved flow and wetting properties.
CYMEL 683	For general industrial baking applications and special automotive topcoat and clearcoat formulations.
CYMEL 688	For high quality general industrial coating formulations.
CYMEL 1158	Is a high imino n-butylated resin for medium solids automotive topcoat and clearcoat formulations.

Product characteristics

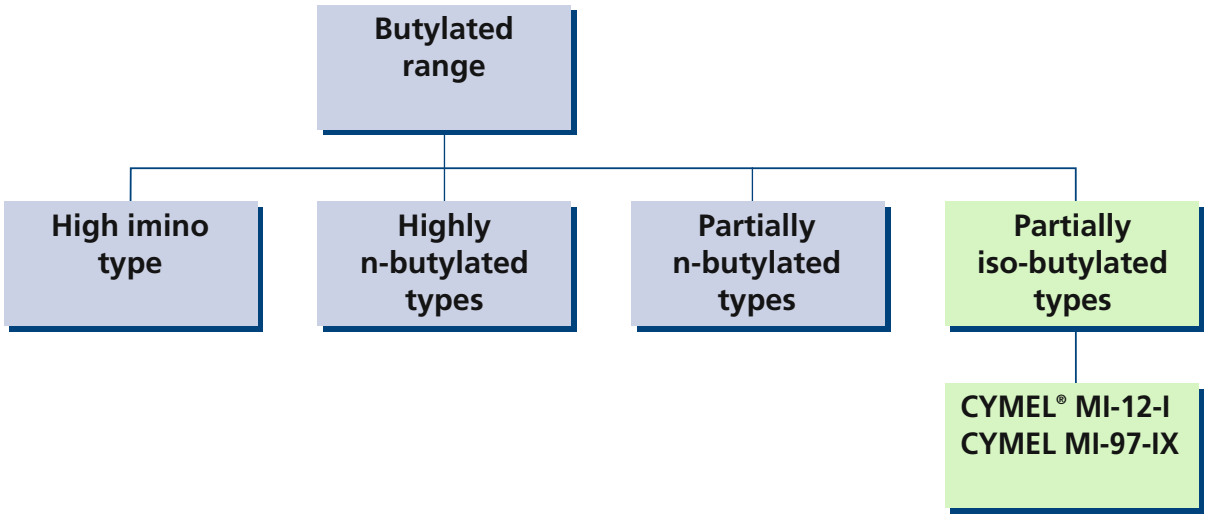
Products	Solids 2h/120°C %	Solvents	Viscosity mPa.s 25°C	Free HCHO %	MW range	Tolerances	Stoichiometry	
							F	n-Bu
CYMEL MB-11-B	58–62 [1]	n-butanol	800–1600 [3]	1.0	6000–10000	30–60 [4]	4.4	2.6
CYMEL MB-14-B	68–72 [1]	n-butanol	3800–5600 [3]	1.5	8000–10000	25–50 [4]	5.2	3.0
CYMEL 615	58–62	n-bu, xylene	1050–2150	2.0	10000–20000	25–45 [5]	4.9	3.4
CYMEL 651	58–62	n-bu, xylene	1000–2000	1.5	7000–16000	25–45 [5]	4.9	3.2
CYMEL 683	73–77	n-butanol	3000–6000	1.5	2000–4000	25–40 [5]	5.3	2.9
CYMEL 688	68–72	n-butanol	2850–5850	2.0	3000–5500	20–30 [5]	5.4	2.8
CYMEL 1158	78–82 [2]	n-butanol	3000–7000 [3]	< 1.5	2000–4500	400–1200 [6]	4.3	2.5

[1] 1h/100°C [2] 45 min/45 °C [3] 23 °C [4] i-octane tolerance [5] naphta-tolerance ASTM [6] Standard solvent tolerance

Comparison tables: Partially n-butylated and high imino melamine resins

Properties	Partially n-butylated	High imino
Solids/viscosity		
Cure response		
Film hardness development		
Wetting, flow, leveling		
Adhesion properties		
Exterior durability		
Weight retention/VOC		
Applications	**Partially n-butylated**	**High imino**
General industrial coatings		
Automotive coatings		
Primer formulations		
Medium solids coatings		
Acid curing coatings		
Metal decorating coatings		

22 Partially iso-butylated Melamine Crosslinker Range



These crosslinkers differ primary in their degree of alkylation and molecular weight distribution, and are polymeric in nature, with main functionalities iso-butoxy and methylol. They react by general acid catalysis, and under normal baking conditions an external catalyst is usually not required to obtain fast cure.

A better hydrocarbon tolerance usually means there will be improved compatibility with a wider range of primary film formers. Resins with a lower hydrocarbon solvent tolerance are generally faster curing and provide better film hardness.

Important Characteristics

- Good compatibility
- High tendency to self-condensation reactions
- No catalyst required
- Good wetting of metal substrates
- Fast reaction speed
- Excellent adhesion properties
- Excellent film hardness
- Good resistance properties

Recommended Application Areas

- Acid curing coatings
- Automotive coatings
- Container coatings
- Dipping enamels
- General industrial coatings
- Metal decorating coatings
- Primer formulations
- Wood coatings

Partially iso-butylated melamine crosslinkers are known for excellent reaction speed

CYMEL MI-12-I	For fast drying general industrial stoving applications, especially for primer formulations.
CYMEL MI-97-IX	For fast drying acid curing wood finishes.

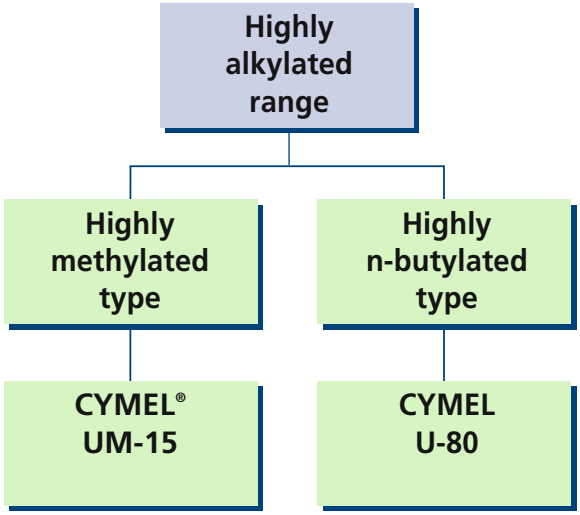
Product characteristics

Products	Solids (pan) 1h/100 °C %	Solvents	Viscosity mPa.s 23 °C	Free HCHO %	Iso-octane tolerance	MW typical	Stoichiometry	
							F	i-Bu
CYMEL MI-12-I	58–62	iso-butanol	1050–1950	1.0	40–100	4000	4.9	2.6
CYMEL MI-97-IX	68–72	iso-bu/xyl	480–760	1.0	>200	6000	5.2	3.6

Comparison tables: Partially n-butylated and partially iso-butylated melamine resins

Properties	Partially n-butylated	Partially iso-butylated
Solids/viscosity		
Cure response		
Film hardness development		
Solvent resistance		
Wetting, flow, leveling		
Adhesion properties		
Formulation stability		
Humidity resistance		
Applications	**Partially n-butylated**	**Partially iso-butylated**
General industrial coatings		
Automotive basecoat formulations		
Automotive top coatings		
Wood coating formulations		
Acid curing coatings		
Primer formulations		

Highly alkylated Urea Crosslinker Range



These crosslinkers differ primarily in their degree of alkylation alcohol. Due to their reaction behaviour it is not possible to produce urea crosslinkers which are completely alkylated. Consequently, those urea crosslinkers are oligomeric in nature with main functional sites, alkoxymethyl, methylol and imino. They react according to specific acid catalysis and require a strong acid catalyst to obtain the required film properties.

The methylated urea resin has excellent solubility in polar solvents but very limited solubility in hydrocarbon solvents. The butylated resin has excellent compatibility with organic solvents and many polymer backbone resins, including epoxy resins. CYMEL UM-15 resin and CYMEL U-80 resin are not suitable for outdoor applications because of the rather poor UV-light resistance of urea resins.

CYMEL UM-15 Important Characteristics

- High solids
- Water solubility
- Excellent solubility in polar solvents
- Limited hydrocarbon solvent compatibility
- Very fast reaction speed
- High weight retention
- Good adhesion properties

CYMEL UM-15 Recommended Application Areas

- Acid curing coatings
- Hydroxyl functional latex systems
- Paper coatings
- Printing inks
- Textile coatings
- Waterborne coatings

CYMEL U-80 Important Characteristics

- High solids
- Excellent storage stability
- Excellent solubility in polar solvents
- Fast reaction speed
- Excellent adhesion properties

CYMEL U-80 Recommended Application Areas

- Automotive primer
- Drum coatings
- General industrial coatings
- Primer formulations

Highly alkylated urea crosslinkers are known for high solids and very fast cure at low temperature conditions

CYMEL U-80	This highly butylated urea resin has been designed for high solids primer formulations with excellent adhesion and intercoat adhesion properties.
CYMEL UM-15	This highly methylated urea resin has been designed for very fast curing waterborne finishes, especially for acid curing systems.

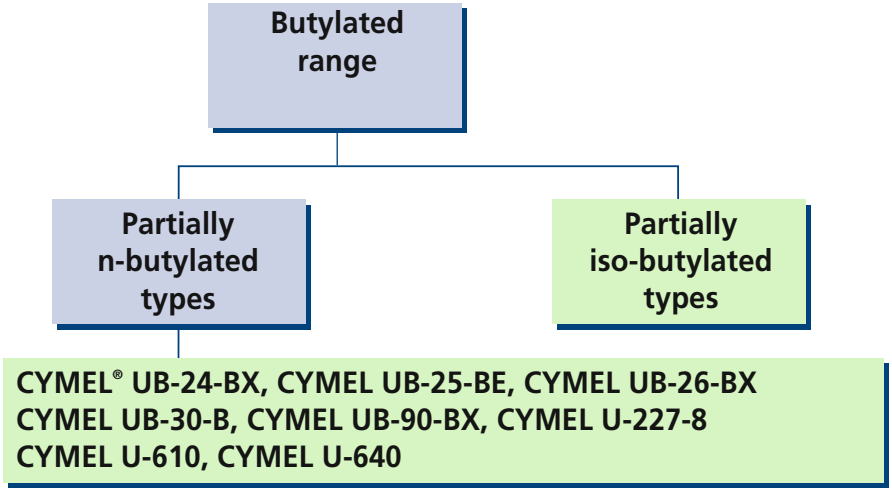
Product characteristics

Products	Solvents	Solids (Foil) %	Viscosity mPa.s 23 °C	Free HCHO %	Typical monomer %	Iso-octane tolerance	Stoichiometry		
							F	Me	n-Bu
CYMEL U-80	n-butanol	>96	1700–4500	0.2	18	>200	2.8	–	1.7
CYMEL UM-15	–	>96	6800–17000	0.7	35	–	2.3	1.4	–

Comparison tables: Highly alkylated urea and methylated melamine resins

Properties	Highly alkylated urea	Methylated melamine
Cure response		
Formulation stability		
Film hardness development		
Adhesion properties		
Exterior durability		
Mechanical properties		
Resistance properties		
Applications	**Highly alkylated urea**	**Methylated melamine**
Acid curing coatings		
Primer formulations		
Exterior applications		
Waterborne coatings		
Textile coatings		

Partially n-butylated Urea Crosslinker Range



Partially n-butylated urea resin crosslinkers differ primarily in their degree of alkylation, solvent composition and non volatile/viscosity relationship. They are polymeric in nature with main functional sites butoxymethyl, methylol and imino and react according to general acid catalysis.

Under normal baking conditions an external catalyst is usually not necessary to obtain fast cure. This range of n-butylated urea resins enables the coating formulator to obtain very economical and fast curing systems. Urea resins are known for better adhesion properties compared to melamine resins, and consequently they find use in many primer applications.

Those urea resins are not suitable for outdoor applications because of the rather poor UV-light resistance of urea resins.

Important Characteristics

- Economical
- Good compatibility
- No catalyst required
- Fast reaction speed
- Excellent adhesion properties
- Excellent film hardness

Recommended Application Areas

- Acid curing coatings
- General industrial coatings
- Primer formulations
- Drum coatings

Conventional n-butylated urea crosslinkers are polymeric in nature and provide fast cure response combined with excellent adhesion properties

CYMEL UB-24-BX	For general industrial stoving finishes when electrostatic spray application is required.
CYMEL UB-25-BE	For general industrial stoving finishes and acid curing wood coating formulations with rather low free formaldehyde level.
CYMEL UB-26-BX	For general industrial stoving finishes and primer formulations.
CYMEL UB-30-B	For general industrial primer formulations.

CYMEL UB-90-BX	For general industrial stoving formulations special for electrostatic spray applications.
CYMEL U-227-8	For general industrial primer formulations with good epoxy compatibility properties.
CYMEL U-610	For general industrial baking applications especially for metal decorating primer formulations
CYMEL U-640	For general stoving primer formulations with excellent flow and levelling properties.

Product characteristics

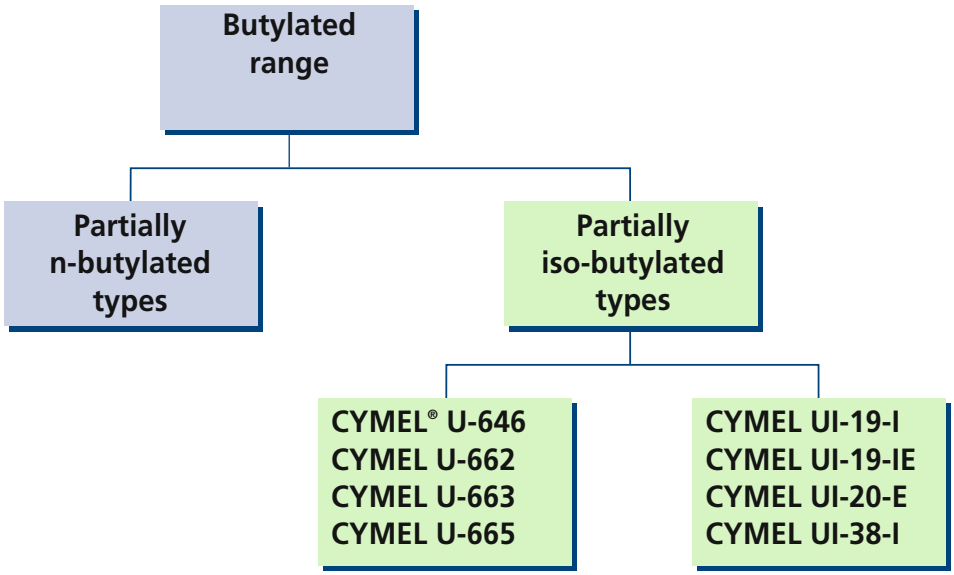
Products	Solids 1h/100 °C %	Solvents	Viscosity mPa.s 23 °C	Iso-octane tolerance	Free HCHO %	MW typical	Stoichiometry	
							F	n-Bu
CYMEL UB-24-BX	61–65	n-bu/xyl	1700–2600	10–25	1.0	6000	2.1	1.1
CYMEL UB-25-BE	61–65	n-bu/EtOH	1000–3000	15–20	0.7	5000	2.0	1.1
CYMEL UB-26-BX	61–65	n-bu/xyl	1700–2600	10–25	0.6	6000	2.1	1.1
CYMEL UB-30-B	63–67	n-bu	13000–25000	15–25	0.6	10000	2.0	1.1
CYMEL UB-90-BX	63–67	n-bu/xyl	700–1100	25–40	0.3	3000	2.3	1.1
CYMEL U-227-8	54–58 [3]	n-bu/xyl	1700–4500	>100 [4]	1.0	6000	2.0	1.0
CYMEL U-610	65–69 [1]	n-bu/xyl	10000–13000 [2]	5–20 [5]	2.5	4000	2.2	1.0
CYMEL U-640	58–62 [1]	n-bu/xyl	800–1400 [2]	5–20 [5]	2.5	2500	2.2	1.0

[1] 2h/120 °C [2] 25 °C [3] 2h/105 °C [4] Stand.solvent tolerance [5] Naphta tolerance

Comparison tables: Partially butylated urea and partially butylated melamine resins

Properties	Partially n-butylated urea	Partially n-butylated melamine
Solids/viscosity		
Cure response		
Film hardness development		
Solvent resistance		
Wetting, flow, leveling		
Adhesion properties		
Exterior durability		
Resistance properties		
Applications	**Partially n-butylated urea**	**Partially n-butylated melamine**
General industrial coatings		
Primer formulations		
Acid curing coatings		
Drum coatings		

28 Partially iso-butylated Urea Crosslinker Range



This series of urea crosslinkers is known as partially iso-butylated resins. These crosslinkers differ primarily in their degree of alkylation, solvent composition and non volatile/viscosity relationship. They are polymeric in nature with main functional sites iso-butoxymethyl, methylol and imino, and react according to general acid catalysis.

Under normal baking conditions an external catalyst is usually not necessary to obtain fast cure. Partially iso-butylated urea resins were developed primarily for acid curing systems, and they meet the requirements of reactivity and resistance properties with good economics. Urea resins are noted for superior adhesion compared to melamine resins. Those urea resins are not suitable for outdoor applications because of the rather poor UV-light resistance of urea resins.

Important Characteristics

- Economical
- Good compatibility
- No catalyst required
- Fast reaction speed
- Excellent stackability properties
- Excellent adhesion properties
- Excellent film hardness

Recommended Application

- Acid curing coatings
- General industrial coatings
- Primer formulations
- Wood furniture coatings

Partially iso-butylated urea crosslinkers are established in acid curing wood coating formulations

CYMEL U-646	For general industrial coating finishes and acid curing wood coating formulations.
CYMEL U-662	For fast drying acid curing wood coating formulations with low formaldehyde emission during the drying process.
CYMEL U-663	For fast drying acid curing wood coating formulations with high gloss properties.
CYMEL U-665	For fast curing general industrial baking formulations with very good adhesion properties.
CYMEL UI-19-I	For fast drying acid curing wood coating formulations.
CYMEL UI-19-IE	For fast drying acid curing wood coating formulations with low odor requirements.
CYMEL UI-20-E	For fast drying higher solids acid curing wood coating formulations with high film build and low formaldehyde emission during the drying process.
CYMEL UI-38-I	For general industrial stoving applications with good electrostatic spray application properties.

Product Characteristics

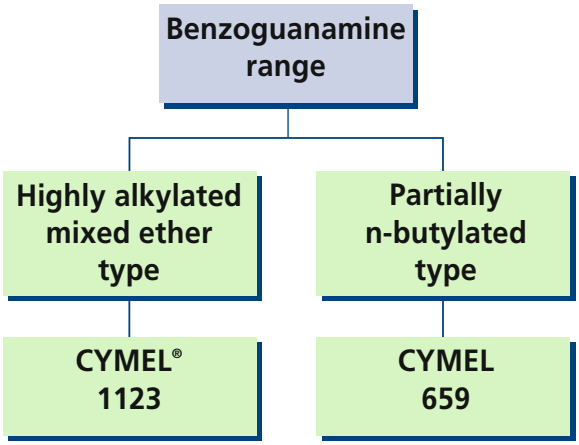
Products	Solids 1h/100 °C %	Solvents	Viscosity mPa.s 23 °C	Free HCHO %	MW typical	Naphta tolerance ASTM	Iso-octane tolerance	Stoichiometry	
								F	i-Bu
CYMEL U-646	63–67 [1]	i-butanol	5850–9450 [2]	1.6	4000	9–12	–	2.2	1.0
CYMEL U-662	58–62 [1]	n-bu/xylene	1000–2000 [2]	0.3	4000	15–30	–	2.1	1.1
CYMEL U-663	60–64 [1]	n-butanol	2000–4000 [2]	0.3	4000	20–40	–	2.1	1.1
CYMEL U-665	63–67 [1]	i-butanol	3250–6250 [2]	1.0	4000	16–30	–	2.1	1.1
CYMEL UI-19-I	61–65	i-butanol	8700–16000	1.2	6000	–	15–30	2.0	1.0
CYMEL UI-19-IE	58–62	i-bu/EtOH	1700–3500	1.2	6000	–	10–20	2.0	1.0
CYMEL UI-20-E	76–80	EtOH	1700–3500	0.7	2000	–	10–20	2.2	1.3
CYMEL UI-38-I	67–71	i-butanol	12000–20000	1.5	4000	–	25–45	2.2	1.1

[1] 2h@120 °C [2] @25 °C

Comparison tables: Partially n-butylated urea and partially iso-butylated urea resins

Properties	Partially n-butylated urea	Partially iso-butylated urea
Cure response		
Film hardness development		
Wetting, flow, leveling		
Adhesion properties		
Formulation stability		
Applications	**Partially n-butylated urea**	**Partially iso-butylated urea**
Acid curing coatings		
Primer formulations		
General industrial coatings		
Drum coatings		

Benzoguanamine Crosslinker Range



CYMEL 659 resin is a partially n-butylated benzoguanamine resin. It is polymeric in nature and the main functionalities are butoxymethyl and methylol. It reacts according to general acid catalysis with a high tendency for the self-condensation reactions which improve the reaction speed, but limit the flexibility of the cured films. Under normal baking conditions an external catalyst is usually not required to obtain fast curing and good resistance properties.

The benzoguanamine structure provides excellent adhesion to metal substrates, with good chemical and detergent resistance properties, compared with melamine and urea crosslinked systems.

CYMEL 1123 resin crosslinker is a highly alkylated mixed ether benzoguanamine resin. It is monomeric in nature with alkoxy methyl functionality and reacts according to specific acid catalysis with a low tendency for self-condensation reactions which enhance the flexibility of the cured film. A strong acid catalyst is required to obtain high performance properties like high weight retention, excellent flexibility and excellent resistance properties. The cured films offer superior combinations of salt and detergent resistance properties compared with melamine and urea crosslinked systems. CYMEL 1123 resin and CYMEL 659 resin are not suitable for outdoor applications because of the rather poor UV-light resistance of benzoguanamine resins.

CYMEL 659
Important Characteristics

- No catalyst required
- Very good adhesion properties
- Good corrosion resistance
- Good detergent resistance

CYMEL 1123
Important Characteristics

- Solvent-free
- Excellent compatibility
- Excellent storage stability
- High weight retention
- Low formaldehyde release upon cure
- Excellent adhesion to metal substrates
- Excellent corrosion resistance
- Excellent detergent resistance

CYMEL 659
Recommended Application Areas

- Automotive primers
- Coil coating primers
- Container coatings
- General industrial primers

CYMEL 1123
Recommended Application Areas

- Automotive primers
- Coil coating primers
- Container coatings
- Anodic electrodeposition coatings
- General industrial coatings

Benzoguanamine crosslinkers are known for excellent adhesion and chemical resistance properties

CYMEL 659	For general industrial baking formulations which provide very good adhesion, corrosion and chemical resistance properties. CYMEL 659 resin contains a non silicone flow additive.
CYMEL 1123	For high quality industrial primer formulations which provide excellent film flexibility, adhesion, corrosion and chemical resistance properties.

Product characteristics

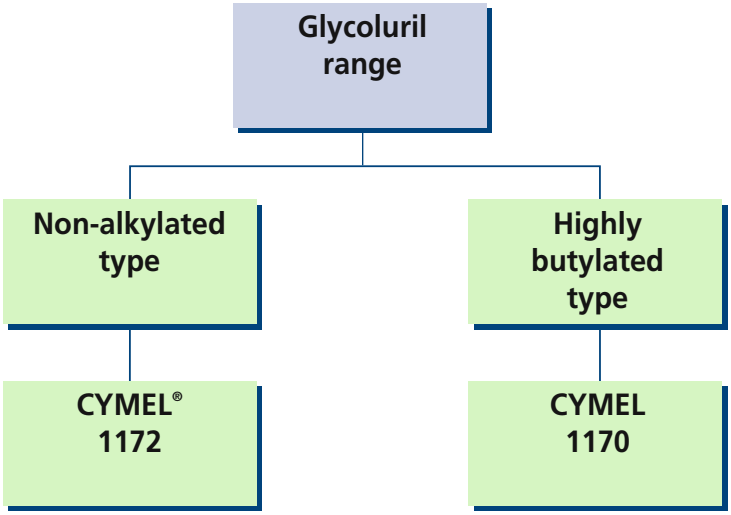
Products	Sol-vents	Solids 2h/120 °C %	Viscosity mPa.s 25 °C	Free HCHO %	Typical monomer %	Naphta tolerance ASTM	Water tolerance	Stoichiometry			
								F	Me	Et	n-Bu
CYMEL 659	n-bu/xyl	70–74	575–1075	<2.0	45	25–45	–	3.4	–	–	1.8
CYMEL 1123	–	≥ 98 [1]	3800–10200 [2]	<0.3	72	–	180–300	3.9	2.0	1.5	–

[1] Foil 45min 45 °C [2] 23 °C

Comparison tables: Benzoguanamine and melamine resins

Properties	Melamine resins	Benzoguanamine resins
Cure response		
Adhesion properties		
Film flexibility		
Compatibility		
Exterior durability		
Detergent resistance		
Corrosion resistance		
Water resistance		
Applications	**Melamine resins**	**Benzoguanamine resins**
General industrial coatings		
Automotive primers		
Container coatings		
Exterior coatings		
Coil coating primers		

32 Glycoluril Crosslinker Range



This series of glycoluril crosslinkers is known as high performance crosslinkers with improved properties over existing melamine and benzoguanamine resins. These crosslinkers differ primarily in the nature of their alkylation alcohols and consequently in their hydrophobicity.

They are monomeric in nature with the main functionality butoxymethyl for CYMEL 1170 resin, and methylol for the CYMEL 1172 resin. They react according to specific acid catalysis with a very low tendency for self-condensation that enhances the film flexibility of the cured film.

Important Characteristics

- Very stable ring structure
- Excellent storage stability
- Wide compatibility
- Wide solubility
- Strong acid catalyst required
- Very high weight retention
- Very low formaldehyde release upon cure
- Good corrosion resistance
- Excellent chemical resistance
- Very good exterior durability

Recommended Application Areas

- Automotive primers
- Coil coatings
- Container coatings
- General industrial coatings
- High solids coatings
- Metal decorating coatings
- Primer formulations
- Waterborne coatings

The glycoluril crosslinkers are known for their high performance, low weight loss and low formaldehyde release during baking conditions

CYMEL 1170	For high solids high quality industrial coating formulations with very low formaldehyde release during baking conditions.
CYMEL 1172	For very fast curing waterborne coating formulations. CYMEL 1172 resin has a high tendency to demethylolate under basic conditions. Consequently is it not suitable for amine stabilized waterborne coating formulations.

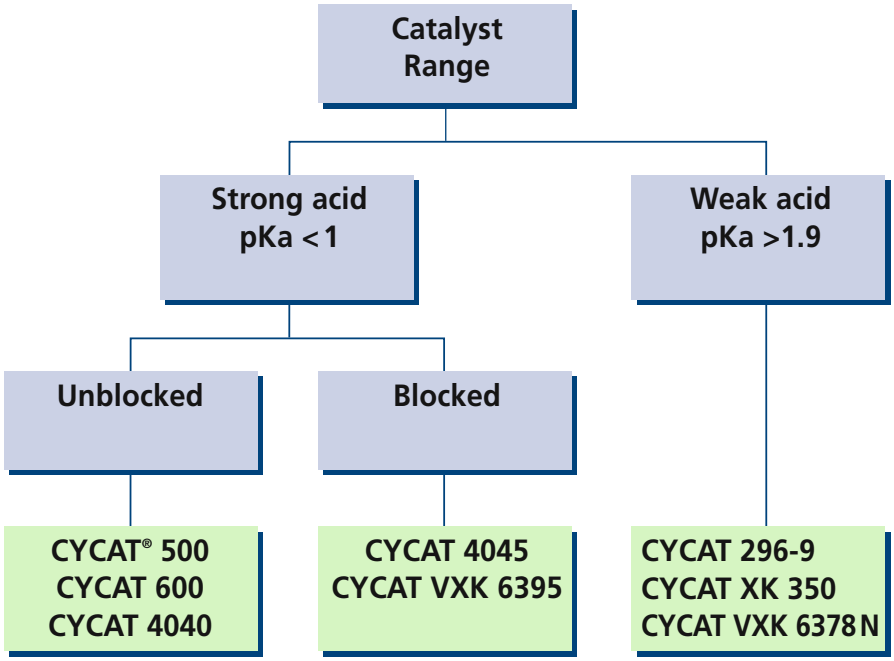
Product characteristics

Products	Solvents	Solids (Foil) %	Viscosity mPa.s 23 °C	Typical monomer %	Water dilution	Xylene dilution	Stoichiometry	
							F	n-Bu
CYMEL 1170	n-butanol	>96	3000–6000	75	insoluble	complete	4.0	4.0
CYMEL 1172	water	43–47	<50	–	complete	insoluble	4.0	–

Comparison tables: Glycoluril and melamine resins

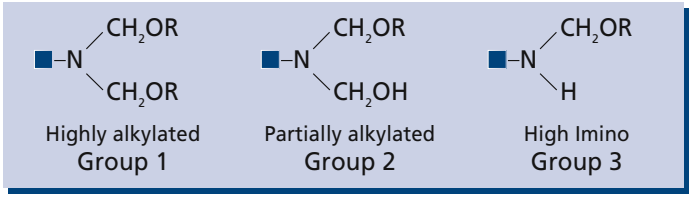
Properties	Melamine resins	Glycoluril resins
Solids/viscosity		
Cure response		
Cure inhibition		
Formaldehyde release		
Formulation stability		
Weight retention/VOC		
Film hardness development		
Film flexibility		
Resistance properties		
Applications	**Melamine resins**	**Glycoluril resins**
Coil coatings		
High solids coatings		
Low cure coatings		
Primer formulations		
Metal decorating coatings		
Waterborne coatings		

Catalyst Range



The selection of an acid catalyst is an important step in formulating satisfactory coatings using amino resins. All crosslinking reactions of amino resins are acid-catalyzed reactions. They proceed very slowly, if at all, under neutral or alkaline conditions. In some applications, the acidity of the primary film former or other components of the formulation will be sufficient to catalyze the reaction of partially alkylated and high imino (-NH) melamine resins.

Amino resins have paired functional groups attached to the amino nitrogen's. The three most common paired groups may be represented as follows:



Where R is generally a low molecular weight alkyl group, such as methyl, ethyl, n-butyl or iso-butyl. The amino resins with predominantly group (1) functionality are called highly alkylated resins and are catalyzed only by hydrogen ions. They require strong proton donors to initiate their reactions. Sulphonic acids of various types have been found to be efficient catalysts for these types of amino resins. The sulphonic acids are generally preferred over other proton donors because of their better solubility in organic solvents, and they are less corrosive to application equipment than the more volatile mineral acids

CYCAT 4040 catalyst is recognized as one of the most efficient sulphonic acids for catalyzing the crosslinking reactions of group (1) functionality resins.

CYCAT 500 and CYCAT 600 catalysts are also used in applications where their particular properties are required.

Under most conditions, amino resins with functional groups (2) and (3) react best when a weak acid catalyst is used. Catalysts in this category would have a pKa value greater than 1.9. Phosphoric acid and the alkyl acid phosphates have been widely used as effective catalysts for these classes of amino resins. CYCAT 296-9, CYCAT XK 350 and CYCAT VXK 6378 N are recognized as very effective catalysts for catalyzing the crosslinking reactions of group (2) and (3) functional amino resins.

To avoid the need for a two-pack coating system or to obtain longer package stability the acid is preferable added in a latent form. A very simple way of forming a latent sulphonic acid is the neutralization of the acid with amines.

CYCAT 4045 and VXK 6395 are recognized as very effective blocked strong acids for catalyzing the crosslinking reaction of group (1) functionalities.

Catalyst range

CYCAT 296-9	Weak acid phosphate catalyst to accelerate the cure reactions of high imino and partially alkylated resins.
CYCAT XK 350	Weak phosphoric acid catalyst to accelerate the cure reactions of high imino and partially alkylated resins.
CYCAT 500	Strong naphthalene sulfonic acid catalyst, especially recommended for electro coating and electrostatic spray systems with improved water resistance.
CYCAT 600	Strong dodecyl benzene sulfonic acid catalyst, especially recommended for high solids formulations with hydrocarbon solubility.
CYCAT 4040	Strong alkyl benzene sulfonic acid catalyst for highly alkylated melamine, benzoguanamine, glycoluril and urea resins.
CYCAT 4045	Amine blocked alkyl benzene sulfonic acid catalyst for highly alkylated melamine, benzoguanamine, glycoluril and urea resins. It provides excellent stability in waterborne and high solids systems.
CYCAT VXK 6378 N	Based on a mixture of alkyl phenyl phosphates, recommended for 1K alkyd-amino systems as well as in acid curing wood applications.
CYCAT VXK 6395	Blocked p-TSA catalyst, especially for low temperature curing of urea and melamine crosslinking systems. Typical application areas are industrial coating and automotive OEM.

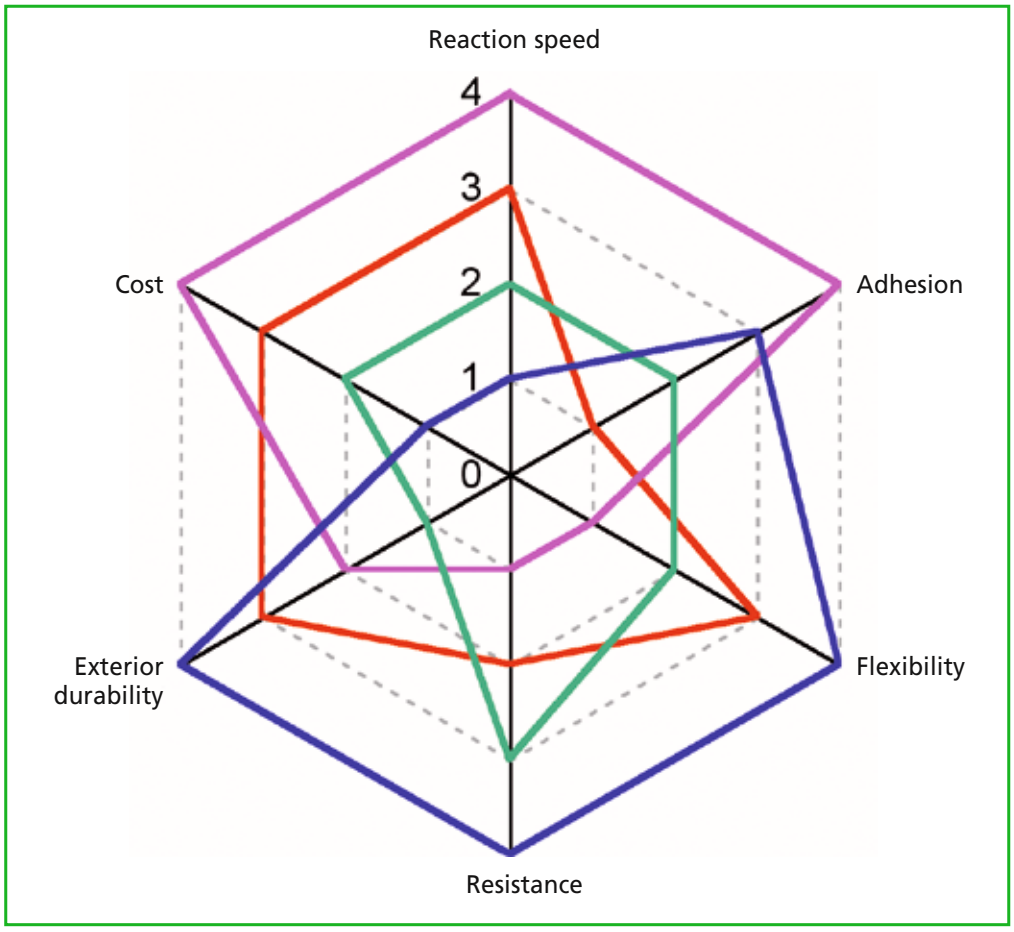
Catalyst Range
(continued)

Product characteristics

Products	Solvents	Solids (Pan) 1h/100 °C %	Acid number ISO3683	pKa value	Density kg/m³	Water solubility	Xylene solubility
CYCAT® 296-9	iso-butanol	50	360–385	>2	1050	soluble	soluble
CYCAT XK 350	butyl acetate	62	180–200	>2	1000	insoluble	soluble
CYCAT 500	iso-butanol	40	80–90	<1	927	insoluble	soluble
CYCAT 600	iso-propanol	70	125–135	<1	960	soluble	soluble
CYCAT 4040	iso-propanol	40	130–140	<1	960	soluble	insoluble
CYCAT 4045	ethylene glycol	35	60–70	<1	1160	soluble	soluble
CYCAT VXK 6378 N	iso-butanol	32	140–160	>2	920	insoluble	soluble
CYCAT VXK 6395	iso-propanol	35	70–80	<1	950	soluble	soluble

Recommended catalysts for various application areas

Products	Water reducible sytems	Electro-coating	Wood	Paper	Air-spray	Electro-static Spray	Low in alcohols	General industry	Coil coat-ings	Can coat-ings
Weak acid										
CYCAT 296-9	–	–	+	–	+	–	–	+	–	+
CYCAT 6378	+	–	–	–	+	+	–	+	–	+
CYCAT 350	+	–	–	–	+	–	–	+	–	+
Strong acid										
CYCAT 500	+	+	–	–	+	+	–	+	+	+
CYCAT 600	+	–	–	–	+	–	+	+	+	+
CYCAT 4040	+	–	+	+	+	–	–	+	+	+
Blocked catalyst										
CYCAT 4045	+	–	–	+	+	–	–	+	+	+
CYCAT 6395	+	–	–	–	+	+	–	+	+	+



where 4 is best

	Melamine
	Urea
	Benzoguanamine
	Glycoluril

	Melamine resins	Urea resins	Benzoguana-mine resins	Glycoluril resins
Reaction speed	3	4	2	1
Adhesion	1	4	2	3
Flexibility	3	1	2	4
Resistance	2	1	3	4
Exterior durability	3	2	1	4
Cost	3	4	2	1

The numbers in this table are relative and only valid for comparison of the crosslinker types

Product and Application Overview

Amino resins														
	Highly methylated					Partially methylated			Methylated high imino					
Application areas	CYMEL 301	CYMEL 303LF	CYMEL 350	CYMEL 3745	CYMEL MM-100	CYMEL 370	CYMEL 373	CYMEL 3749	CYMEL 323	CYMEL 325	CYMEL 327	CYMEL 328	CYMEL 385	CYMEL 1116
AUTOMOTIVE COATINGS														
PRIMER SURFACER														
High solids	●	●		●	●									●
Medium solids	●	●		●	●	●		●		●	●			
Conventional solids														
Waterborne formulations		●	●	●		●	●	●		●	●	●		
BASE COAT														
Solventborne	●	●		●										
Waterborne	●	●	●	●		●	●	●		●	●	●		
CLEAR & TOPCOAT														
High solids	●	●												●
Medium solids										●	●			
Conventional solids														
Waterborne	●	●		●						●	●	●		
COIL COATINGS														
Primer	●	●		●	●					●	●			●
Topcoat	●	●		●	●					●	●			●
Backcoat	●	●		●	●					●	●			
ACID CURING WOOD COATINGS														
Sealer														
Lacquers														
Topcoats														
CAN COATINGS														
Basecoat solventborne	●	●		●	●	●		●		●	●			●
Basecoat waterborne	●	●	●	●	●	●	●	●		●	●	●		
Inks solventborne	●	●		●	●	●		●		●	●			●
Inks waterborne	●	●	●	●	●	●	●	●		●	●	●		
Varnish solventborne	●	●		●	●	●		●		●	●			●
Varnish waterborne	●	●	●	●	●	●	●	●		●	●	●		
Internal formulations	●	●		●	●					●	●	●		●
GENERAL INDUSTRIAL COATINGS														
Primer high solids	●	●		●	●									●
Primer medium solids	●	●		●	●	●		●	●	●	●			
Primer conventional solids														
Primer waterborne	●	●	●	●	●	●	●	●	●	●	●	●		
Topcoat high solids	●	●		●	●				●	●	●			●
Topcoat medium solids	●	●		●	●	●		●	●	●	●			
Topcoat conventional solids														
Topcoat waterborne	●	●	●	●	●	●	●	●	●	●	●	●		
EMULSIONS	●	●	●	●	●	●	●	●	●	●	●	●	●	
FOIL & PAPER COATING	●	●		●	●						●	●		
MIRROR COATING									●	●	●	●		
ELECTRODEPOSITION														●
TEXTILE COATING	●	●	●	●	●	●	●	●	●	●	●	●	●	

Melamine																							
Highly alkylated mixed ether				Highly alkylated carboxylated		High imino mixed ether			Highly n-butylated		High imino & partially n-butylated							Partially i-butylated		Highly alkylated	
CYMEL 1130	CYMEL 1133	CYMEL 1161	CYMEL 1168	CYMEL 1125	CYMEL 1141	CYMEL 202	CYMEL 203	CYMEL 254	CYMEL 1156	CYMEL MB-98	CYMEL 615	CYMEL 651	CYMEL 683	CYMEL 688	CYMEL 1158	CYMEL MB-11-B	CYMEL MB-14-B	CYMEL MI-12-I	CYMEL MI-97-IX	CYMEL U-80	CYMEL UM-15
●	●	●	●	●	●				●											●	
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Urea																	Benzo-guanamine		Glycoluril	
Partially n-butylated									Partially i-butylated								Part. n-but.	Highly me./et.	Highly n-bu	Non alk.
CYMEL UB-24-BX	CYMEL UB-25-BE	CYMEL UB-26-BX	CYMEL UB-30-B	CYMEL UB-90-BX	CYMEL U-227-8	CYMEL U-610	CYMEL U-640	CYMEL U-646	CYMEL U-662	CYMEL U-663	CYMEL U-665	CYMEL UI-19-I	CYMEL UI-19-IE	CYMEL UI-20-E	CYMEL UI-38-I	CYMEL 659	CYMEL 1123	CYMEL 1170	CYMEL 1172
																	●	●	
																●	●	●	
●	●	●	●	●	●	●	●	●			●				●	●			
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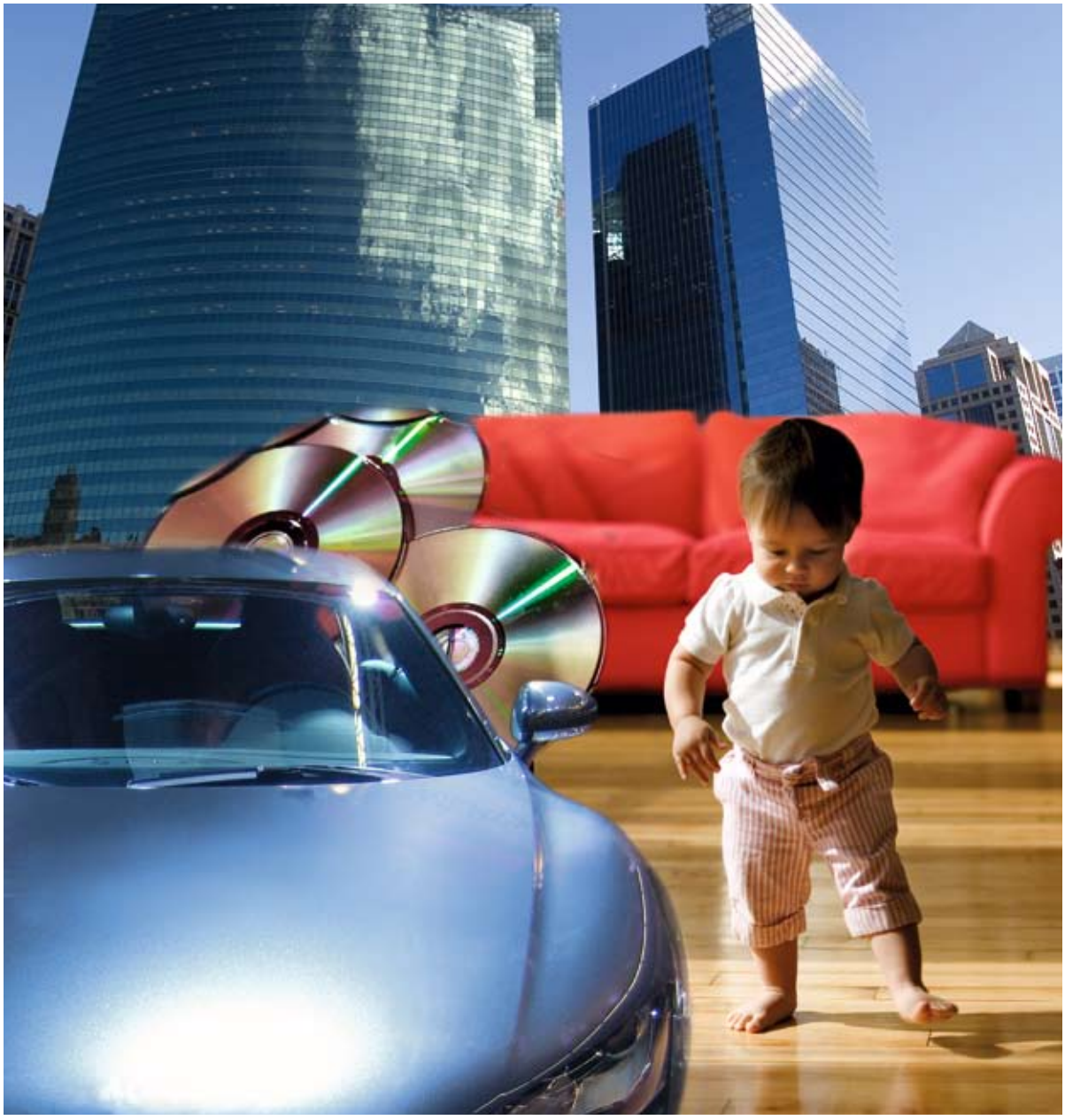

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