CYTEC

Can Coating

Conventional and UV Resins and Additives for Can Coating

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.

We are a total solutions provider with a broad range of products, including eco-friendly technologies. We support our customers worldwide with excellent technical service and applications research.

Innovative Technology

Cytec's products are innovative and diverse, and can help 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.

4 Introduction to the Can Coating Industry

Resins for the Can Coating Industry

Canning of food and drink has become a very important industry. Millions of people depend on this invention today and many more will do so in future. For example in developing countries, where refrigirator ownership is low, canning is indispensable for minimising harvest loss. And canning allows perishable foods to be consumed around the year, anywhere in the world.

All metal containers have to be coated on the inside, as a minimum, to avoid contact between the food/drink and bare metal – this would otherwise lead to unwanted chemical reactions. The coatings used have to resist not only aggressive food components but also sterilization processes.

Cytec supplies a broad range of solvent and waterborne resins for the can coating industry. These include phenolic and amino resins as crosslinkers, epoxy resins, epoxy esters, acrylic and saturated polyester resins as main binders and a variety of additives to improve properties like wetting, gloss, abrasion and reactivity.

As a major resin supplier, specific product know-how is what our customers can expect from us.

We constantly work on broadening our knowledge base and proactively take up new challenges like epoxy-free interior coating systems.

Contents

6 Phenolic Resin Grades

Standard grades

PHENODUR® PR 217*

- Medium reactive, rather dark colour, good sulphur staining resistance and acid retort resistance.

PHENODUR PR 260

- Used alone or in combination with (poly)vinyl butyrate for high chemical resistant coatings (drum interiors, collapsible tubes etc.), non-food applications.

PHENODUR PR 285

- Very reactive, cures from 160 °C onwards. Catalysts are not recommended. For "coil for can" systems.

PHENODUR PR 307, PR 308

- Colouring resins

PHENODUR PR 373

- Very reactive, used alone or in combination with polyvinyl butyral for high chemical resistant coatings (drum interiors, collapsible tubes etc.).

PHENODUR PR 401, PR 515

- Very reactive, very light colour (silver lacquer); somewhat less flexible, good sterilisation resistance. PR 515 is slightly more flexible than PR 401.

PHENODUR PR 411

- Like ***PHENODUR PR 401***
  Lower content of free monomers

PHENODUR PR 516

- Like ***PHENODUR PR 515*** but free of ***BISPHENOL A***; also for "epoxy-free" systems.

PHENODUR PR 565

- Good flexibility and sulphur resistance
- Light colour
- Medium reactivity

PHENODUR PR 612

- High solid, low viscosity, medium reactive, giving yellow/greenish colour shade; very flexible and good retort resistance. Catalyst is necessary (***ADDITOL® XK 406 N***).

* ***PHENODUR*** phenolic resins

PHENODUR PR 722, PR 723

- Very good overall properties, very good sulphur staining resistance; medium reactivity, excellent flexibility, rather light in colour.

PHENODUR PR 882

- With alkyd resins for electrical-insulation varnishes, dynamo sheet coatings and related products.

PHENODUR PR 897, PR 898

- Excellent flexibility and retort resistance; low reactivity. The cured film is light in colour.

PHENODUR VPM 1150

- Crosslinker for high molecular weight epoxide resins. To formulate clear or white interior/exterior coatings.

PHENODUR VPR 1775

- High solid, low viscosity, high reactivity, very low amount of free monomers (low smell), very light in colour, for "coil for can" applications.

PHENODUR VPR 1785

- Highest intrinsic flexibility of all ***PHENODUR*** grades. To be combined either with less epoxy than usual or with polyvinyl butyral/polyesters to formulate ***BISPHENOL A***/BADGE-free systems.

PHENODUR VPW 1942

- Waterborne phenol/epoxide pre-condensate; a unique combination of high molecular weight, high solids, extremely low VOC and very small particle size; good reactivity, rather light in colour, for "coil for can" (coil coating); very good adhesion to aluminium and other non-ferrous metals; excellent corrosion resistance at low film thickness; medium retort resistance and sulphur staining resistance; good wetting and flow.

Phenolic Resins

for the Can Coating Industry

Products	Epoxy resins	PVB (BUTVAR)	Usual ratio	Colour	Silver lacquer	Typical stoving conditions (min.)	°C	*ADDITOL®* XK 406 N*	Coil for can
Compatibility with									
PHENODUR®* PR 217	yes	no	80:20 to 1:1 (EP: Phenolic) or for drums 90:10 Phenolic: Butvar)	dark	no	12–15	200	yes	yes
PHENODUR PR 260	no	yes		medium	no	15	230	no	no
PHENODUR PR 285	yes	yes		dark	no	15	190	no	yes
PHENODUR PR 373	no	yes		medium	no	15	200/230	no	no
PHENODUR PR 401	yes	no		very light	yes	10–12	180	yes	yes
PHENODUR PR 411	yes	no		very light	yes	10–12	200	yes	yes
PHENODUR PR 515	yes	yes		very light	yes	12	200	yes	yes
PHENODUR PR 516	yes	yes		very light	yes	10–12	200	yes	yes
PHENODUR PR 565	yes	yes		very light	yes	12–15	200	yes	no
PHENODUR PR 612	yes	yes		medium	no	12	200	yes	no
PHENODUR PR 722	yes	yes		medium	no	12	200	yes	no
PHENODUR PR 723	yes	yes		medium	no	12	200	yes	no
PHENODUR PR 897/898	yes	yes		light	no	15–20	200	yes	no
PHENODUR VPM 1150	yes	n. a.	co-curing res.	clear	yes	12	200	no	yes
PHENODUR VPR 1775	yes	yes	–	very light	yes	12	200	yes	yes
PHENODUR VPR 1785	yes	yes	3:7–7:3	medium	no	12	200	yes	yes
PHENODUR PR 307	yes	yes	additive	very dark	no	–	–		
PHENODUR PR 308	yes	yes	additive	very dark	no	–	–		
PHENODUR VPW 1942	n. a.	n. a.	–	n. a.	no	12	200	yes (blocked)	yes

n. a. = not applicable

* ***ADDITOL*** additives
* ***PHENODUR*** phenolic resins

Wedge bend	Erichsen cup n °2	2% Lactic acid	Cystein test 90 min./ 121 °C	Can	Tubes	Drums	Metal foils	Water-borne	Non vol. content
		Steril. 60 min/129 °C Tinplate E1		Main uses					
very good	good	good	bad	●	●	–	–	no	65 B
medium	medium	good	medium	–	–	●	–	no	65 B
very good	good	good	good	●	●	–	–	yes	55 IBB
bad	bad	good	medium	–	–	●	–	no	53 BGB
medium	good	good	good	●	–	–	–	no	72 B
medium	good	good	good	●	–	●	●	–	75 B
medium	good	medium	bad	●	●	●	●	no	60 LG
good	good	good	good	●	●	●	●	no	60 B
very good	very good	good	very good	●	–	–	●	no	65 XB
good	very good	good	medium	●	●	●	●	yes	80 B
very good	very good	good	good	●	–	–	–	no	53 BGB
good	medium	good	bad	●	●	–	–	no	60 BMP
good	good	very good	good	●	●	–	–	no	53 BGB/52 BGB
depends on EP-resin used	depends on EP-resin used	very good	medium	co-curing resin for high molecular weight epoxy resin or polyesters				no	50 EEP
very good	extra good	good	medium	●	–	–	–	no	70 XB
very good	very good	very good	good	●	●	–	●	no	50 MP
–	n. a.	n. a.	n. a.	colouring resin				yes	63 XMP
–	n. a.	n. a.	n. a.					yes	62 MP
good	medium	good	medium	(●)	●	–	●	yes	52 WA

Abbreviations

Mw molecular weight
AV acid value
OHV hydroxyl value

Viscosity Höppler viscosity, expressed in mPa.s
Dilution Parts of diluent in 100 parts of product
-C=C- Unsaturation content expressed in meq/g

BECKOPOX® EM 438*

- Base epoxy resin is of type 7.
  For white interior coating materials.
- Shock-curing (e.g. 20”/290 °C) or for example 12 min./200 °C. Sterilisation resistant, high gloss coatings. Can be catalysed with H_3PO_4 (limits storage stability). For white interior coating materials.

BECKOPOX EM 440, EM 441

BECKOPOX EM 440 can only be used in combination with ***BECKOPOX EM 441*** for one-pack-stoving systems, e.g. primers with high corrosion protection, foil and packing lacquers. Very flexible and resistant to alkaline agents.

Products	Form of supply	Dynamic viscosity mPas DIN EN ISO 32A	Base epoxide resin	Used in comb. with	Usual ratio	White interior coatings	Gold lacquers	Drum interior coatings
						Used for		
BECKOPOX®* EM 438	50 % EEP/ EPAC	2 200 – 4 500	7	self-crosslinking	–	yes	yes*	no
BECKOPOX EP 401	50 % LG	23 000 – 35 000	phenoxy	additive for others	up to 10 %	as additive	as additive	
BECKOPOX EM 440	20 % LG	10 – 20		EM 441	1 : 3 with EM 441	no	no	yes
BECKOPOX EM 441	60 % LG	13 000 – 22 000	special	EM 440	3 : 1 with EM 440	no	no	yes

* ***BECKOPOX*** epoxy resins

BECKOPOX EP 401

- Extremely fast drying.
- Excellent corrosion protection.
- Sole binder or with polyiso-cyanates for anti-corrosion primers and zinc-rich paints.
- As additive to improve flexibility in can coatings.

Coil coating for can	Very flexible, e. g. DRD	Typical stoving conditions	Shockdrying	Catalyst	Acid media 1 h./129 °C	Sulphur staining 90 min./121 °C	Erichsen cup n °2	Wedge-bend-test	Uses
					Sterilisation resistance				
yes		12 min./ 200 °C	yes (tin)	H_3PO_4	good	medium	good	55 %	white interior
as additive	yes	reduces reactivity		no					additive
no	yes	20 min./ 180 °C	yes	EH 610	mediocre	mediocre	excellent	excellent	corr. protection
no	yes	20 min./ 180 °C	yes	EH 610	mediocre	mediocre	excellent	excellent	corr. protection

Acrylic and Polyester Resins
for Can Coating

Self-crosslinking acrylic resins

VIACRYL®* SC 422, 423, 444, 454

- Used in exterior systems for white base coats and clear overprint varnishes for can caps and closures.
- High chemical resistance, hardness, flexibility and gloss.
- Products differ in reactivity and flexibility.
- Predominantly self-crosslinking, small additions of epoxy resins further improve flexibility.

Saturated polyester resins

- Used in exterior systems for white base coats and clear overprint varnishes for can caps and closures.
- Used for the exterior coating of collapsible tubes and aerosol cans.
- Crosslinked either with melamine or benzoguanamine resins, alternatively with blocked (poly)isocyanates.

* ***VIACRYL*** acrylic resins

DUROFTAL® PE 6160, VPE 6104*

- FDA § 175.300 compliant, good resistance properties, for “BADGE-free Systems”. PE 6160 is recommended for interior and exterior can coating.

DUROFTAL VPE 6128

- High solid exterior can coating systems, high gloss good chemical resistance and high flexibility. Non volatile contents of > 70 % achievable.

DUROXYN® EF 935, VIALKYD®* AN 950*

- Used in exterior systems for white base coats and clear overprint varnishes. Used mainly for general line decorations.

* ***DUROFTAL*** polyster resins
* ***DUROXYN*** epoxy resin ester
* ***VIALKYD*** alkyd resins

Amino Resin Crosslinkers
for Can Coating Applications

Amino resins in combination with polyester, epoxy or acrylic binders are widely used as crosslinkers in the can coating industry.

Their technical strength lies in their high reactivity with such polyols, coupled with excellent film flexibility and adhesion properties of the baked coating films. For maximum film flexibility properties, highly alkylated amino resins are recommended.

These crosslinkers differ primarily in monomer content and consequently in molecular weight. They react by specific acid catalysis with low tendency for self condensation reactions that improve 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.

Recommendations for external varnish

Products	Product description	Form of delivery %	Dynamic viscosity mPa.s 23 °C	Key features
Solventborne				
CYMEL®* 303 LF	Highly methylated melamine resin	> 98	3 000 – 6 000	For high solids formulations very good film flexibility, formulations stability and resistance properties.
CYMEL 1133	Mixed ether highly alkylated melamine resin	> 98	750 – 1 950	For high solids formulations with improved hydrophobicity characteristics to balance VOC and film appearance properties.
CYMEL 327	Methylated high NH melamine resin	88 – 92	5 100 – 16 000	For fast curing medium to high solids formulations with improved film flexibility properties.
CYMEL 1123	Mixed ether highly alkylated benzoguanamine resin	> 96	3 800 – 10 200	For improved adhesion and chemical resistance properties.
CYMEL 1170	Highly alkylated glycoluril resin	> 96	3 000 – 6 000	For high solids, high quality industrial coating formulations with very low formaldehyde release during cure.
Waterborne				
CYMEL 303 LF	Highly methylated melamine resin	> 98	3 000 – 6 000	For high solids formulations very good film flexibility, formulations stability and resistance properties.
CYMEL 1130	Mixed ether highly alkylated melamine resin	> 96	3 000 – 6 000	To improve hydrophobicity characteristics to balance VOC and film appearance properties.
CYMEL 328	Methylated high NH melamine resin	83 – 87	1 000 – 3 000	For fast curing waterborne formulations with good formulation stability.
CYMEL 1123	Mixed ether highly alkylated benzoguanamine resin	> 96	3 800 – 10 200	For improved adhesion and chemical resistance properties.
CYMEL 1171	Highly alkylated glycoluril resin	93 – 97	3 800 – 7 500	For high solids and waterborne high quality industrial coating formulations.

* ***CYMEL*** amino crosslinking resins

Water solubility	Formulation stability	Flow and wetting	Weight retention/ VOC	Cure response	Film hardness	Film flexibility/ deformation	Adhesion	Water resistance	Sterilisation resistance
	●●●●●	●●	●●●●●	●●●	●●●●	●●●●●	●●●	●●●	●●●●
	●●●●●	●●●●	●●	●●	●●●	●●●●●	●●●●	●●●●	●●●●●
	●●●	●●●	●●●●	●●●●	●●●●●	●●●●	●●●	●●●	●●●●
	●●●●●	●●●●	●●●●	●●	●●●	●●●●●	●●●●●	●●●●●	●●●●●
	●●●●●	●●●●●	●	●	●●	●●●●●	●●●●●	●●●●●	●●●●●
●●	●●●●●	●●	●●●●●	●●●	●●●●	●●●●●	●●●	●●●	●●●●
●	●●●●●	●●●●	●●●	●●	●●●	●●●●●	●●●●	●●●●	●●●●●
●●●●●	●●●	●●●	●●●●	●●●●	●●●●●	●●●●	●●●	●●●●●	●●●●●
●	●●●●●	●●●●	●●●●	●●	●●●●	●●●●●	●●●●●	●●●●●	●●●●●
●	●●●●●	●●●●	●●	●	●●	●●●●●	●●●●●	●●●●●	●●●●●

● low
●● moderate
●●● good
●●●● very good
●●●●● excellent

Amino Resin Crosslinkers
for Can Coating Applications (continued)

Recommendations for internal container coatings

Products	Product description	Form of delivery %	Dynamic viscosity mPa.s 23 °C	Key features
Solventborne				
CYMEL®* 303 LF	Highly methylated melamine resin	≥ 98	3 000 – 6 000	For high solids formulations very good film flexibility, formulation stability and resistance properties.
CYMEL 1133	Mixed ether highly alkylated melamine resin	≥ 98	750 – 1 950	For high solids formulations with improved hydrophobicity characteristics to balance VOC and film resistance properties.
CYMEL 327	Methylated high-NH melamine resin	88 – 92	5 100 – 16 000	For fast curing medium to high solids formulations with improved film flexibility properties.
CYMEL 1123	Mixed ether highly alkylated benzoguanamine resin	≥ 96	3 800 – 10 200	For improved adhesion and chemical resistance properties.
CYMEL 659	Partially butylated benzoguanamine resin	70 – 74 (1)	650 – 1 200	For primer formulations with good adhesion and corrosion resistance properties.
CYMEL U-80	Highly butylated urea resin	≥ 96	1700 – 4 500	For high solids primer formulations with excellent compatibility and adhesion properties.
Waterborne				
CYMEL 303 LF	Highly methylated melamine resin	≥ 98	3 000 – 6 000	For high solids formulations very good film flexibility, formulations stability and resistance properties.
CYMEL 1130	Mixed ether highly alkylated melamine resin	≥ 96	3 000 – 6 000	To improve hydrophobicity characteristics to balance VOC and film appearance properties.
CYMEL 328	Methylated high-NH melamine resin	83 – 87	1 000 – 3 000	For fast curing waterborne formulations with good formulation stability.
CYMEL 1123	Mixed ether highly alkylated benzoguanamine resin	≥ 96	3 800 – 10 200	For improved adhesion and chemical resistance properties.

(1) at 120 °C / 2h Pan

* ***CYMEL*** amino crosslinking resins

Water solubility	Formulation stability	Wetting, flow and leveling	Weight Retention/ VOC	Cure response	Film hardness	Film flexibility/ deformation	Adhesion	Water resistance	Sterilisation resistance	Chemical resistance
	●●●●●	●●	●●●●	●●●	●●●●	●●●●●	●●●	●●●	●●●●	●●●
	●●●●●	●●●●	●●	●●	●●●	●●●●●	●●●●	●●●●	●●●●●	●●●●
	●●●	●●●	●●●●	●●●●	●●●●●	●●●●	●●●	●●●	●●●●	●●●
	●●●●●	●●●●	●●●●	●●	●●●	●●●●	●●●●●	●●●●●	●●●●●	●●●●●
	●●●	●●●●●	●	●●●●●	●●●●●	●●	●●●●●	●●●●●	●●●●	●●●●
	●●●●●	●●●●●	●●	●●	●●	●●●●●	●●●●●	●●●●	●●●●●	●●●●
●●	●●●●●	●●	●●●●	●●●	●●●●	●●●●●	●●●	●●●	●●●●	●●●●
●	●●●●●	●●●●	●●●	●●	●●●	●●●●●	●●●●	●●●●	●●●●●	●●●●
●●●●●	●●●	●●●	●●●●	●●●●	●●●●●	●●●●	●●●	●●●●	●●●	●●●
●	●●●●●	●●●●	●●●●	●●	●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●

● low
●● moderate
●●● good
●●●● very good
●●●●● excellent

Amino Resin Crosslinkers
for Can Coating Applications (continued)

For improved adhesion and corrosion resistance properties the more hydrophobic amino resins are recommended. These crosslinkers differ primarily in the nature of their alkylation alcohol consequently in their hydrophobicity.

The alkylation alcohol has a significant effect on the final properties of the resulting amino resin. Longer chain alkylation alcohols increase the molecular weight of the amino resin and lower the functionality on an equivalent weight basis.

Recommendations for external base coat

Products	Product description	Form of delivery %	Dynamic viscosity mPa.s 23 °C	Key features
Solventborne				
CYMEL®* 303 LF	Highly methylated melamine resin	≥ 98	3000 – 6000	For high solids formulations very good film flexibility, formulation stability and resistance properties.
CYMEL 1133	Mixed ether highly alkylated melamine resin	≥ 98	750 – 1950	For high solids formulations with improved hydrophobicity characteristics to balance VOC and film resistance properties.
CYMEL 325	Methylated high-NH melamine resin	78 – 82	2500 – 4500	For very fast curing medium to high solids formulations.
CYMEL 327	Methylated high-NH melamine resin	88 – 92	5100 – 16000	For fast curing medium to high solids formulations with improved film flexibility properties.
CYMEL 1123	Mixed ether highly alkylated benzoguanamine resin	≥ 96	3800 – 10200	For improved adhesion and chemical resistance properties.
CYMEL 1170	Highly butylated glycoluril resin	≥ 96	3000 – 6000	For high solids, high quality industrial coating formulations with very low formaldehyde release during cure.
Waterborne				
CYMEL 303 LF	Highly methylated melamine resin	≥ 98	3000 – 6000	For high solids formulations very good film flexibility, formulation stability and resistance properties.
CYMEL 1130	Mixed ether highly alkylated melamine resin	≥ 96	3000 – 6000	To improve hydrophobicity characteristics to balance VOC and film appearance properties.
CYMEL 328	Methylated high-NH melamine resin	83 – 87	1000 – 3000	For fast curing waterborne formulations with good formulation stability.
CYMEL 202	High-NH mixed ether melamine resin	80 – 84	2500 – 7500	For fast medium to high solids formulations with improved hydrophobicity characteristics.
CYMEL 1123	Mixed ether highly alkylated benzoguanamine resin	≥ 96	3800 – 10200	For improved adhesion and chemical resistance properties.
CYMEL 1171	Mixed ether highly alkylated glycoluril resin	93 – 97	3800 – 7500	For high solids and waterborne high quality industrial coating formulations.

* ***CYMEL*** amino crosslinking resins

It is necessary to consider that the lower available functionality requires higher ratios of amino resins. Urea resins are recommended for their excellent adhesion properties.

Benzoguanamine and glycoluril resins are recommended for their excellent chemical and corrosion resistance properties.

Water solubility	Formulation stability	Flow and wetting	Weight retention	Reaction speed	Film hardness	Film flexibility/ deformation	Adhesion properties	Water resistance	Sterilisation resistance
	●●●●●	●●	●●●●●	●●●	●●●●	●●●●●	●●●	●●●	●●●
	●●●●●	●●●●	●●●	●●	●●●	●●●●●	●●●●	●●●●	●●●●
	●●●	●●●	●●●●	●●●●●	●●●●●	●●●	●●●	●●●	●●
	●●●	●●●	●●●●	●●●●	●●●●●	●●●●	●●●	●●●	●●●
	●●●●●	●●●●	●●●●	●●	●●●	●●●●●	●●●●●	●●●●●	●●●●●
	●●●●●	●●●●●	●	●	●●	●●●●●	●●●●●	●●●●●	●●●●●
●●	●●●●●	●●	●●●●●	●●●	●●●●	●●●●●	●●●	●●●	●●●
●	●●●●●	●●●●	●●●	●●	●●●	●●●●●	●●●●	●●●●	●●●●
●●●●●	●●●	●●●	●●●●	●●●●	●●●●●	●●●●	●●●	●●	●●●
●	●●●	●●●●	●●●	●●●●	●●●●●	●●●●	●●●●	●●●●	●●●●
●	●●●●●	●●●●	●●●●	●●	●●●	●●●●●	●●●●●	●●●●●	●●●●●
●	●●●●●	●●●●	●●	●	●●	●●●●●	●●●●●	●●●●●	●●●●●

● limited
●● moderate
●●● good
●●●● very good
●●●●● excellent

Amino Resin Crosslinkers

for Can Coating Applications (continued)

Recommendations for external ink formulations

Products	Product description	Form of delivery %	Dynamic viscosity mPa.s 23 °C	Key features
Solventborne				
CYMEL®* 303 LF	Highly methylated melamine resin	≥ 98	3 000 – 6 000	For high solids formulations very good film flexibility, formulation stability and resistance properties.
CYMEL 1133	Mixed ether highly alkylated melamine resin	≥ 98	750 – 1 950	For high solids formulations with improved hydrophobicity characteristics to balance VOC and film resistance properties.
CYMEL 1156	Highly butylated melamine resin	≥ 98	3800 – 7500	For improved hydrophobicity characteristics.
CYMEL 327	Methylated high-NH melamine resin	88 – 92	5 100 – 16 000	For fast curing medium to high solids formulations with improved film flexibility properties.
CYMEL 1123	Mixed ether highly alkylated benzoguanamine resin	≥ 96	3 800 – 10 200	For improved adhesion and chemical resistance properties.
CYMEL 1170	Highly butylated glycoluril resin	≥ 96	3 000 – 6 000	For high solids, high quality industrial coating formulations with very low formaldehyde release during cure.
Waterborne				
CYMEL 303 LF	Highly methylated melamine resin	≥ 98	3 000 – 6 000	For high solids formulations very good film flexibility, formulation stability and resistance properties.
CYMEL 1130	Mixed ether highly alkylated melamine resin	≥ 96	3 000 – 6 000	To improve hydrophobicity characteristics to balance VOC and film appearance properties.
CYMEL 328	Methylated high-NH melamine resin	83 – 87	1 000 – 3 000	For fast curing waterborne formulations with good formulation stability.
CYMEL 202	High-NH mixed ether melamine resin	80 – 84	2 500 – 7 500	For fast medium to high solids formulations with improved hydrophobicity characteristics.
CYMEL 1123	Mixed ether highly alkylated benzoguanamine resin	≥ 96	3 800 – 10 200	For improved adhesion and chemical resistance properties.
CYMEL 1171	Mixed ether highly alkylated glycoluril resin	93 – 97	3 800 – 7 500	For high solids and waterborne high quality industrial coating formulations.

* ***CYMEL*** amino crosslinking resins

Water solubility	Formulation stability	Flow and wetting	Reaction speed	Film hardness	Film flexibility/ deformation	Adhesion properties	Water resistance	Sterilisation resistance
	●●●●●	●●	●●●	●●●●	●●●●●	●●●	●●●	●●●
	●●●●●	●●●●	●●	●●●	●●●●●	●●●●	●●●●	●●●●
	●●●●●	●●●●●	●	●●	●●●●●	●●●●●	●●●●	●●●●
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●●	●●●●●	●●	●●●	●●●●	●●●●●	●●●	●●●	●●●
●	●●●●●	●●●●	●●	●●●	●●●●●	●●●●	●●●●	●●●●
●●●●●	●●●	●●●	●●●●	●●●●●	●●●●	●●●	●●●	●●●
●	●●●	●●●●	●●●●	●●●●●	●●●●	●●●●	●●●●	●●●●
●	●●●●●	●●●●	●●	●●●	●●●●●	●●●●	●●●●	●●●●
●	●●●●●	●●●●	●	●●	●●●●●	●●●●●	●●●●●	●●●●●

●　limited
●●　moderate
●●●　good
●●●●　very good
●●●●●　excellent

Amino Resin Crosslinkers

for Can Coating Applications (continued)

Product characteristics

Products	% Solids (Foil) 45'/45 °C	Viscosity mPa.s 23°C ISO 3219	Free HCHO ISO 9020	Typical monomer %	Water dilution	FDA approval
CYMEL®* 303 LF	≥98	3000–6000	<0.25	60	<0.7	●
CYMEL MM-100	≥98	10000–25000	<0.50	45	<0.7	●
CYMEL 1130	≥96	3000–6000	<0.15	42	–	
CYMEL 1133	≥98	750–1950	<0.15	60	–	
CYMEL 1156	≥96	3800–7500	<0.20	32	–	●
CYMEL 1170	≥96	3000–6000	<0.25	75	–	
CYMEL 1171	≥90	3800–7500	<0.25	80	>400	
CYMEL 370	86–90	5100–10200	<3.50	40	>15	●
CYMEL 325	78–82	2500–4500	<1.30	46	>30	●
CYMEL 327	88–92	5100–16000	<1.30	58	>400	●
CYMEL 328	83–87	1000–3000	<0.70	56	>400	
CYMEL 202	80–84	2500–7500	<1.00	40	–	
CYMEL 1123	≥96	3800–10200	0.10	72	–	●
CYMEL 659	70–74 (1)	650–1200	<2.00	750 (2)	–	● (3)
CYMEL U-80	>96	1700–4500	0.20	18	–	●

(1) Pan 2H/120 °C,
(2) Typical MW,
(3) Level does not exceed 12 % of resin solids by weight of final coating solids

* ***CYMEL*** amino crosslinking resins

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-catalysed reactions. They proceed very slowly, if at all under neutral or alkyline conditions. In some applications the acidity of the primary film former or other components of the formulation will be sufficient to catalyse the reaction of partially alkylated and high imino (NH) amino resins.

Product characteristics

Products	Product description
CYCAT®* 296–9	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 electrocoating 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 for general purpose strong 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.

Products	Product description
ADDITOL®* XK 350	Weak catalyst, based on organic acid, recommended for melamine curing systems to improve anti corrosion performance.
ADDITOL VXK 6357	Covalently blocked catalyst, based on p-TSA, to accelerate curing reaction in water- and solvent-borne amino stoving resins.
ADDITOL VXK 6378	Based on a mixture of alkyl phenyl phosphates, recommended for 1K alkyd-amino systems as well as in acid curing wood applications.
ADDITOL 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.
ADDITOL XK 406 N	Phosphoric acid based catalyst, good compatibility with phenolic resins, improve adhesion, reactivity and sulphur resistance.
ADDITOL SXK 407 N	Phosphoric acid based catalyst, good compatibility with phenolic resins, improve adhesion, reactivity and sulphur resistance.

* ***CYCAT*** acid catalysts * ***ADDITOL*** additives

Solvent	Gardner colour	% Solids (Pan)	Acid number ISO 3683	pKa value	Density kg/M³	Water solubility	Xylene solubility	FDA Approval
i-butanol	1	50	360–385	>2	1050	complete	complete	
i-butanol	10	40	80–90	<1	927	insoluble	complete	
i-propanol	8	70	125–135	<1	960	complete	complete	●
i-propanol	1	40	130–140	<1	960	complete	insoluble	
ethylene glycol	1	35	60–70	<1	1160	complete	complete	

Solvent	Gardner colour	Non volatile	Acid number	pKa value	Density	Water solubility	Xylene solubility	FDA Approval
Butyl acetate		62%	180–220	1000	1000	insoluble	soluble	
Methoxy pro-poxy propanol		90%	104–112	1020	1020	insoluble	soluble	
Butyl acetate/ iso-butanol		32%	140–160	920	920	insoluble	soluble	
iso-propanol		35%	70–80	950	950	soluble	soluble	
Xylene/ n-Butanol	<12	_	~ 9% on f.o.d.	>2	900	partly soluble	complete	●
Xylene/ Isobutanol	<9	_	~ 9% on f.o.d.	>2	900	partly soluble	complete	●

Polyester and Acrylic Resins for Exterior Can Coating Systems

Solvent-based systems

Type	Chemical characteristics	Form of supply	Acid value (solid resin) [mg KOH/g]	OH-value (solid resin) [mg KOH/g]
DUROFTAL®* PE 6160	oil-free, saturated polyester	50% MPAC	< = 8	20–50
DUROFTAL VPE 6104	oil-free, saturated polyester	55% Solvent mixture (Solvent Naphtha 180/200, MPP, MPAC) and 60% in MPAC (55 LG)	<8	50
DUROFTAL VPE 6128	oil-free, saturated polyester	70% Solvent Naphtha 150/180/Butyl glycol (70 SNABG)	<12	60
VIALKYD®* AN 950	oil-free, saturated polyester	60% in Solvent Naphta 180/210/Butyl glycol (60 SNBBG)	<12	100
DUROXYN®* EF 935	epoxy modified alkyd resin	50% DACT	max. 6	not applicable
RESYDROL®* AF 502 w	water dilutable, fatty acid modified alkyd resin	35% in deion. Water (no co-solvent) (35 WA)	–	–
VIACRYL®* SC 422	self-crosslinking acrylic resin	50% Butanol/Solvent Naphtha 180/210 (50 BSNB)	max. 15	(crosslinking process: OH-groups containing acrylic monomers and acrylamid)
VIACRYL SC 423	self-crosslinking acrylic resin	55% ISO Butanol/Solvent Naphtha 180/210 (55 IBSNB)	max. 15	(crosslinking process: OH-groups containing acrylic monomers and acrylamid)
VIACRYL SC 444	self-crosslinking acrylic resin	55% ISO Butanol/Solvent Naphtha 180/210 (55 IBSNB)	12–15	(crosslinking process: OH-groups containing acrylic monomers and acrylamid)
VIACRYL SC 454	self-crosslinking acrylic resin	50% Butanol/Solvent Naphtha 180/210 (50 BSNB)	14–22	(crosslinking process: OH-groups containing acrylic monomers and acrylamid)

* ***CYMEL*** amino crosslinkers resins
* ***DUROFTAL*** polyster resins
* ***DUROXYN*** epoxy resins
* ***RESYDROL*** alkyd resins
* ***VIALKYD*** akrylic resins

Application	Co-curing agent
Clear and white interior and exterior lacquers for tubes and cans.	Amino resins like *CYMEL 303®*, 327, 659, 1123.* Benzoguanamine resins e.g. *CYMEL 659.*
Clear and white exterior lacquers for tubes and cans.	1. Amino resins like *CYMEL 303, 327, 1123, 202.* 2. *VPM 1150* and flexible phenolic resins e.g. *PR 612.*
Clear and white high type solid systems.	Amino resins like *CYMEL 303, 327, 328, 1123.*
Clear and white exterior lacquers for tubes and cans.	Amino resins like *CYMEL 303, 327, 1123.*
High reactive exterior can coating system.	Amino resins like *CYMEL 303, 327, 1123.*
General industrial stoving systems, e.g. waterborne drum exterior coatings.	Amino resins like *CYMEL 303, 327, 202, 1123, 659.*
Clear and white exterior coatings for tubes, cans and closures, high resistance and flexibility.	none
Clear and white exterior coatings for tubes, cans and closures, high resistance and flexibility.	none
Clear and white exterior coatings for tubes, cans and closures, high resistance and flexibility.	none
Clear and white exterior coatings for tubes, cans and closures, high resistance and flexibility.	none

SANTOSOL® DME-1* for Can Coating

SANTOSOL products are dimethyl esters of adipic, glutaric and succinic acids. They are employed in a wide variety of applications as solvents, formulating agents and chemical intermediates. They are clear, colorless liquids offering a unique combination of high solvency power, low volatility and cost, high flash point, and are readily biodegradable. ***SANTOSOL*** dimethyl esters are very stable under ambient conditions of humidity and temperature.

The highbake temperatures and brief oven dwell times of the coil coating process demand a solvent balance which will preserve film integrity, appearance, and properties during cure. ***SANTOSOL DME-1*** or ***DME*** can be used to effectively replace typical solvents such as isophorone, glycol ethers and other HAPS solvents thus enhancing the environmental sustainability of the coating system.

SANTOSOL dimethyl esters present attractive alternatives to many established solvents, some of which have become increasingly regulated for environmental and health impact. Chlorinated solvents, such as methylene chloride and 1,1,1 trichloroethane and glycol ethers and their acetates, are examples of solvents which can be replaced with dimethyl esters. As VOC levels become increasingly more restrictive, ***SANTOSOL*** dimethyl esters offer an effective, long-term solution for meeting VOC compliance in the formulation of coatings, cleaning solvents and other products.

* ***SANTOSOL*** dimethyl esters

SANTOSOL DME-1

SANTOSOL DME-1 is a mixture of dimethyl esters provided as a clear, colorless liquid. It may be formulated into a wide variety of applications such as a solvent for coatings, paint strippers, and cleaners, or as a chemical intermediate.

Physical Properties Specifications

Property Limits Test Methods

Dimethyl Succinate Content, wt % 17–25

Dimethyl Glutarate Content, wt % 59–73

Dimethyl Adipate Content, wt % 10–14

Total Dimethyl Ester Content, wt % 99.0 min.

Acid Number, mg KOH/g 0.3 max.

Water Content, wt % 0.1 max.

Methanol Content, wt %. 0.2 max.

Color, APHA 50 max.

Useful Information

Specific Gravity @ 25 °C 1.091

Solubility in Water 5.5 wt %

Water Solubility in DME-1 3.6 wt %

Distillation Range 195–216 °C

Flash Point (Pensky-Martens, closed cup) 212 °F (100 °C)

Freezing Point –40.0 °C

Cytec started already some time ago to develop and introduce polyester resins and phenolic resins suitable to replace existing epoxy/phenolic resin systems in interior can coating area.

DUROFTAL®* PE 6160/50 MGAC in combination with ***PHENODUR®* PR 516*** is now "state of the art" in formulating ***BISPHENOL®* A*** and BADGE-free system.

For further information, please contact:

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* ***BISPHENOL*** phenolic resins
* ***DUROFTAL*** polyster resins
* ***PHENODUR*** phenolic resins

UV Resins and Additives

for exterior Can Decoration

Radiation curing of 'UV' (UltraViolet) technology is increasingly used for metal decoration and external can coatings. Most of the time, UV inks are applied by offset lithography and protected by an overprint varnish. UV inks and varnishes are 100% solids systems cured virtually instantaneously under UV light, which triggers a radical or cationic polymerisation reaction between the different ingredients of the ink.

Cytec has developed a wide range of resins for UV inks and varnishes applied on metallic substrates under the trade name ***EBECRYL***®* (radical UV polymerisation) and ***UVACURE***®* (cationic UV polymerisation). The ***EBECRYL*** resins developed for offset lithographic inks show outstanding properties in terms of pigment wetting, reactivity, adhesion and lithographic behaviour (misting, ink water balance).

Products for paste inks (lithography, letterpress)

Products	Products	Pigment wetting	Tack 350 m/min	Misting
DPHA	Dipentaerythritol hexaacrylate	●●●●	●●●●	●●
OTA 480	Propoxylated glycerol triacrylate	●●●	●●●	●
TMPTA	Trimethylol propane triacrylate	●●	●●●	●
EBECRYL®* 140	Ditrimethylol propane tetraacrylate	●●●	●●●●	●●
EBECRYL 150	Diacrylated bisphenol A derivative	●●●●	●●●●●	●●●
EBECRYL 160	Ethoxylated trimethylol propane triacrylate	●●●	●●●	●
EBECRYL 220	Aromatic hexafunctional urethane acrylate	●●	●●	●●
EBECRYL 436	Chlorinated polyester resin	●	●	●●
EBECRYL 438	Chlorinated polyester resin	●	●	●●
EBECRYL 446	Chlorinated polyester resin	●	●	●●
EBECRYL 450	Hexafunctional polyester acrylate	●●●●	●●●	●●
EBECRYL 524	Polyester resin	●	●	●●
EBECRYL 584	Chlorinated polyester resin	●	●	●●
EBECRYL 657/1657	Tetrafunctional polyester acrylate	●●●●	●	●●●
EBECRYL 811	Tetrafunctional polyester acrylate	●●	●●●●	●●●●
EBECRYL 812	Tetrafunctional polyester acrylate	●●●	●●●●	●●●
EBECRYL 870/1870	Hexafunctional polyester acrylate	●●●●	●●	●
EBECRYL 1290	Aliphatic hexafunctional urethane acrylate	●●	●●	●●
EBECRYL 1608	Standard bisphenol A epoxy acrylate	●●	●	●●●
EBECRYL 3700/250T	Standard bisphenol A epoxy acrylate	●●	●	●●●
EBECRYL 3708	Modified diacrylate of bisphenol A epoxy resin	●●	●	●●●
EBECRYL 5129	Aliphatic hexafunctional urethane acrylate	●●	●●	●●
EBECRYL 6040	Modified diacrylate of bisphenol A epoxy resin	●●	●	●●●

* ***EBECRYL*** UV curable resins and diluting oligomers, * ***UVACURE*** cationic UV curable resins

Key

	●	➡	●●●●●
Pigment wetting	Poor		Very good
Tack	High		Low
Misting	High		Low
Ink water balance	Poor		Very good
Reactivity	Low		High
Adhesion	Poor		Very good
Rubber compatibility	Affects ink rollers		No effect on ink rollers
Flow	Poor		Very good
Substrate wetting	Poor		Very good
Solvent/water resistance	Poor		Very good
Flexibility	Poor		Very good
Yellowing	Yellowing		No Yellowing

Viscosity	Höppler viscosity, expressed in mPa.s
Dilution	Parts of diluent in 100 parts of product
-C=C-	Unsaturation content expressed in meq/g

Abbreviations

Mw	molecular weight
AV	acid value
OHV	hydroxyl value

Ink water balance	Reactivity	Adhesion	Rubber compatibility	Viscosity 25 °C (mPas)	Dilution %	
●	●●●●●	●●	●●●●●	16 000	–	–
●●	●●●	●●	●●●	90	–	–
●●	●●●●	●●●	●●	115	–	–
●●	●●●●	●●	●●●	1 000	–	–
●●●	●●●	●	●●●●	1 400	–	–
●●	●●●	●●	●●●	80	–	–
●	●●●●●	●●●	●●●●●	28 500	–	–
●●	●●	●●●●	●●●	1 500 (60 °C)	TMPTA	40
●●	●●	●●●●	●●●●	1 500 (60 °C)	OTA 480	40
●●●	●●	●●●●	●●●●	1 800 (60 °C)	TMPA	32
●●●●	●●●●	●●●	●●	8 600	–	–
●	●	●●●●●	●	60 000	HDDA	30
●	●	●●●●●	●	2 000	HDDA	40
●●●●	●●●	●	●●●●●	125 000	–	–
●●●	●●	●●●●	●●●	75 000	–	–
●●	●●●	●●●	●●●●	8 000	–	–
●●●●	●●●●	●●	●●●●	48 000	–	–
●	●●●●●	●	●●●●●	2 000 (60 °C)	–	–
●	●●●●●	●	●●●	1 000 (60 °C)	OTA 480	15
●	●●●●●	●	●●●	60 000	OTA 480	25
●●●	●●●	●●	●●●	3 500 (60 °C)	–	–
●●●	●●●	●	●●●●	700 (60 °C)	–	–
●	●●●●●	●●	●●●	25 000	–	–

UV Resins and Additives – Product Range

Cationic UV curable resins

Cationic UV cure technology is used to produce solvent-free, environmental friendly lacquers, inks, coatings and adhesives, offering unique film properties. Typical applications for cationic UV cure technology are metal decoration on cans, packaging inks (including aluminium laminating adhesives and overprint varnishes). As the ionic polymerization reaction continues after exposure to UV light, a process knows as post cure or dark cure effect, practically all of the reactive species are incorporated into the final polymer matrix.

Cationic UV curable resins

Products	Product description	Viscosity 25°C-mPa.s	Colour Gardner	Density g/cm³	EEW g/mol	HEW g/mol
UVACURE®* 1500	Cycloaliphatic di-epoxide, high purity	275	100 Apha	1.17	134	
UVACURE 1503	Modified low viscosity cycloaliphatic di-epoxide	85	1	1.12	157	
UVACURE 1504	Cationic reactive diluent, OH-fuctional (cyclic ether)	25	1	1.02	116	484
UVACURE 1530	Modified cycloaliphatic di-epoxide, OH-functional	400	100 Apha	1.14	184	370
UVACURE 1533	Acrylic modified cycloaliphatic di-epoxide	310000	2	1.10	262	
UVACURE 1534	Modified cycloaliphatic di-epoxide, OH-functional	2300	1	1.10	268	375
UVACURE 1561	Epoxide/acrylate for hybrid, cationic/free radical curing	150000	5	1.18	451	

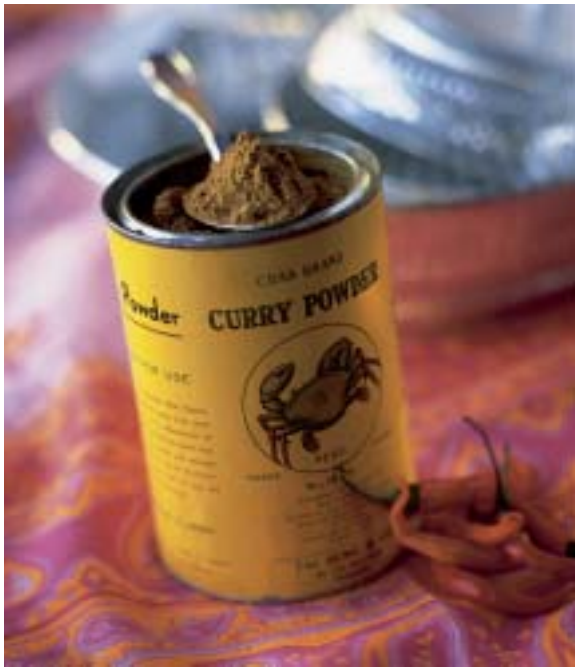
* ***UVACURE*** cationic UV curable resins

Abbreviations

EEW epoxy equivalent weight
HEW hydroxyl equivalent weight

Key

Tensile strength tensile strength at break measured on free films (ASTM D882)
Elongation elongation at break measured on free films (ASTM D882)
Young modulus obtained on free films (ASTM D882)
Toughness obtained on free films (ASTM D882)



Tensile strength MPa	Elongation %	Young modulus MPa	Toughness MPa	Key features
41	7	1048	2	Primary component of cationic UV-curing formulations giving a hard and tough film.
				Viscosity reducing diluent leading to flexible films.
				High cure speed, low viscosity diluting agent leading to a flexible film.
60	8	1379	3	High cure speed, strength, hardness, solvent resistance and crosslink density.
4	230	6	4	Soft, flexible, exceptional adhesion in coatings and laminating adhesives.
25	135	331	24	Good flexibility, good water resistance and excellent toughness.
77	8	1669	4	Faster initial cure, increased strength, improved chemical resistance.

UV Resins and Additives – Product Range
(continued)

Additives

Reactive additives were specifically developed for radiation curing applications to give specific additive characteristics (adhesion, wetting, leveling, slip) while becoming part of the network after curing.

Additives

Products	Product description	Viscosity mPa.s at 25°C	Density g/cm³	AV mg KOH/g	Colour Gardner	Lithography
Stabilizers						
ADDITOL®* S100	In-can stabilizer	50			Yellow	✓
ADDITOL S110	In-can stabilizer	500			Dark brown	✓
ADDITOL S120	In-can stabilizer	100			Pale	✓
ADDITOL S130	In-can stabilizer	100			Pale	✓
Adhesion promoters						
EBECRYL®* 168	Methacrylated acidic compound	1350	1.28	290	3	
EBECRYL 170	Acrylated acidic compound	3000	1.33	300	6	
Amine functional acrylate co-initiators						
EBECRYL 7100	Amine functional acrylate co-initiator	1000	1.10		4	
EBECRYL P115	Tertiary amine co-initiator	20	0.99		2	
Flow and leveling agents						
EBECRYL 350	Silicone diacrylate	350	1.05	7	10	
EBECRYL 1360	Silicone hexaacrylate	2100	1.11	25	10	
MODAFLOW®* 9200	Silicone free leveling agent	4000			Pale	
Miscellaneous						
EBECRYL 341	Silicone free slip agent	50			White	
EBECRYL 373	Anti misting additive	Paste			Yellow	✓

* ***ADDITOL*** additives
* ***EBECRYL*** UV curable resins
* ***MODAFLOW*** flow modifiers

Flexography	Inkjet	Screen	OPV	Addition level %	Key features
✓	✓	✓		1–3	Suitable for grinding and in-can stabilisation of white and pale colours. No negative impact on reactivity.
✓	✓	✓		1–3	Very effective for grinding and in-can stabilisation of a wide variety of pigmented systems. No negative impact on reactivity.
✓	✓	✓	✓	1–2	Universal use, for grinding and in-can stabilisation of pigmented systems and clear coatings. No negative impact on reactivity.
✓	✓	✓	✓	1–2	In-can stabilisation of clear coatings and pigmented systems, including metallic pigments.
		✓	✓	1–5	Adhesion promoter for metals and glass.
		✓	✓	5–8	Adhesion promoter for metals.
✓	✓	✓	✓	10–15	Highly efficient co-initiator. Excellent adhesion to plastic substrates. Nitrogen content: 3.5 %. Can be used as a resin.
		✓	✓	5–8	Highly efficient co-initiator. Nitrogen content: 4.9 %.
✓		✓	✓	0,5–2	Copolymerisable, substrate wetting and slip additive.
✓		✓	✓	0,5–2	Copolymerisable, substrate wetting and slip additive. Recommended for EB applications.
✓		✓	✓	0,5–2	Silicone free leveling agent with excellent compatibility.
			✓	2–5	Silicone free slip additive for use in OPVs. Allows overprintability.
				3–5	***EBECRYL 373*** reduces misting of paste inks.

✓ = recommended for use

UV Resins and Additives – Product Range
(continued)

Photoinitiators

Cytec has been the global leader in radiation curing chemicals for many years. Supplying monomers, oligomers and reactive diluents for both graphic arts and industrial coatings applications. In order to better service customers, Cytec has added photoinitiators to the already extensive portfolio of radiation curable products.

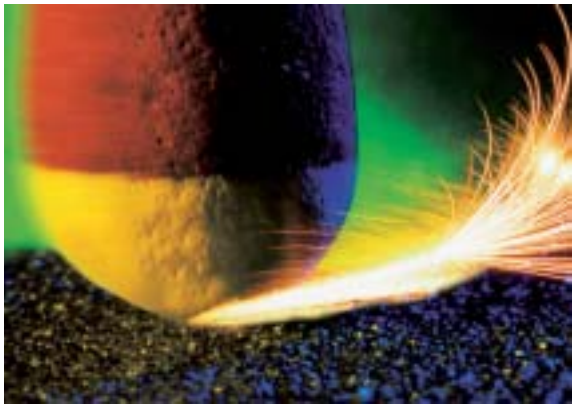
While focus for innovation and technical service remains on monomers and oligomers, Cytec provides excellent quality ***ADDITOL***®* photoinitiators.

The ***ADDITOL*** photoinitiator product range includes the most commonly used photoinitiators in graphic arts. The tables show the typical application areas for each of the ***ADDITOL*** photoinitiators.

Photoinitiators

Products	Product description	Type	State	Non yellowing	Lithography
ADDITOL®* ***BCPK***	Benzophenone, 1-hydroxy-cyclohexylphenyl-ketone mixture	combination	liquid	✓	✓
ADDITOL BDK	2,2-dimethoxy-1,2-diphenylethan-1-one	α-cleavage	solid		✓
ADDITOL BP	Benzophenone	H-abstraction	solid		✓
ADDITOL CPK	1-hydroxy-cyclohexylphenyl-ketone	α-cleavage	solid	✓	✓
ADDITOL EHA	2-ethylhexyl-4-dimethylaminobenzoate	amine co-initiator	liquid		✓
ADDITOL EPD	Ethyl-4-(dimethylamino)benzoate	amine co-initiator	solid		✓
ADDITOL HDMAP	2-hydroxy-2-methyl-1-phenyl-propanone	α-cleavage	liquid	✓	✓
ADDITOL ITX	Isopropyl thioxanthone (2-and 4- isomer mixture)	H-abstraction	solid		✓
ADDITOL MBF	Methyl benzoyl formate	α-cleavage	liquid		✓
ADDITOL PBZ	4-phenyl benzophenone	H-abstraction	solid		✓
ADDITOL TPO	2, 4, 6-trimethylbenzoyl diphenyl phosphine oxide	α-cleavage	solid	✓	✓
EBECRYL®* ***P38***	Acrylated derivative of benzophenone	H-abstraction	liquid		

* ***ADDITOL*** photoinitiators
* ***EBECRYL*** UV curable resins



Flexography	Inkjet	Screen	OPV	Key features
✓	✓	✓	✓	Good surface and through cure.
✓	✓	✓	✓	Good solubility. Balanced surface and through cure.
✓	✓	✓	✓	Good solubility. Excellent surface cure. To be used in combination with an amine synergist.
✓	✓	✓	✓	Good solubility. Good surface and through cure. Non-yellowing photoinitiator.
✓	✓	✓		Low odour. Good surface and through cure.
✓	✓	✓		Good solubility. Good surface and through cure.
✓	✓	✓	✓	Balanced surface and through cure.
✓	✓	✓	✓	Good solubility. Good through cure. Low odour.
✓	✓	✓	✓	Mild odour. Very good surface cure. Limited yellowing.
✓	✓	✓	✓	Low odour for inks and OPV.
✓	✓	✓		Low odour. Low volatility. Increased depth cure. Used in white pigmented systems.
			✓	Photoinitiator for low odor UV coatings.

✓ = recommended for use

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