EASTMAN

Eastman products for industrial wood coatings

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Beauty meets performance

At Eastman, our raw materials enhance the appearance, performance, and protection capabilities of industrial wood coatings and finishes. These products allow coatings formulators to create clear, beautiful, and durable finishes—all while balancing cost and value.

Eastman products meet global performance and appearance requirements—ensuring that quality is never compromised and that The Material Difference™ is unmistakable.

Eastman and the industrial wood coatings market

Eastman Chemical Company supplies solutions for the formulating needs of the industrial wood coatings market. Our products allow formulators to satisfy important market drivers such as higher performance, optimized unit cost, appearance, and regulatory requirements. Eastman has a broad range of raw materials for industrial wood coatings applications and is committed to developing innovative solutions that will create value for the coatings formulator. Eastman offers these solutions for finishes on residential furniture, office and institutional furniture, cabinetry, building products, and other wood-based composite applications.

Eastman product families for industrial wood coatings

Cellulose esters

- Eastman CAB

Eastek™ polymer dispersions

- Eastek 1000, 1100, 1200, 1400

Solvents

- Ketones
- Esters
- Alcohols
- Glycol ethers and glycol ether esters

Additives

- Eastman SAIB (sucrose acetate isobutyrate)
- Eastman plasticizers
- Eastman Solus™ 2100 performance additive

Adhesion promoters

For various wood plastic composites

- Solventborne: chlorinated and nonchlorinated
- Waterborne: chlorinated and nonchlorinated

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High performance products for wood coatings

Eastman cellulose esters, as a family of polymers, offer a wide range of performance-enhancing properties for wood coatings. They are supplied as 100% solids, free-flowing powders and can be dissolved in a variety of solvents and reactive diluents.

Eastman CAB (cellulose acetate butyrate) resins have been used in wood-coatings systems for many years. They find widespread use in high quality 2K acrylic urethane systems and in the growing trend towards radiation-curable systems. Besides these principal coatings applications, Eastman CAB is also used in thermoplastic and acid-curable coatings.

Benefits of cellulose esters

Cellulose esters offer wood coatings systems a variety of advantages including:

- Fast hardness development allowing early stacking and processing of coated products
- Nonyellowing under influence of UV light
- Excellent flow and leveling characteristics resulting in defect reduction and improved coating appearance
- Achieving the correct balance of viscosity and solids content which allows excellent wetting, penetration, and pore definition on "open pore" wood species
- Superior control of silica matting aids allowing consistent gloss levels at a variety of film thicknesses
- Reduced variation of film thickness due to "picture framing"
- Improved atomization
- User-friendly application characteristics
- Improved adhesion (UV systems)
- Resistance to plasticizer migration

Eastman Solus™ 2100 performance additive

Eastman Solus™ 2100 performance additive possesses improved compatibility with alkyd resins commonly used in wood coatings formulations as compared to cellulose esters. Alkyd urethane wood coatings for furniture are typically formulated utilizing nitrocellulose resins—particularly where low gloss is required. One of the main issues with this approach has been that the nitrocellulose binders impart excessive yellowing in the coating, even more so than the short oil alkyd and aromatic isocyanate cobinders.

The incorporation of Solus 2100 performance additive into an alkyd urethane wood coating offers the following benefits:

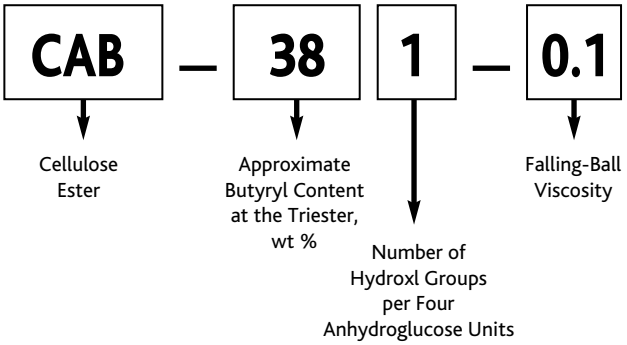
- Improved resistance to yellowing under UV light
- Improved dry-to-touch time and hardness development
- Excellent flow/leveling and appearance
- Higher solids content at application viscosity giving lower VOC levels

Choosing an Eastman CAB resin for initial screening

The unique structure and composition of cellulose ester materials allow us to modify key attributes of the products to alter solubility, compatibility, hydroxyl content, and molecular weight. This provides a range of products that offers coatings formulators a wide variety of formulation options.

Knowing how cellulose esters are named, one can easily make relative comparisons among them for initial screening in any application. Three variables—butyryl content, hydroxyl content, and viscosity—determine which cellulose ester to screen for a given application. These variables are described by the nomenclature for cellulose esters.

Eastman CAB nomenclature
Eastman cellulose esters



For a cellulose ester with greater:	Choose a cellulose ester with:
Compatibility	Higher butyryl content
Solubility	Higher butyryl content or higher hydroxyl content if the solvent blend is high in alcohol
Reactivity	Higher hydroxyl content
Toughness	Higher viscosity
Hardness	Lower butyryl content or higher hydroxyl content
Chemical resistance	Lower butyryl content
Flexibility	Higher butyryl content
Higher solids at fixed viscosity	Lower viscosity
Moisture resistance	Lower hydroxyl content
Adhesion	Higher butyryl and hydroxyl content

Generally, Eastman CABs with higher butyryl content are best for initial screening due to greater compatibility with other resins. If compatibility is good with the higher butyryl esters, others may then be evaluated. In many cases, a lower butyryl ester may be incompatible with a system while a higher butyryl ester shows good compatibility. Testing is advised to determine compatibility with the resin of your choice.

Type of wood finish	Typical use level, solids, wt%	Suggested Eastman performance additive for initial screening
Lacquer	30–60	551-0.2, 381-0.5
2K alkyd/urea	10–40	553-0.4
1K precatalyzed	10–40	553-0.4
Sealers	10–30	551-0.2
2K polyurethane	5–60	551-0.2, 551-0.01, 381-0.1, 381-0.5
Higher solids	20–50	551-0.2, 381-0.1, Solus™ 2100
High solids	5–25	551-0.01, Solus 2100
UV-curable	1–5	551-0.01, 381-0.5, Solus 2100
Unsaturated polyester	1–10	551-0.2, 551-0.01

Industrial wood finishes using Eastman cellulose esters

For more than 40 years, Eastman CABs and Eastman CAPs have been used as coresins or additive raw materials providing a number of benefits to 2K PU/acrylics, acid-cured, UV-curing, and other wood coatings technologies.

Additionally, the molecular structure of cellulose ester chains provides unique rheological properties. Eastman CAB solutions demonstrate almost “Newtonian” flow behavior at certain shear domains allowing excellent atomization, flow, and leveling very quickly after application. The elastic modulus predominates over viscous modulus resulting in fast hardness development and excellent film properties.

Eastman CAB lacquers

Lacquers based on cellulosic resins are versatile wood finishes. The main advantages of CAB over nitrocellulose are that it is nonyellowing, and has superior cold check resistance and lower flammability. CAB is the best choice for those finishes where nonyellowing is required. CAB/acrylic lacquers are also particularly suitable as topcoats for light-colored wood or light-shaded basecoats.

Eastman CAB/acrylic lacquers maintain traditional lacquer qualities, such as ease of repair, ease of handling, fast drying, clarity, and superior appearance.

Formulating tips for lacquers

- Eastman CAB has limited compatibility with alkyd resins. However, if formulated with an alkyd resin, the slowest evaporating solvent in the system should be an aromatic hydrocarbon to ensure blush-free films. It is important to include some aromatic hydrocarbon in the solvent blend to help achieve overall compatibility, solution clarity, and smoothness of Eastman CAB lacquers while reducing solvent costs.
- Lacquers containing Eastman CAB should not be mixed with those containing nitrocellulose because they are generally incompatible.
- Compatibility with alkyds may vary depending on the alkyd type. Testing has shown greater compatibility with resins based on coconut, castor, and soya oils. Eastman suggests testing with your alkyd to confirm compatibility. Additional information is available from your Eastman representative.
- Solus 2100 performance additive has shown better capability with alkyd resins and is recommended for use in 2K polyurethane alkyd technology.

Polyurethane finishes

Polyurethane wood finishes exhibit outstanding film properties and are commonly used in top quality furniture with high demand for appearance and chemical resistance. Drying rates, flowout—in particular on open pore wood species—and surface smoothness can be improved by incorporating Eastman CAB into polyurethane finishes. Most polyurethane formulations are composed of Eastman CAB, polyisocyanate resins, and/or hydroxyl-functional acrylic or polyol resins. The hydroxyls on the Eastman CAB molecules react with isocyanate to form tough, durable urethane networks in addition to the lacquer-like application properties that Eastman CAB provides these coatings. Existing pure polyurethane/acrylic systems may also be modified with low levels (1%–10%) of Eastman CAB to improve flow properties and drying rates.

Formulating tips for polyurethane finishes

- No alcohol or water should be present in the solvents; use only urethane grade solvents.
- Aliphatic isocyanate resins are recommended for better compatibility and they provide better color stability and yellowing resistance.
- A slight molar excess of isocyanate to hydroxyl functionalities helps ensure superior chemical resistance.

Acid-cured alkyd/amino conversion varnishes

Conversion varnishes combine the fast-curing properties of a lacquer with the higher-performance properties of alkali, solvent, water, and heat resistance of a varnish. The incorporation of Eastman CAB imparts lacquer-like handling to this type of coating. Acid-catalyzed Eastman CAB finishes may also be formulated with hydroxyl functional acrylic resins in place of alkyds for nonyellowing applications.

Formulating tips for acid-cured alkyd/amino conversion varnishes

- High alcohol content in the solvent blend will stabilize the coating and extend catalyzed pot life.
- *p*-Toluenesulfonic acid (*p*TSA) is often used as a catalyst. Weaker catalysts, such as acid phosphates, will extend pot life but slow cure response.
- In most cases, 3% *p*TSA catalyst, based on solids, will provide maximum cure response. Additional catalyst will not improve coating properties and could cause hydrolysis of butyrate esters. The hydrolysis reaction forms butyric acid, which will have little effect on film properties but will cause an unpleasant odor.

Precatalyzed lacquers

Eastman CAB/acrylic precatalyzed lacquers are an excellent choice for applications where the discoloration of conventional nitrocellulose/alkyd precatalyzed lacquers is unacceptable. Technically, "precatalyzed lacquers" are not true lacquers. These coatings are one-package systems usually containing hydroxyl functional resins and amino resins. They contain weak catalysts that provide a pot life of 4 months to 1 year. Although slower to cure than two-part *p*TSA-catalyzed systems, precatalyzed lacquers are more convenient to use and perform adequately for many applications. Suggested starting point formulations for clear and white precatalyzed Eastman CAB/acrylic lacquers are available on request.

Formulating tips for precatalyzed lacquers

- Alcohol solvents help extend pot life.
- Increasing the solids content of a formula may decrease pot life.
- Typical catalysts are butyl and phenyl acid phosphates.
- Pigments with surface treatments of highly basic pH may decrease formulation stability and film cure or gloss.

UV-curing finishes

Eastman CABs improve the flow and leveling and drying rate of UV-cure finishes. Incorporating 1%–5% Eastman CAB may improve drying rate, adhesion, and flow out. It has been observed that Eastman CAB in small amounts of <1% reduce penetration into porous substrates. Eastman CAB can also help the formulator to reduce film shrinkage, which has been hypothesized to cause adhesion failures. Eastman CAB is soluble in styrene and many acrylate oligomers commonly used in UV-cure coatings. Besides Eastman CAB, Eastman Solus™ 2100 performance additive has shown excellent solubility and can be recommended for use in UV.

Viscosity of 5% solutions of Eastman CAB resins in reactive diluents (Brookfield LVTDVII)

Monomer	HDDA		TMPTA		DPGDA		TPGDA		IBOA		Styrene	
	Viscosity (cP)	Rating	Viscosity (cP)	Rating	Viscosity (cP)	Rating	Viscosity (cP)	Rating	Viscosity (cP)	Rating	Viscosity (cP)	Rating
Eastman CAB												
Type	5% CAB		5% CAB		5% CAB		5% CAB		5% CAB		5% CAB	
553-0.4	1550	H	1550 (2%)	IG	1190	IG	40K	H	NA	IG	NA	I
551-0.01	29	S	661	S	40	S	57	S	90 (10%)	S	7	S
551-0.2	87	SH	2080	S	136	S	204	S	140	S	30	IG
381-0.1	60	S	1670	S	113	S	180	S	NA	IG	NA	I
321-0.1	53	S	1420	S	93	S	128	IG	NA	IG	NA	I
Solus 2100 performance additive	<10	S	242	S	30	S	—	—	—	—	<10	S

Legend

HDDA	*1,6-Hexanediol diacrylate [η = 10cP]*	
TMPTA	*Trimethylolpropane triacrylate [η = 105cP]*	
DPGDA	*Dipropylene glycol diacrylate [η= 15cP]*	
TPGDA	*Tripropylene glycol diacrylate [η = 17.5cP]*	
IBOA	*Isobornyl acrylate [η= 13cP]*	
Styrene	*Styrene acrylate monomer [η= 2.5cP]*	
η	*Viscosity*	
cP	*Centipoise*	
Rating	*S*	*Soluble, totally clear solution*
	SH	*Slight haze, barely visible to the naked eye*
	H	*Hazy, very visible, yet still translucent*
	IG	*Large quantity of partially solubilized translucent gel particles that cause haze or sediment*
	I	*Insoluble, very little if any soluble material*
	NA	*Not applicable, viscosity unmeasurable due to insolubility*

Eastek™ polymer dispersions

Sulfopolyester building blocks are comprised of glycols, aromatic acids, and 5-sodiosulphoisophthalic acid (SSIPA). The glycol ratio influences hydrophobicity and stiffness; the SSIPA content dictates dispersibility in water. Upon dispersing, sulfopolyesters spontaneously form small micellar aggregates. Eastek products are colloidal dispersions (Figure 1) with extremely small particle size, 10–50 nm in diameter.

This unique polymer chemistry offers several advantages in waterborne coating systems. However, there are a number of significant differences versus commonly used waterborne binders. Eastek™ 1200 polymer dispersion, the most alcohol-resistant dispersion in this family of products, may be resistant enough for top-coat applications. We recommend the use of Eastek products in primer/intermediate coat systems. The solids content, ~30% w/w, of Eastek dispersion better suits these coating layers.

Benefits

The benefits of Eastek polymer dispersions as binders in wood-coating primers include the following:

- Outstanding Anfeuerung (wet look, clarity, warmth) on a variety of wood types
- Harmonizing effect: improved penetration into wood of nonuniform density, ensuring uniform color and colored stain acceptance
- Low odor
- Nonskinning
- Fast drying and hardness development
- Excellent crosscut adhesion
- Very high gloss and clarity
- Easy to formulate
- Excellent flexibility and resistance to mechanical damage with and without top-coat systems
- Excellent light fastness

Solvents

Eastman solvents are used in all stages of the wood-finishing process. Eastman is dedicated to being a reliable supplier of traditional lacquer solvents as well as specialty solvents useful in formulating wood coatings to meet changing environmental regulations. An important issue faced by the wood-finishing industry is compliance with Hazardous Air Pollutant (HAP) regulations. The majority of Eastman solvents are non-HAPs.

For specific reformulations needs and information about product availability in your region, contact your Eastman representative.

The following are examples of solvents that are particularly useful in wood finishes.

Ketones

Eastman MAK (methyl *n*-amyl ketone) and Eastman MIAK (methyl isoamyl ketone) are non-HAP (HAP content <1%), highly active retarder solvents for lacquers, polyurethanes, and conversion varnishes. Because of their strong solvency, low weight per volume, and low density, Eastman MAK and Eastman MIAK are excellent choices for higher solids systems. These ketones also work well in higher-solids lacquers applied by high-pressure or hot-spray techniques.

Eastman MPK (methyl *n*-propyl ketone)[1] is a highly active solvent that may be used to replace portions of commonly used solvents such as MEK and MIBK. It has an evaporation rate of 2.3 and provides excellent solvency for most wood-coating resins.

[1] *May contain up to 10% MIBK by weight*

Esters

Eastman *n*-butyl acetate is a non-HAP, medium-evaporating, "workhorse" solvent for many lacquers, sealers, and conversion varnishes. It is the most popular "middle" solvent and provides great flow properties.

Eastman IBIB (isobutyl isobutyrate) is a HAP-free, economical retarder solvent useful in nitrocellulose lacquers and polyurethane coatings. It has very low surface tension and extremely low water miscibility. IBIB can be a useful solvent to improve flow in warm, dry, or drafty application conditions.

Eastman *n*-butyl propionate is a non-HAP, slow evaporating, urethane grade ester with good solvency for most coating resins. It can be a useful retarder solvent in lacquers and ambient cure enamels. Its slow evaporation rate allows for flow and leveling but does not prevent the quick rubbing and sanding of the lacquer. *n*-Butyl propionate could be used as a replacement for xylene in coating applications such as high-solids thermoset enamels, processing solvents for high-solids acrylic resins, and electrostatically applied coatings.

Eastman *n*-propyl propionate is a non-HAP, medium evaporating, urethane grade ester with good solvency for most coating resins. It could be used as a replacement for xylene in coatings applications such as lacquers, enamels, processing solvents for high-solids acrylic resins, and electrostatically applied coatings.

Eastman EEP (ethyl-3-ethoxypropionate) is a high performance ether-ester solvent that has utility in wood finishes. EEP's high electrical resistance makes it useful for electrostatic spray applications. EEP may be preferred over PM acetate because of its lower density and slower evaporation rate.

Eastman methyl acetate, high purity is a VOC-exempt (USA), non-HAP solvent useful in wood finishing that does not cause blushing. It has similar solvent strength and evaporation rate to acetone.

Alcohols

Eastman isobutanol (isobutyl alcohol) is a primary alcohol of high purity that has properties similar to those of *n*-butyl alcohol. This similarity has led to the use of isobutyl alcohol as a supplement or replacement for *n*-butyl alcohol in many applications. A relatively slow-evaporating latent solvent in lacquers, isobutyl alcohol is effective in reducing the viscosities of many formulations while simultaneously promoting flow and retarding blushing. In coatings cross-linked with melamine resins, alcohols such as isobutyl alcohol are commonly used to improve the coatings' viscosity stability. In addition to its use as a solvent, isobutyl alcohol can be substituted for *n*-butyl alcohol as a diluent-reactant in the manufacture of certain urea-formaldehyde and melamine-formaldehyde resins.

Eastman Tecsol™ special industrial solvents are particularly useful in stains. Many alcohol-soluble dye stains that contain high levels of methyl alcohol can be reformulated with Tecsollethyl alcohols as part of a solvent blend to comply with HAP regulations.

Glycol ethers and glycol ether esters

Eastman EB solvent (ethylene glycol monobutyl ether) is a non-HAP, colorless liquid having a mild odor and high dilution ratio with petroleum hydrocarbons. It is soluble in alcohol and water. It is very useful in formulating lacquers with good blush resistance.

Eastman PM acetate (propylene glycol monomethyl ether acetate) is a non-HAP, colorless, slow evaporating glycol ether ester. It is active for several commonly used coating polymers including CAB, NC, acrylics, and epoxy and phenolic resins. The combination of slow evaporation rate and good solvent activity makes Eastman PM acetate an effective retarder solvent for use in lacquers and enamels, as well as in thinners.

Additives

To complete Eastman's full range of products available to the wood coatings industry, Eastman offers a number of additives to enhance the performance properties of wood coatings formulations. Contact your Eastman representative about product availability in your region.

Eastman SAIB (sucrose acetate isobutyrate)

Eastman SAIB is used as an extender resin in wood sealers and topcoats. It may serve to increase nonvolatile content by levels of 10%–15% solids with no significant increase in viscosity. While Eastman SAIB has some plasticizing effect at these levels, it does not cause appreciable film softening and often improves adhesion. Eastman SAIB has excellent solubility and compatibility with resins and other modifiers and has very good light stability. In nitrocellulose lacquers that also contain hard resins and plasticizers, Eastman SAIB can replace the nonoxidizing alkyd resins commonly used to produce a low-viscosity lacquer at a given solids level. Starting point formulas for Eastman SAIB in nitrocellulose wood lacquer are available on request.

Eastman Optifilm™ enhancer 400

Eastman Optifilm™ enhancer 400 is an excellent alternative to traditional phthalate plasticizers. It has been shown to be more efficient than o-phthalates in improving flexibility of lacquer films. The product has also very good weathering stability.

Plasticizers

Eastman offers the following plasticizers that may be used in wood finishes:

- Eastman DOP plasticizer (dioctyl phthalate)
- Eastman 168™ plasticizer (dioctyl terephthalate)
- Eastman 425 plasticizer (blend of dioctyl terephthalate and diethylene glycol dibenzoate)
- Eastman DOA plasticizer (dioctyl adipate)
- Eastman TOTM plasticizer (trioctyl trimellitate)

Adhesion promoters

The market for wood-filled polyolefin composites is currently growing in all regions of the worlds. The main industrial application areas for wood-filled polypropylene composites are door frames, decorative profiles, siding, and furniture. The amount of wood fiber or flour added to polypropylene profiles typically varies between 30% and 85% depending on the end use and the manufacturer concerned; however, in most cases, a good balance of cost and performance is seen at levels of ~50% wood loadings.

Eastman has a range of adhesion promoters that are suitable to improve adhesion, allowing such materials to be painted as natural wood-building products.

Eastman Technical Service Laboratories

Eastman has four technical service laboratories to assist with wood coatings development. If you have questions about formulating, regulations, products, or other related areas, contact one of the technical service centers listed on the back cover of this publication.

Visit us at **http://www.eastman.com/Markets/Coatings/Markets_Applications/Pages/Industrial_Wood.aspx**

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