EASTMAN

Spectrum

An array of
formulating options
with Eastman's tackifier resins

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The spectrum of Eastman's tackifier resins

Brands	Product class	Description
Regalrez™	Hydrogenated hydrocarbon resins	Water-white, fully and partially hydrogenated products
Regalite™ Plastolyn™	Hydrogenated hydrocarbon resins	Water-white, fully and partially hydrogenated products
Eastotac™	Hydrogenated hydrocarbon resins	Hydrogenated hydrocarbon resins with a range of colors
Endex™ Kristalex™ Piccolastic™ Piccotex™ Plastolyn™	Aromatic resins	Water-white aromatic resins
Piccotac™	Aliphatic and aromatic-modified aliphatic resins	Light-yellow nonhydrogenated aliphatic resins with a range of aromatic modification
Picco™	Aromatic resins	Dark aromatic resins
Foral™-E Foralyn™ Staybelite-E™ Pentalyn-E	Hydrogenated rosin resins	Highly stabilized rosin resins with different degrees of hydrogenation
Poly-Pale™ Dymerex™	Modified rosin	Pale noncrystalline, polymerized and dimerized acidic resins with higher softening points and better stability than nonmodified rosin
Abalyn™	Liquid rosin resins	Amber-colored, viscous liquid methyl ester of rosin
Abitol™	Liquid rosin resins	Light-colored balsamic, primary, monohydric alcohol derived from hydrogenated rosin acids

Matching polymers with tackifier resins

If the polymer being used is:	*Then select from:*	*See page:*
Polyethylene, polypropylene, EPDM, SEBS, butyl rubber, ethylene-propylene rubber, amorphous polyolefin, m-PE, m-PP, olefin block copolymers	• Regalrez™ hydrogenated hydrocarbon resins • Regalite™ hydrogenated hydrocarbon resins • Plastolyn™ hydrogenated hydrocarbon resins (1000 types only) • Eastotac™ hydrogenated hydrocarbon resins • Foral™-E hydrogenated rosin resins	6 7 7 8 16
Natural rubber, SIS, polyisoprene, petroleum wax	• Regalite™ hydrogenated hydrocarbon resins • Eastotac™ hydrogenated hydrocarbon resins • Piccotac™ aliphatic hydrocarbon resins (1000, 9000, 8000 types) • Rosin resins	7 8 13 16
SBR, SBS, polybutadiene, EVA (<30% vinyl acetate)	• Piccotac™ aliphatic hydrocarbon resins (1000, 7000, 6000, 3000 types) • Endex™, Kristalex™, Piccolastic™, Piccotex™, and Plastolyn™ water-white aromatic resins • Picco™ aromatic hydrocarbon resins • Rosin resins	13 10 15 16
EVA (>30% vinyl acetate), acrylic, polychloroprene, nitrile, alkyd paint base	• Regalrez™ hydrogenated hydrocarbon resins (3000, 6000 types only) • Regalite™ hydrogenated hydrocarbon resins (7000, 5000 types only) • Endex™, Kristalex™, Piccolastic™, Piccotex™, and Plastolyn™ water-white aromatic resins • Picco™ aromatic hydrocarbon resins • Rosin resins	6 7 10 15 16
Polystyrene, ABS, PVC, styrenic block copolymers	• Endex™, Kristalex™, Piccolastic™, Piccotex™, and Plastolyn™ water-white aromatic resins • Picco™ aromatic hydrocarbon resins • Rosin resins	10 15 16

Tackifier resins are low-molecular-weight materials, ranging from viscous liquids at room temperature to hard, brittle solids with softening points as high as 165°C. The color of tackifier resins varies from water-white (less than Gardner Color 1) to very dark brown (greater than Gardner Color 12). Tackifier resins are rarely used alone; most applications involve combinations with other materials ranging from waxes to high-molecular-weight rubber and plastic polymers. The tackifiers are used to modulate physical properties of the formulation during processing and end use, providing properties like reduction in processing temperature, improved adhesion, tackiness, damping, and improved mechanical strength to the compound.

Tackifier resins can be derived from two distinctly different raw material sources. Hydrocarbon resins are low-M_w polymers synthesized from various hydrocarbon monomers derived from petrochemical feed streams. Rosin resins are derivatives of natural rosin acids obtained from pine trees. Both groups of tackifiers are described in more detail in the following sections.

What are hydrocarbon resins?

There are four main divisions used to classify hydrocarbon resins:

- **Aliphatic resins**—These are made from linear or cyclic hydrocarbon monomers ranging from 5 to 10 carbon chains with at least 1 double bond per monomer unit capable of sustaining a polymerization reaction. Because the predominant monomers used for aliphatic resins have 5 carbons, these materials are frequently called C5 resins.
- **Aromatic resins**—These are made from feedstocks containing a 6-carbon aromatic ring structure and a side chain with a minimum of 2 carbons with at least 1 double bond capable of sustaining a polymerization reaction. The predominant monomers used for aromatic resins have 9 carbons; they are frequently called C9 resins.
- **Mixed or C5/C9 resins**—It is possible to copolymerize aliphatic and aromatic monomers to produce a material with both aliphatic and aromatic characteristics. These may also be called aliphatic/aromatic or aromatic/aliphatic resins, depending on which type of majority monomer is in the recipe.
- **Hydrogenated resins**—These are resins derived from polymerizing either aliphatic or aromatic monomers followed by a hydrogenation process. Hydrogenation lowers the color of the polymer as well as improves its heat, oxidation, and UV radiation degradation resistance. It is also possible to partially hydrogenate a resin to achieve a low-color product with a controlled proportion of aromatic and aliphatic structures.

What are rosin resins?

Rosin resins are generally based on rosin acids or esters thereof. Rosin acids can be obtained by tapping living pine trees (gum rosin), by extraction of tree stumps (wood rosin), or as a by-product from the kraft papermaking process (tall oil rosin). Eastman uses gum rosins as raw materials for our rosin resins.

Depending on the alcohol used for esterification, the physical properties of the rosin esters vary from a viscous liquid at room temperature to brittle solids with softening points of above 150°C. The most common rosin derivatives are glycerol esters and pentaerythritol esters.

Premium rosin esters are based on modified rosin acids, Eastman uses hydrogenation to provide exceptional stability in its Foral-E, Foralyn, Staybelite-E, and Pentalyn-E products.

Rosin resins are amphiphilic in that they have polar and nonpolar parts in the molecule, which when combined with their low molecular weights makes them compatible with an exceptionally broad range of polymers.

Applications for tackifier resins

- **Adhesives**—The primary application for tackifier resins is the formulation of adhesives. Tackifier resins are low-molecular-weight modifiers which improve flow, wetting, and adhesion when combined with adhesive polymers. Unlike oils and plasticizers, tackifier resins increase the T_g of the formulation into the desired temperature region required for effective bond formation as well as reduce its hardness and improve flow.
- **Thermoplastic polymer modification**—Resins can be used in combination with specific polymers to impart properties not achievable with the polymer alone. The specific function of the resin depends on the nature of the thermoplastic being modified. For example, in styrenic block copolymers, a highly aromatic resin can increase hardness and tensile strength, while an aliphatic or hydrogenated resin can soften, plasticize, or tackify the polymer. In polypropylene, aliphatic and hydrogenated hydrocarbon resins can reduce moisture transmission rates, decrease heat-shrink onset temperatures, increase the shrink percentage, and impart dead-fold properties to polypropylene film. In nonadhesive applications such as road marking and carpet backing, resins provide flow and wetting and enable high-filler loadings.

- **Wax modification**—The use of resins in wax compounds can improve adhesion, increase the coefficient of friction, enhance gloss, inhibit shrinkage on solidification, and improve the heat resistance of waxes. Hydrocarbon resins are critical in the formulation of wax-based compounds for paper coatings, food containers, investment casting compounds, depilatory compounds, and friction-control coatings for sporting equipment.
- **Stand-alone applications**—While most applications for resins require mixing with other materials, there are a few specialized applications in which they are used either by themselves or as the main polymer in a compound. These applications include dry sizing, breakaway objects for film and stage props, and preservation clear-coat varnishes for artwork. These applications take advantage of the unusual physical characteristics of hydrocarbon resins, such as low solution viscosity, relatively low softening point and molten viscosity, brittleness, transparency, and inertness.

Selection of tackifier resins

Eastman manufacturers a wide variety of tackifier resins. Selecting the right one for a given application requires balancing compatibility with other system components and properties such as color, functionality, stability, regulatory compliance, and cost. This requires a deep understanding of formulation, but there are a few critical characteristics that can assist in resin selection, such as:

- **Compatibility**—There are two characteristics of resins which largely determine their compatibility with other polymers.
  - The aliphatic/aromatic balance of hydrocarbon resins and the amphiphilic nature of rosin derivatives affect the miscibility of the resin with the other components of a formulation.
  - Molecular weight determines the size of the resin molecules, which determines the ability of a resin to fit within the free volume of a higher-molecular-weight polymer.
- **Glass transition temperature (T_g)**—The temperature at which a resin changes its state from a rigid, brittle, glasslike polymer to a viscous fluid, the T_g is a critical property for resin selection. T_g defines performance properties; tack, cohesion, low-temperature flexibility, softening point, compression set, application temperature, melt viscosity, and more all relate back to the T_g of the components of the compound.
- **Color**—The color of a tackifier resin can be an important factor for the aesthetics of a formulation. Lighter color also indicates the degree of thermal stability of a tackifier resin. Lighter-color resins are typically more highly processed to impart improved stability.

The tables on the following pages include much of the information needed to make informed selections of resins for a particular application. Product properties of interest include:

- **Ring-and-ball softening point and T_g**—useful in determining the mechanical and thermal properties of a resin as well as the optimum loading of hydrocarbon resins in polymer mixtures
- **Color measured on Gardner, yellowness index, or HunterLab b scale**—relating to the suitability of a resin for a particular application as well as the thermal stability of the resin
- **Cloud points**—indicating the aliphatic/aromatic content, polarity, and molecular weight of a resin, which influence the compatibility of a hydrocarbon resin with various polymers
- **Molecular weight distributions**—influencing the compatibility and mechanical properties of a polymer/resin compound

Understanding physical properties of resins

Resin color measurements

The method and conditions used to determine color are noted in the data tables for resin properties and include:

- **Yellowness index (YI)** is an instrumental spectrophotometric analysis used for materials with colors too pale or differences too small to be detected visually.
- **Gardner color** is based on visual comparisons of a sample against standards. While visual standards can be used, Eastman uses spectrophotometry to eliminate subjectivity.
- **HunterLab b scale** is a spectrophotometric method which measures coordinates in a three-dimensional color space with the axes defined as: L = black-white, a = red-green, and b = yellow-blue. For hydrocarbon resins only, the measurement on the b scale is used.
- **Test conditions**—There are two common sample conditions for color measurements:
  - Neat: the sample is introduced directly to a measurement cell in liquid or molten form.
  - 50% solids in toluene: the sample is dissolved in toluene prior to testing; measurements made in solution will always report lower values than the same sample tested neat.

Softening point measurement

Eastman has adopted the ring-and-ball method described in ASTM E28 for reporting softening points. Using automated equipment to run a softening point test is critical in producing meaningful and reproducible results

Glass transition temperature (T_g)

The T_g is a critical property in the formulation of adhesives and is measured with DSC (ASTM method).

Compatibility

Compatibility of polymers is difficult to measure and may mean different things in various contexts. We use cloud points to understand the solubility characteristics of our resins, which consequently indicate compatibility with different polymer systems.

Cloud points are measurements of the solubility of a polymer in systems of solvents chosen to indicate differences in the characteristics of polymers. Cloud points are determined by dissolving a small sample in hot solvents and allowing the solution to cool to observe the temperature at which the sample precipitates. There are four solvent systems for which a significant number of determinations have been made:

- **Mixed methylcyclohexane-aniline (MMA cloud point or MMAP)** uses a 1:2 mixture of methylcyclohexane and aniline to indicate the aromatic content of a polymer. As the MMAP temperature decreases, the level of aromaticity in the polymer increases.
- **Diacetone alcohol (DA cloud point or DACP)** uses a 1:1 mixture of xylene and diacetone alcohol to indicate the polarity of a polymer. Polarity increases as DACP decreases. Due to the presence of xylene in the solvent system, highly aromatic polymers will not exhibit a DACP to the limit of the test at –40°C.
- **Odorless mineral spirits (OMS cloud point or OMSCP)**, otherwise known as Stoddard solvent, indicate the relative molecular weight in a series of aromatic resins with similar composition. OMS cloud point increases as the molecular weight of a resin increases up to the boiling point of the solvent, 180°C. This test is not applicable to highly aliphatic resins due to the complete solubility of these resins in OMS.

The **molecular weight of polymers** cannot be represented by a single value. All polymers are mixtures of chains with variable lengths; therefore, the molecular weight of a polymer is expressed as a distribution described by four parameters:

- M_N (number average) is the average molecular weight of the polymer and emphasizes the low-molecular-weight fractions of the polymer.
- M_W (weight average) is the calculation of the peak regions of the distribution, so it is the number that best represents the overall molecular weight of the polymer. Most hydrocarbon resins have M_W values between 1,000 and 5,000 daltons.
- M_Z is the weight of the heaviest chains detected in the polymer. In general, polymers with a higher M_Z are less compatible with other polymers.
- P_d **(M_W/M_N)** is the polydispersity of the polymer. The higher the P_d, the broader is the molecular weight distribution. Polymers with a low P_d are more compatible with other polymers. Most hydrocarbon resins have P_d numbers between 1.5 and 2.5.

Eastman hydrocarbon resins

Regalrez™ hydrogenated hydrocarbon resins

Typical properties

	Regalrez 1018	Regalrez 1085	Regalrez 1094	Regalrez 1126	Regalrez 6108	Regalrez 3102
Ring-and-ball softening point, °C	17	87	95	124	108	103
Color, yellowness index[a]	6	3	3	3	3	5
T_g, °C (midpoint)	–23	35	39	69	55	50
MMA cloud point, °C	65	87	84	91	56	25
DA cloud point, °C	20	43	53	69	25	–29
OMS cloud point, °C	<–40	<–40	<–20	<–40	<–40	<–40
Molecular weight						
M_Z	500	1,500	1,500	2,100	2,300	2,400
M_W	370	1,050	950	1,300	1,460	1,500
M_N	300	680	590	800	800	800
P_d (M_W/M_N)	1.2	1.5	1.6	1.6	1.8	1.9

[a]*50% solids in toluene*

Characteristics

These products are manufactured by hydrogenation of aromatic resins. Their specific gravity is between 0.95 and 1.05 measured at 25°C (77°F).

No antioxidants or UV stabilizers are added to these products, as they demonstrate exceptional thermal and UV stability.

Nomenclature

The first digit of the grade number identifies the level of hydrogenation. Grade numbers beginning with 1 are fully hydrogenated. Grade numbers with first digits from 3 to 6 are partially hydrogenated, and the grade number indicates the relative degree of hydrogenation in the product. The other 3 digits of the grade number indicate the ring-and-ball softening point of the product.

Applications

Fully hydrogenated Regalrez resins are most compatible with low-polarity polymers such as polyolefins, including m-PE and OBC, SEBS and SEPS block copolymers (mid-block modification only), petroleum waxes, and hydrocarbon oils. Partially hydrogenated grades are compatible with more polar polymers such as EVA, acrylic, SBR, and ABS.

Fully hydrogenated grades are most commonly used as tackifiers for SEBS and SEPS block copolymers for adhesive and sealant applications. Regalrez tackifiers are used where the lowest color and most environmental resistance are required. For plastic modification, Regalrez resins are used for producing soft and flexible thermoplastic elastomer compounds with high coefficients of friction. The partially hydrogenated grades are also suitable as tackifiers for acrylic polymers.

Regional availability

Regalrez resins are made in the United States and are available globally.

Regalite™ and Plastolyn™ hydrogenated hydrocarbon resins

Typical properties

	Regalite R1010	Regalite C8010	Regalite R1090	Regalite R1100 S1100	Regalite R1125	Plastolyn R1140	Regalite S5090	Regalite R7100	Regalite C6100	Regalite C6100L	Regalite S5100	Regalite S7125
Ring-and-ball softening point, °C	Liquid	Liquid	88	100	123	139	91	102	100	100	100	123
Color, HunterLab, b[a]	<1[b]	<10[c]	0.6[a]	0.6[a]	0.8[a]	1.2[a]	4.8[a]	2.4[a]	<1[b]	9[c]	5.0[a]	2.1[a]
T_g, °C (midpoint)	—	—	36	—	70	91	—	49	49	49	—	69
MMA cloud point, °C	82	—	77	80	88	94	56	66	31	31	60	77
DA cloud point, °C	—	—	39	45	56	—	—	14	31	31	8	35
OMS cloud point, °C	<–40	<–40	<–40	<–40	<–40	<–40	<–40	–32	<–50	<–50	–5	<–40
Molecular weight												
M_Z	—	—	1,000	1,200	1,800	2,400	1,200	1,400	1,880	—	1,500	2,200
M_W	—	—	700	830	1,200	1,500	740	890	1,010	—	900	1,300
M_N	—	—	530	600	780	900	540	600	610	—	610	800
P_d (M_W/M_N)	—	—	1.3	1.4	1.5	1.7	1.4	1.5	1.6	—	1.5	1.6

[a]*HunterLab color b-scale product specification, 50% solids in toluene, 5-cm path length*
[b]*Gardner color, 50% solids in toluene*
[c]*Yellowness index, 2-cm path*

Characteristics

These products are manufactured by selective hydrogenation of aromatic resins. Their specific gravity is between 0.99 and 1.03 measured at 25°C (77°F).

The first digit of the grade number identifies the level of hydrogenation; 1 as the first digit indicates full hydrogenation. Grade numbers with first digits from 5 to 7 indicate the relative degree of partial hydrogenation. Regalite R grades are stabilized with an antioxidant; S grades have no antioxidant added.

Applications

Regalite resins are used when low color and excellent thermal stability are needed. Due to the selective hydrogenation technology used to produce Regalite resins, they are compatible with a wide range of polymers; however, the level of hydrogenation must be considered in selecting the correct product for a specific application. Fully hydrogenated Regalite resins are compatible with polymers such as polyolefins, including m-PE, m-PP, APAO, and OBC, as well as SEBS and SEPS block copolymers (mid-block modification only), petroleum waxes, and hydrocarbon oils. Partially hydrogenated Regalite grades are compatible with more polar polymers such as EVA, acrylic, SBR, and SIS and SBS block copolymers. Typical uses include adhesives, sealants, and coatings.

The most important application for Plastolyn R1140 is in the production of BOPP films for packaging.

Regional availability

Regalite R and S types and Plastolyn R1140 are available globally. Regalite C-type hydrogenated hydrocarbon resins are available only in the Asia Pacific region.

Eastotac™ hydrogenated hydrocarbon resins *(H-series)*

Typical properties

	Eastotac H-100E	Eastotac H-100R	Eastotac H-100L	Eastotac H-100W	Eastotac H-115E	Eastotac H-115R	Eastotac H-115L	Eastotac H-115W	Eastotac H-130E	Eastotac H-130R	Eastotac H-130L	Eastotac H-130W	Eastotac H-142R	Eastotac H-142W
Ring-and-ball softening point, °C	100	100	100	100	115	115	115	115	130	130	130	130	142	142
Color, yellowness index	5[a]	11[b]	18[c]	8[c]	5[a]	11[b]	18[c]	8[c]	5[a]	11[b]	18[c]	8[c]	11[b]	8[c]
T_g, °C (midpoint)	47	47	47	47	59	59	59	59	74	74	74	74	88	88
MMA cloud point, °C	77	78	81	82	77	78	81	82	77	78	81	82	78	82
DA cloud point, °C	62	70	74	82	62	70	72	82	62	70	74	82	78	82
OMS cloud point, °C	<–50	<–50	<–50	<–50	<–50	<–50	<–50	<–50	<–50	<–50	<–50	<–50	<–50	<–50
Molecular weight														
M_Z	2,100	2,200	2,200	2,000	2,100	2,200	2,200	2,000	2,100	2,200	2,220	2,000	2,200	2,000
M_W	1,000	980	980	930	1,000	980	980	930	1,000	980	980	930	980	930
M_N	480	500	490	500	480	500	490	500	480	500	490	500	500	500
P_d (M_W/M_N)	2.1	2.0	2.0	1.9	2.1	2.0	2.0	1.9	2.1	2.0	2.0	1.9	2.0	1.0

[a] *Gardner color*
[b] *50% solids in toluene, 1-cm path length*
[c] *50% solids in toluene, 5-cm path length*

Characteristics

These products are produced from mixed hydrocarbon feedstocks followed by hydrogenation. They are characterized by low color, low odor, good heat stability, and excellent compatibility with olefinic polymers. Eastotac resins are produced in four ranges of color (economical, regular, light, and water-white) and softening point. Their specific gravity is 1.05 measured at 25°C (77°F). For protection against degradation during storage, all Eastotac resins have 0.1%–0.5% antioxidant added.

Applications

Eastotac H-series resins are suitable for a variety of adhesive and sealant applications where low color and excellent stability are required. They are compatible with m-PE, m-PP, OBC, SIS, SEBS and SEPS block copolymers (mid-block modification only), EVA (<30% vinyl acetate), butyl rubber, EPDM, natural rubber, amorphous polyolefins, petroleum waxes, and hydrocarbon oils. The low color and high stability of Eastotac R-, L-, and W-type resins make them especially useful for rubber and plastic modification and in formulation of hot-melt adhesives for production of nonwoven laminates and packaging. Eastotac E-type resins are useful in applications where color and stability are not as critical.

Regional availability

Eastotac H-series resins are produced in the United States and are available throughout North and South America, Europe, Middle East, and Africa. Availability in Asia will depend on whether or not there is a regionally produced equivalent material available.

Eastotac™ hydrogenated hydrocarbon resins *(C-series)*

Typical properties

	Eastotac C-100R	Eastotac C-100L	Eastotac C-100W	Eastotac C-100XF	Eastotac C-115R	Eastotac C-115L	Eastotac C-115W
Ring-and-ball softening point, °C	100	100	100	100	115	115	115
Color, yellowness index	11[a]	9[b]	4[b]	2	11[a]	9[b]	4[b]
T_g, °C (midpoint)	47	47	47	—	59	59	59
MMA cloud point, °C	78	81	82	83	77	81	82
DA cloud point, °C	70	74	82	64	70	74	-82
OMS cloud point, °C	<–50	<–50	<–50	<–50	<–50	<–50	<–50
Molecular weight							
M_Z	2,200	2,200	2,000	1,900	2,200	2,200	2,000
M_W	980	980	930	1000	980	980	930
M_N	500	490	500	550	500	490	500

[a]*50% solids in toluene, 1-cm path length*
[b]*50% solids in toluene, 5-cm path length*

Characteristics

These products are produced in China from mixed hydrocarbon resins followed by hydrogenation. They are characterized by low color, low odor, good heat stability, and compatibility with a wide range of polymers. Eastotac C100XF is a premium grade with excellent thermal stability and low VOC content.

Applications

Eastotac C-series resins are used in the same applications as the H-grades described previously.

Regional availability

The Eastotac C-series hydrogenated hydrocarbon resins are produced in China and are available throughout the Asia Pacific region.

Specialty water-white aromatic resins

Typical properties

	Endex 155	Endex 160	Piccolastic A5	Piccolastic A75	Piccolastic D125	Piccotex 75	Piccotex LC	Piccotex 100	Piccotex 120	Plastolyn 240	Plastolyn 290
Ring-and-ball softening point, °C	153	158	5	73	127	75	92	98	119	120	140
Color, yellowness index	5	4	3[a]	7	4	8	8	6	6	5	5
T_g, °C (midpoint)	105	110	–22	36	64	36	46	50	70	72	90
MMA cloud point, °C	15	16	–6	5	13	–1	3	7	11	9	8
DA cloud point, °C	–20	–12	<–40	<–40	<–40	<–40	<–40	<–40	<–40	<–40	<–40
OMS cloud point, °C	117	152	–29	63	>180	–15	–9	26	52	>180	>180
Molecular weight											
M_Z	12,900	22,500	560	2,200	238,000	1,800	2,200	4,100	7,200	7,600	10,900
M_W	6,900	9,200	360	1,360	41,800	1,100	1,400	2,400	4,100	4,060	5,000
M_N	2,500	2,900	280	760	1,450	650	860	1,200	1,800	1,550	1,600
P_d (M_W/M_N)	2.8	3.2	1.3	1.8	28.8	1.7	1.6	2.0	2.3	2.6	3.1

[a]*Gardner color 50% solids in toluene, 5-cm path length*

Characteristics

These are aromatic resins based on pure monomer feedstocks. The degree of reactive unsaturation is low, with bromine numbers <8. The specific gravity of these products at 25°C (77°F) is 1.04 to 1.10. Because of their inherent stability, these products do not contain an antioxidant.

Applications

Endex™ and Piccolastic™ hydrocarbon resins

The high molecular weight and T_g of Endex resins make them particularly suited for reinforcement of styrenic block copolymers (SBC). They are used in hot-melt adhesives, pressure-sensitive adhesives, and modification of TPE compounds to increase cohesive strength, hardness, and resistance to high temperatures and reduce compression set of SBC-based compounds. The liquid-grade Piccolastic A5 aromatic resin is useful as a plasticizer for aromatic, acrylic, and epoxy polymers. The high-softening-point grades are used in adhesives, rubber and plastic modification, EVA compounding, and as a binder for xerographic toner. The workability, clarity, and resilience of Piccolastic D125 make it especially useful in the production of breakaway objects.

Piccotex™ and Plastolyn™ hydrocarbon resins

Piccotex resins are commonly used in adhesives, coatings, investment casting, and baking enamels and as dry size agents. Piccotex resins added to paraffin inhibit shrinkage of the mixture on solidification, making them especially suited to formulation of wax-casting compounds. Plastolyn resins are used as processing aids for injection molding for polymers like EVA, ABS, PVC, and SBC. Their low color and compatibility make them ideal tackifiers for polychloroprene-based contact adhesives for uses where low color is required.

Regional availability

Endex, Piccotex, and Piccolastic water-white aromatic resins are made in the United States and are available globally. Piccolastic A5 is not available in Europe.

Kristalex™ water-white aromatic resins

Typical properties

	Kristalex 3070	Kristalex F85	Kristalex 3085	Kristalex 3100	Kristalex F100	Kristalex 1120	Kristalex F115	Kristalex 5140
Ring-and-ball softening point, °C	70	86	85	100	100	120	117	140
Color, yellowness index	7	2.2[a]	4	5	1.8[a]	5	2.2[a]	5
T_g, °C (midpoint)	32	32	39	51	53	68	60	90
MMA cloud point, °C	1	5	2	6	—	2	—	10
DA cloud point, °C	<–40	<–40	<–40	<–40	—	<–40	—	<–40
EMDA cloud point, °C	4	—	—	—	55	—	88	—
OMS cloud point, °C		49	35	65	69	>180	107	>180
Molecular weight								
M_Z	1,320	1,700	1,900	2,500	2,100	6,000	3,200	9,800
M_W	900	1,000	1,200	1,500	1,300	2,600	1,900	4,900
M_N	600	670	660	900	920	900	1,000	1,750
P_d (M_W/M_N)	1.5	1.6	1.8	1.7	1.6	2.9	1.9	2.8

[a]*HunterLab color b scale product specification, 50% solids in toluene, 5-cm cell*

Characteristics

These are resins with low color, excellent stability, and a wide range of softening points. The specific gravity of these products at 25°C is 1.04 to 1.10. Because of their inherent stability, these products do not contain an antioxidant.

Applications

A major application of Kristalex™ hydrocarbon resins is the modification of the end blocks of styrenic block copolymers. The grades of Kristalex resins with low softening points will tend to soften and contribute to the tack of block copolymer formulations, while the higher-softening-point grades tend to strengthen the end blocks and increase cohesion and high-temperature resistance. Kristalex resins are also used in EVA packaging, woodworking, and bookbinding adhesives to provide specific adhesion properties. Other uses for Kristalex resins include coatings, clear sealants, laminating adhesives, textile dry sizes, and plastic modification.

Regional availability

Kristalex F-series resins are made in Europe; all other Kristalex resins are made in the United States. Kristalex resins are available globally.

Low-VOC, water-white aromatic hydrocarbon resins

Typical properties

	Kristalex 3105SD	Kristalex 3115LV	Kristalex 5140LV	Kristalex 5140SD	Plastolyn 290LV
Ring-and-ball softening point, °C	100	120	140	140	140
Organic volatile content, ppm[a]	150	300	300	150	300
Color, yellowness index	7[b]	10	7	7	7
T_g, °C (midpoint)	51	72	90	90	90
MMA cloud point, °C	6	5	10	10	8
DA cloud point, °C	<–40	<–40	<–40	<–40	<–40
OMS cloud point, °C	65	105	>180	>180	>180
Molecular weight					
M_Z	2,400	3,700	8,900	8,900	7,300
M_W	1,450	2,100	4,650	4,650	3,700
M_N	700	900	1,650	1,650	1,500
P_d (M_W/M_N)	2.1	2.4	2.8	2.8	2.5

[a] *HPLC method*
[b] *50% solids in toluene, 2-cm path length*

Characteristics

To address demand for products with low volatile organic compound (VOC) levels in formulations, Eastman now offers Kristalex 3105SD, Kristalex 3115LV, Kristalex 5140SD, and Plastolyn 290LV resins. These products are identical in performance and compatibility compared to non-LV counterparts in adhesives, sealants, and TPE compounds, but they are manufactured with a maximum 500 ppm VOC content. This compares to VOC content ranging from 2,000 to 10,000 ppm for traditional pure monomer resins. With very low VOC and residual monomer levels, these products are attractive options for those concerned with controlling VOC levels without sacrificing the performance of traditional pure monomer resins. Kristalex 3105SD and 5140SD have particularly low residual monomer and oligomer content and exceptional thermal stability and are recommended for use in direct food packaging applications as well as for applications requiring very low odor.

Regional availability

Low-VOC pure monomer resins are available globally.

Piccotac™ hydrocarbon resins

(Aliphatic hydrocarbon resins)

Typical properties

	Piccotac 1020	Piccotac 1020-E	Piccotac 1095	Piccotac 1095N	Piccotac 1098	Piccotac 1100	Piccotac 1100-E	Piccotac 1115
Ring-and-ball softening point, °C	10	Liquid	95	97	100	101	101	112
Color, Gardner[a]	3	3	2	3	2	2	4	2
T_g, °C (midpoint)	–22	—	44	—	48	47	—	58
MMA cloud point, °C	92	92	94	94	95	96	97	96
DA cloud point, °C	51	46	57	47	61	65	58	73
OMS cloud point, °C	<–40	<–50	<–40	<–50	<–40	<–40	<–50	<–40
Molecular weight								
M_Z	3,200	2,900	3,600	3,400	4,900	8,000	6,700	9,650
M_W	1,400	1,800	1,800	1,900	2,200	3,000	2,700	3,400
M_N	650	1,100	900	1,000	900	1,000	1,200	1,100
P_d (M_W/M_N)	2.2	1.6	2.0	1.8	2.4	3.0	2.2	3.1

[a]*50% solids in toluene*

Characteristics

These products are produced using mixed hydrocarbon feedstocks. They are characterized by low color, low odor, good heat stability, and compatibility with a wide range of polymers. They have a moderate level of reactive unsaturation with bromine numbers between 20 and 40. Specific gravity is between 0.91 and 0.97 measured at 25°C (77°F). For protection against degradation during storage, all Piccotac resins have 0.1% antioxidant added.

Applications

Fully aliphatic types of Piccotac resins have grade numbers that begin with 1. The low polarity of the aliphatic structure of these resins suggests their use in polymer systems, including polyolefins, petroleum waxes, natural rubber, SIS block copolymers, and EVA with <30% vinyl acetate. Piccotac aliphatic resins are typically used in wax and rubber compounding, adhesives, hot-melt road marking, and coatings.

Regional availability

Piccotac resins are available globally. Grades of Piccotac resins with a four-digit grade number are produced in the United States; those with a letter suffix such as -E or -N are produced in Europe.

Piccotac™ hydrocarbon resins

(Aromatic modified aliphatic resins)

Typical properties

	Piccotac 9095	Piccotac 9095-E	Piccotac 8595	Piccotac 8095	Piccotac 8090-E	Piccotac 7590-N	Piccotac 7050
Ring-and-ball softening point, °C	95	95	94	95	92	91	49
Color, Gardner	3	3	2	2	4	2	2
T_g, °C (midpoint)	44	—	44	44	—	—	7
MMA cloud point, °C	87	87	82	78	66	67	65
DA cloud point, °C	53	—	43	45	20	22	14
OMS cloud point, °C	<–40	—	<–40	<–40	—	—	<–40
Molecular weight							
M_Z	4,250	3,500	3,250	5,300	3,700	2,500	1,700
M_W	2,150	1,900	1,700	2,200	1,800	1,700	1,000
M_N	800	1,000	850	900	910	1,000	650
P_d (M_W/M_N)	2.3	1.9	2.0	2.4	1.9	1.7	1.5

Characteristics

These products are produced from mixed aliphatic hydrocarbon feedstocks. They are characterized by light-yellow color, low odor, good heat stability, and compatibility with a wide range of polymers. They have a moderate level of reactive unsaturation with bromine numbers between 20 and 40. Specific gravity is between 0.91 and 0.97 measured at 25°C (77°F). For protection against degradation during storage, all Piccotac resins have 0.1% antioxidant added.

Nomenclature

These products are produced from mixed aliphatic and aromatic hydrocarbon feedstocks. By introducing carefully controlled levels of aromaticity, compatibility with a range of different polymers is possible. The first two digits of a Piccotac resin grade number indicate the relative aliphatic content: 90 < 85 < 80, etc. The last two digits indicate the ring-and-ball softening point of the product.

Applications

The more aliphatic types of Piccotac resins, those with grade numbers higher than 8000, are compatible with natural rubber, SIS block copolymer, and polyolefins. The more aromatic Piccotac resins, those with grade numbers 8500 and lower, are compatible with SIS/SBS SIBS block copolymers, SBR, and EVA with <40% vinyl acetate. Aromatic-modified grades are commonly used in pressure-sensitive adhesives for tapes and labels, hot-melt assembly adhesives for nonwoven products, and hot-melt packaging adhesives

Regional availability

Piccotac resins are available globally. Grades of Piccotac resins with a four-digit grade number are produced in the United States; those with a letter suffix such as -E or -N are produced in Europe.

Picco™ hydrocarbon resins

(Aromatic hydrocarbon resins)

Typical properties

	Picco A10	Picco AR85	Picco A100	Picco AR100	Picco A120	Picco A140
Ring-and-ball softening point, °C	Liquid	87	101	101	124	140
Color, Gardner	11 (neat)	9	8	9	7	6
T_g, °C (midpoint)	—	36	55	—	—	88
EDMA cloud point, °C	106	39	58	43	56	74
DA cloud point, °C	–24	—	—	—	—	—
OMS cloud point, °C	0	<-30	35	<-30	65	94
Molecular weight						
M_Z	1,850	1,100	1,600	1,100	2,400	3,300
M_W	750	720	860	750	1,300	1,800
M_N	420	530	560	580	750	940
P_d (M_W/M_N)	1.8	1.4	1.5	1.3	1.7	1.9

Characteristics

These products are manufactured using a mixture of petroleum-derived aromatic feed streams. They are characteristically light-amber to dark-brown materials with a characteristic aromatic hydrocarbon odor.

Applications

Picco resins have varying degrees of aromaticity and reactive unsaturation and are useful in adhesives, rubber compounding, printing inks, coatings, paints, concrete curing, waterproofing, and sealants. They are compatible in useful proportions with styrene-butadiene rubber, acrylics, nitrile rubber, polychloroprene, and chlorinated paraffin.

Regional availability

Picco A-series and AR-series resins are manufactured in Middelburg, The Netherlands. These products are available in Europe, Middle East, Africa, and Asia Pacific regions.

Eastman rosin resins

Foral™ hydrogenated rosin resins

(Fully hydrogenated rosin resins)

Typical properties

	Foral 85-E CG	Foral 85-E	Foral 105-E CG	Foral 105-E	Foral AX-E
Ring-and-ball softening point, °C	85	85	101	101	80
Color, Gardner[a]	2	2	6	6	1
Acid number (mg KOH/g)	9	9	14	14	165
Density @ 25°C	1.06	1.06	1.06	1.06	—
Viscosity, Brookfield,[b] cP					
120°C	—	1,500	—	20,000	—
140°C	—	340	—	2,100	—
160°C	—	<100	—	410	—

[a] *50% solids in toluene*
[b] *Brookfield LVTF, spindle 31*

Characteristics

Due to their high degree of hydrogenation, Foral resins have outstanding resistance to oxidation and discoloration caused by heat or aging. These resins do not contain antioxidants.

Applications

Typical applications for Foral resins are solvent-based and hot-melt pressure-sensitive adhesive for specialty tapes and labels, as well as UV-curable acrylic hot-melt adhesives due to their low absorbance in the UV spectrum. Due to their high degree of hydrogenation, Foral resins have the best compatibility with olefinic polymers out of the rosin resin family and can be used to increase adhesion to difficult substrates.

Foral CG resins are used in cosmetics applications like color cosmetics, nail polish, and lipstick.

Regional availability

Foral resins are manufactured in Europe and are available globally.

Foralyn™ hydrogenated rosin resins

(Fully hydrogenated rosin resins)

Typical properties

	Foralyn 90	Foralyn 90-FG	Foralyn 110	Foralyn 110-FG	Foralyn 5020-F CG	Foralyn 5020-F	Foralyn E
Ring-and-ball softening point, °C	82	90[a]	101	108[a]	Liquid	Liquid	75
Color, Gardner[b]	2	3	3	4	3	3	2
Acid number (mg KOH/g)	8	8	12	13	6	6	168
Density @ 25°C (kg/dm³)	1.07	1.06	1.07	1.07	1.03	1.03	—
Viscosity, Brookfield,[b] cP							
120°C	2,800	—	—	—	—	—	—
140°C	500	—	3,100	—	—	—	—
160°C	130	—	600	—	—	—	—
180°C	—	—	150	—	—	—	—
Refractive Index @ 20°C	—	—	—	—	1,519	1,519	1,498

[a] *Hercules drop method*
[b] *As is (neat resin)*
[c] *Brookfield LVTF, spindle 31*

Characteristics

Foralyn resins combine the thermal and oxidative stability of the other hydrogenated rosin resins with excellent initial color and improved thermal stability.

Applications

Foralyn resins are typically used in solvent-based and hot-melt adhesive formulations where light color and excellent stability are required. They are very compatible with EVA, styrenic block copolymers, natural and synthetic rubbers, and acrylics. They are less suitable for UV-curable acrylics than the Foral grades.

Foralyn 5020-F CG is used for cosmetics applications—for example, as a fixative for perfume formulations.

Foralyn 90-FG and Foralyn 110-FG are used as food ingredients, namely for the formulation of chewing gum base.

Regional availability

Foralyn resins are manufactured in Europe and are available globally.

Staybelite™ and Pentalyn™ rosin resins

Typical properties

	Staybelite Ester 5-E	Staybelite Ester 10-E	Staybelite Ester 3-E	Pentalyn H-E
Ring-and-ball softening point, °C	86[a]	86	—	99
Color, Gardner[b]	6	6	6	8 (molten)
Acid number (mg KOH/g)	7	9	8	15
Density @ 25°C (kg/dm³)	1.06	1.07	—	1.07
Viscosity, cP				
120°C	—	1,800	—	—
140°C	—	330	—	2,600
160°C	—	90	—	480
180°C	—	—	—	110

[a]*50% resin solids in toluene*
[b]*Hercules drop method*

Characteristics

Staybelite resins and Pentalyn H-E are the most economic hydrogenated rosin resins and should be used in formulations where the price is sensitive but which still require the compatibility and stability of a hydrogenated product. These resins do not contain an antioxidant.

Applications

Staybelite resins and Pentalyn are typically used in solvent-based and hot-melt adhesive formulations where very good stability is required. They are very compatible with EVA, styrenic block copolymers, natural and synthetic rubbers, and acrylics. They are less suitable for UV-curable acrylics than the Foral grades.

Staybelite Ester 5-E is used as a food ingredient, namely for the formulation of chewing gum base.

Regional availability

Staybelite and Pentalyn resins are manufactured in Europe and are available globally.

Abalyn™ D-E and Abitol™-E rosin resins

Typical properties

	Abalyn D-E	Abitol-E
Ring-and-ball softening point, °C	Liquid	Liquid
Color, Gardner[a]	4	1
Acid number (mg KOH/g)	5	0.1
Density @ 25°C (kg/dm³)	1.04	1.01
Viscosity, Brookfield,[b] cP	4,700 @ 25°C	6,500 @ 50°C
Refractive Index @ 20°C	1.53	1.53
Color HunterLab b[c]	—	2
Hydroxyl number, %	—	4.7

[a]*As is (neat resin)*
[b]*Brookfield LVTD, spindle 31*
[c]*5-cm path length, 50% in toluene; illuminant C, 2° observer*

Characteristics

Abitol E resin is a colorless, tacky, highly viscous liquid resin with excellent thermal stability. Chemically, it is a high-molecular-weight, primary, monohydric alcohol derived from hydrogenated rosin acids. Abalyn D-E is an amber-colored liquid resin with very good compatibility with almost all polymers and provides excellent wettability and tack.

Applications

Abitol E can be used as an additive to hot-melt and reactive PUR adhesive systems to enhance specific adhesion to difficult substrates. Both resins are used in specialty tapes, as adjuvants for crop protection, and in hot-melt labels.

Regional availability

Both resins are manufactured in Europe and are available globally.

Dymerex™ and Poly-Pale™ modified rosins

Typical properties

	Dymerex	Poly-Pale
Ring-and-ball softening point, °C	144	103
Color, Gardner	9	8
Acid number (mg KOH/g)	145	146
Density @ 25°C (kg/dm^3)	1.069	1.069
Viscosity, Brookfield cP		
100°C	—	100,800
120°C	—	4,100
140°C	—	400
150°C	153,000	—
160°C	—	100
170°C	7,000	—
180°C	—	33
190°C	740	—
210°C	145	—

Characteristics

Dymerex™ modified rosin is a pale, acidic, thermoplastic, high-softening-point resin. It is composed predominately of dimeric acids derived from rosin with lesser amounts of monomeric resin acids and neutral materials of rosin origin. Dymerex modified resin has high resistance to oxidation and does not crystallize from solutions or from solid compositions. It is compatible with many natural and synthetic film formers and rubbers. Being an acidic resin, it reacts readily with polyalcohols or hydrated lime to yield high-melting derivatives.

Poly-Pale™ modified resin is a pale, partially dimerized rosin. Like Dymerex, it has a higher softening point than regular rosin acids, higher viscosity (molten and in solution), much greater resistance to oxidation, and complete freedom from crystallizing when in solid form or in solution.

Applications

Dymerex and Poly-Pale are unique in that they combine the excellent compatibility of other rosin acids with good thermal stability and a very high softening point. They can be used as high-softening-point additives to adhesive formulations to provide polarity and improved adhesion, especially to low-energy surfaces.

Dymerex and Poly-Pale are compatible with ethyl cellulose, natural rubber, SBR (styrene-butadiene), polychloroprene, drying oils, alkyd resins, shellac, low-molecular-weight polyethylene, paraffin, and microcrystalline waxes.

Uses include the preparation of varnishes, driers, synthetic resins, ink vehicles, floor tile, rubber compounds, solder fluxes, and various adhesives and protective coatings.

Regional availability

Both resins are available globally.

We make polymers work.

At Eastman, we're not just proven in the markets we serve; we're improving them. We are a global producer of raw materials for the adhesives and sealants industries, where our material expertise helps our customers make polymers work. And while our resins have set a standard of excellence in the industry, our worldwide manufacturing sites ensure a global security of supply.

What's more, we offer an extensive sales and technology support network to give you a spectrum of formulating and innovation options.

For more information about Eastman tackifier resins, visit www.tackifier.com.

(Some of this information is available only to registered users of the Eastman Customer Center.)

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