CRAY VALLEY | PRODUCT GUIDE

TotalEnergies

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CRAY VALLEY

PROFILE

Cray Valley is a leading manufacturer of low-molecular-weight butadiene homopolymers and copolymers, pure monomer tackifying resins and specialty bio-based monomer resins.

Marketed under the brand names ***Ricon***®, ***Krasol***®, and ***Cleartack***®**,** our resins are known for consistency and quality our customers trust.

Cray Valley supports rubber, adhesive, coatings, electronics, polymer and many more markets. Our technologies allow us to develop products that bring needed properties to the market, including rheology control, dynamic modulus, crosslinking, adhesion, sealing, and dispersion, or provide backbone structures for polymer synthesis or use as reactive intermediates.

Continuous improvement and technology innovation enable Cray Valley to capitalize on new product development and manufacturing excellence. These synergies provide increased value to our customers and the markets they serve.

CRAY VALLEY

TotalEnergies

Cray Valley is part of the TotalEnergies Refining and Chemicals Global Polymers Division.

As part of the TotalEnergies family, Cray Valley benefits from true top-down commitment to sustainability, quality and safety in everything we do. We actively work to supply our plants with sustainable feedstocks and work every day to find renewable solutions to assist in our goal for NetZero initiatives. We strive to manage our facilities in a manner that is safe for our employees and our surrounding communities. With our ISO 9001, Responsible Care, and sustainability international ratings such as EcoVadis, Cray Valley is conscious of its commitment to the environment and its carbon footprint. Along with integrated raw material supplies, enhancing customer support, and always-evolving environmental and regulatory initiatives, the relationship with TotalEnergies allows Cray Valley to support our global customers in areas important to us all.

SUSTAINABILITY

At Cray Valley we aim to accelerate our customers' transition to low carbon and environmentally responsible products through innovative and reliable solutions. We have established our sustainability ambitions into three fundamental pillars:

REDUCING OUR ENVIRONMENTAL FOOTPRINT

Improving our processes and efficiencies both in our manufacturing facilities and supply chain to reduce our CO_2 footprint

- Increasing renewable power, incorporating electrification and improving process efficiencies
- Reducing wastes and emissions
- Carbon neutral supply chain solutions
- Circular solutions for our packaging

ENABLING CUSTOMER SUSTAINABILITY

Creating technologies that help our customers achieve their sustainability objectives

- Enabling energy efficiency improvements in construction and automotive applications
- Enabling green chemistries through VOC reduction and sustainable reactants
- Integrating Life Cycle Analysis in our development and selection criteria

UTILIZING SUSTAINABLE RAW MATERIALS

Utilizing renewable raw materials to produce value-added products with increased sustainable content

- Implementing certified renewable feedstocks through mass balance approach
- Incorporating bio-based monomers into existing products
- Increasing the sustainable content of our customers' formulations
- Identifying and securing new sustainable feedstocks

To accelerate in the circular economy, the platform is developing the use of feedstocks obtained through the processing of bio-based or advanced recycling materials.

Cray Valley offers a complete sustainable portfolio for Ricon, Krasol and Cleartack products under the ISCC PLUS mass balance approach. ISCC PLUS (International Sustainability & Carbon Certification), a globally applicable certification system, ensures traceability and secures the custody through mass balance approach along the value chain, from feedstocks to the final product.

Access to sustainable feedstocks on a global scale is key. Cray Valley is expanding ISCC PLUS certification to all their production sites worldwide while combining R&D developments to maximize the integration of bio-based feedstocks such as farnesene, among others.

MARKET BREAKDOWN

Rubber Additives

Ricon® | Krasol® | Cleartack®

Cray Valley has developed a portfolio of products for the tire industry. Ricon and Krasol liquid polybutadiene resins and Cleartack pure monomer resins are established as performance-enhancing additives for tire tread compounds requiring specific recipes for different segments — winter, summer, all-season, racing, and specialty. Our Ricon resins including silylated resins modify the viscoelastic properties of these compounds to optimize the balance of traction, fuel economy, and durability.

Cray Valley is a trusted provider of Ricon, Krasol and Cleartack functional resins, which manage adhesion and dynamic properties for belt, hose, seal, wire and cable, and other industrial rubber applications. Our specialty additives deliver high modulus, hardness, and abrasion resistance to help belts retain their original properties over millions of revolutions. They enhance strong, lightweight hoses with excellent thermal, corrosion, and chemical resistance. They impart rubber adhesion to metals and reinforcing textiles.

Adhesion Promoters

Ricon® | Krasol® | Cleartack®

Cray Valley offers a wide range of products to enhance adhesion in your performance applications.

Our well-known Cleartack pure monomer resins provide styrenic end block reinforcement in SBC adhesive formulations, while imparting low color and strong tack to hot melt adhesives.

Ricon and Krasol can improve adhesion with polymer substrates such as polyolefins.

In addition to that, our specialty Ricon MA product range (based on maleic anhydride modified liquid polybutadiene) can improve adhesion with a wide variety of metal substrates and textiles such as steel, aluminum, copper, polyamide, and nylon textile. These technical advantages are employed in automotive structural adhesives, sealants, rubber adhesion, belts and hoses.

We also offer C4 resins with a variety of functionality, including hydroxyl-terminated, and maleinized polymers. These resins offer great formulating latitude in reactive adhesives.

Electronics

Ricon® | Krasol®

Our Krasol hydroxyl-terminated polybutadiene resins offer unique properties in potting and encapsulation formulations. Cured as urethanes, these resins impart good thermal resistance, excellent hydrolytic stability, and low moisture permeation. Krasol formulations show consistent elongation and embedment stress at a wide range of temperatures. High transparency enables these grades to be applied to optical applications such as touch panels and digital displays.

Ricon resins can be used in copper clad laminate (CCL) applications to improve electrical properties. When used in methacrylated PPE formulations, Ricon copolymers can replace some or all of the TAIC hardener. The Ricon resins will improve toughness while improving the dielectric properties of the formulation. Ricon copolymers have the appropriate balance of backbone chemistry and processable viscosity needed to meet the increasing demands of this industry.

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Adhesives for Solar Panels and Wind Turbines

Ricon® | Krasol®

Cray Valley's hydrogenated and non-hydrogenated resins such as Krasol can be used for solar panel backsheets to improve water resistance and protection of the solar cells from moisture and degradation, thus extending the global shelf life and efficiency of solar panels.

Ricon and Ricon MA can be used as additives in wind turbine blades to improve the glass or carbon fiber reinforcement of the blade structure and react efficiently in different types of matrices such as epoxy resins and vinyl esters. Our products will improve the toughness and flexibility of the wind turbine blades.

Thermoplastic Elastomers

Ricon® | Krasol® | Cleartack®

Cray Valley products provide important advantages for thermoplastic elastomer (TPE) applications. Ricon, Krasol, and Cleartack resins enhance the processability, mechanical, and adhesion properties for TPE and vulcanizates used in emerging automotive, fluid handling, construction, consumer goods, and wire and cable industries.

Our C4 resins find utility in applications where high filler loading is required. The resins impart the low-temperature flexibility, moisture resistance, and acid/base resistance critical to these formulations.

Ricon, Krasol, and Cleartack are reactive plasticizers in specialty applications such as printing plates where formulators can dial in hardness, chemical resistance, and resiliency. Our resins also act as oxygen scavengers in packaging applications, protecting food, juices, and medications from degradation.

Our goal in specialty markets is to work with each customer to develop value-added products that provide solutions to their formulation challenges.

	Rubber Additives	Adhesion Promoters	Electronics	Adhesives for Solar Panels and Wind Turbines	Thermoplastic Elastomers
Ricon®					
Krasol®					
Cleartack®					

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LIQUID POLYBUTADIENES

Cray Valley offers a diverse selection of specialty liquid polybutadiene grades including low and high vinyl polybutadiene homopolymers, poly(butadiene-styrene) copolymers, and a silylated polybutadiene. Ricon grades offer a complete selection of microstructures, which translates to a wide spectrum of glass transition temperatures. In addition to the base product line, functional derivatives are available.

The Ricon MA and Ricobond series include maleic anhydride grafted grades.

Our unique Krasol product line consists of both unsaturated and fully hydrogenated telechelic polybutadiene diols.

The products are used in an equally broad spectrum of markets and applications. Low-viscosity liquid polybutadienes are used as processing aids, and the wide Tg range allows for modification of tire performance properties. In addition, high vinyl grades are useful as coagents for the peroxide cure of rubber. Functional grades expand the utility of the polybutadiene resins to many other applications including polyurethanes, polyurethane dispersions, hydrophobic sealants and coatings, and thermoset/thermoplastic elastomer (TPE) modification.

RICON

Product	Description	Typical Properties				
		Molecular Weight (M_n, g/mol)	1,2 Vinyl (wt. %)	Viscosity (cps)	T_g (°C)	Specific Gravity @ 25°C
Low Vinyl Content Homopolymers						
Ricon 130	Homopolymer of Butadiene	2,500	25	800 @ 25°C	-86	0.89
Ricon 131	Homopolymer of Butadiene	5,500	28	3,250 @ 25°C	-84	0.89
Ricon 134	Homopolymer of Butadiene	10,000	28	18,000 @ 25°C	-67	0.89
Ricon 300	Homopolymer of Butadiene	1,800	15	1,300 @ 25°C	-86	0.89
Moderate Vinyl Content Homopolymers						
Ricon 138	Homopolymer of Butadiene	2,500	42	8,500 @ 25°C	-65	0.90
Ricon 142	Homopolymer of Butadiene	4,800	55	9,800 @ 25°C	-74	0.89
High Vinyl Content Homopolymers						
Ricon 150	Homopolymer of Butadiene	4,200	72	40,000 @ 25°C	-40	0.89 (1.28)
Ricon 152 (Ricon 152 DA*)	Homopolymer of Butadiene (Powdered Dispersion of High Vinyl Butadiene)	3,900	82	18,000 @ 45°C	-30	0.89 (1.28)
Ricon 153 (Ricon 153 DA*)	Homopolymer of Butadiene (Powdered Dispersion of High Vinyl Butadiene)	6,700	85	65,500 @ 45°C	-22	0.89 (1.28)
Ricon 154 (Ricon 154 DA*)	Homopolymer of Butadiene (Powdered Dispersion of High Vinyl Butadiene)	9,000	87	235,000 @ 45°C	-15	0.89 (1.28)
Ricon 156	Homopolymer of Butadiene	1,800	73	2,000 @ 25°C	-56	0.89
Ricon 157	Homopolymer of Butadiene	2,400	72	6,500 @ 25°C	-51	0.89
Butadiene-Styrene Copolymers						
Ricon 100	Butadiene-Styrene Copolymer (20% Styrene)	2,800	70	40,000 @ 45°C	-22	0.90
Ricon 110	Butadiene-Styrene Copolymer (20% Styrene)	2,400	70	40,000 @ 45°C	-20	0.90
Ricon 181 / Ricon 183	Low Vinyl Butadiene-Styrene Copolymer (28% Styrene)	5,200	30	18,000 @ 25°C	-65	0.90
Ricon 184	Low Vinyl Butadiene-Styrene Copolymer (19% Styrene)	9,400	30	70,000 @ 25°C	-61	0.90
Silylated						
Ricon 603	Silane Functinoalized Polybutadiene	3,500	65	18,000 @ 25°C	-41	0.92

*Available dispersed on powder carrier at 65-70% active

Certified renewable feedstock available

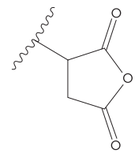
US FDA compliant for use in food contact materials.
Contact us for more information regarding limitations and suitable uses.

(Liquid Polybutadienes list continues on next page)

LIQUID POLYBUTADIENES *(continued)*

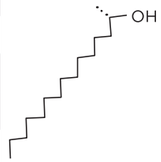
RICON MA, RICOBOND

Product	Description	Typical Properties						
		Molecular Weight (M_n, g/mol)	1,2 Vinyl (wt. %)	Viscosity (cps)	T_g (°C)	Specific Gravity @ 25°C	MA (molecules/chain)	Functionality
Homopolymers								
Ricon 130MA8	Polybutadiene Adducted with Maleic Anhydride	2,700	28	4,500 @ 25°C	-82	0.90	2	
Ricon 130MA13	Polybutadiene Adducted with Maleic Anhydride	3,300	28	19,000 @ 25°C	-76	0.90	4	
Ricon 131MA5	Polybutadiene Adducted with Maleic Anhydride	5,500	28	7,850 @ 25°C	-74	0.90	2	
Ricon 131MA10	Polybutadiene Adducted with Maleic Anhydride	6,000	28	48,000 @ 25°C	-74	0.90	5	
Ricon 131MA20	Polybutadiene Adducted with Maleic Anhydride	7,000	28	80,000 @ 55°C	-72	0.91	11	
Ricon 184MA6	Butadiene-Styrene Copolymer Adducted with Maleic Anhydride	9,200	28	65,000 @ 45°C	-25	0.89	6	
Ricobond 1731 (Ricon 1731HS*)	Polybutadiene Adducted with Maleic Anhydride (Powdered Maleinized Polybutadiene Dispersion)	6,400	28	60,000 @ 45°C	-72	.90 (1.3)	9	
Ricobond 1756 (Ricon 1756HS*)	Polybutadiene Adducted with Maleic Anhydride (Powdered Maleinized Polybutadiene Dispersion)	3,000	70	110,000 @ 55°C	-25	.89 (1.3)	3	
Ricobond 7004	Water-based Functional Aliphatic Polymer (30% Actives)	—	—	500 @ 25°C	—	1.0	—	



HYDROXY-POLYBUTADIENES*

Diols								
Krasol LBH 2000	Hydroxyl Terminated Polybutadiene	2,000	65	13,000 @ 25°C	-35	0.89	1.9	
Krasol LBHP 2000	Hydroxyl Terminated Polybutadiene	2,000	65	13,000 @ 25°C	-40	0.89	1.9	
Krasol LBH 3000	Hydroxyl Terminated Polybutadiene	3,000	65	17,000 @ 25°C	-40	0.89	1.9	
Krasol LBHP 3000	Hydroxyl Terminated Polybutadiene	3,000	65	20,000 @ 25°C	-35	0.89	1.9	
Hydrogenated Diols								
Krasol HLBHP 2000	Hydrogenated Hydroxyl Terminated Polybutadiene	2,000	—	1,750 @ 60°C	-46	0.88	1.9	
Krasol HLBHP 3000	Hydrogenated Hydroxyl Terminated Polybutadiene	3,000	—	3,000 @ 60°C	-46	0.88	1.9	
Monols								
Krasol LBH 2000M	Hydroxyl Terminated Polybutadiene Monol	2,000	62	11,000 @ 25°C	—	0.89	0.99	
Krasol LBH 5000M	Hydroxyl Terminated Polybutadiene Monol	4,700	65	25,000 @ 25°C	-45	0.89	0.99	
Krasol HLBH 5000M	Hydrogenated Hydroxyl Terminated Aliphatic Monol	4,700	—	65,000 @ 25°C	-57	0.88	0.99	
Krasol HLBH 5000M H CF	Hydrogenated Hydroxyl Terminated Aliphatic Monol	4,700	—	65,000 @ 25°C	-57	0.88	0.99	

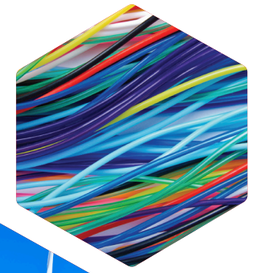


Non-hydrogenated Krasols are export controlled and require a license for export

*Available dispersed on powder carrier at 65-70% active

Certified renewable feedstock available

US FDA compliant for use in food contact materials.
Contact us for more information regarding limitations and suitable uses.



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PURE MONOMER RESINS

Cray Valley's pure monomer resin products complete a diverse portfolio. The Cleartack lines cover a wide spectrum of aromatic grades. The Cleartack W series are colorless pure monomer resins.

Pure monomer resins from Cray Valley have utility in many markets. In adhesives, resins are used in hot melts, pressure sensitive tapes and labels, construction mastics, and many specialty applications. Pure monomer resins are also excellent tackifiers and grip improver compatibilization aids in the rubber and tire market. In addition, pure monomer resins have found utility in coatings, investment wax casting compounds, thermoset/ thermoplastic elastomer (TPE) modification, hydrophobic sealants, and coatings modification, hydrophobic sealants, and coatings.

CLEARTACK

Product	Description	Typical Properties					
		Softening Point (R&B, °C)	Appearance	Color (Gardner)	Specific Gravity (20/20, g/cc)	Molecular Weight (M_n, g/mol)	T_g (°C)
W Series							
Cleartack W-85	Hydrocarbon Resin	85	Colorless Solid	<1	1.06	1,050	35
Cleartack W-90	Hydrocarbon Resin	90	Colorless Solid	<1	1.06	1,150	40
Cleartack W-100	Hydrocarbon Resin	100	Colorless Solid	<1	1.06	1,400	50
Cleartack W-110	Hydrocarbon Resin	110	Colorless Solid	<1	1.06	1,600	60

Certified renewable feedstock available

US FDA compliant for use in food contact materials.
Contact us for more information regarding limitations and suitable uses.

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BIO-BASED RESINS

Cray Valley also develops and expands its bio-based Krasol F

product range by incorporating farnesene, a C15 monomer originated from sugar cane wastes. Farnesene, thanks to its unique brush structure and hydrophobic properties, is suitable for cosmetics applications, adhesives, and rubber applications and benefits from a fossil-free composition.

BIO-BASED RESINS

Product	Description	Typical Properties				
		Molecular Weight (M_n, g/mol)	Viscosity (cps)	T_g (°C)	Specific Gravity @ 25°C	Functionality
Biosourced						
Krasol F3000	Hydroxyl Terminated Polyfarnesene	3,000	1,700	-65	0.90	2.0
Krasol F3100	Hydrogenated Hydroxyl Terminated Polyfarnesene	3,000	15,000	-56	0.90	1.9

Certified renewable feedstock available

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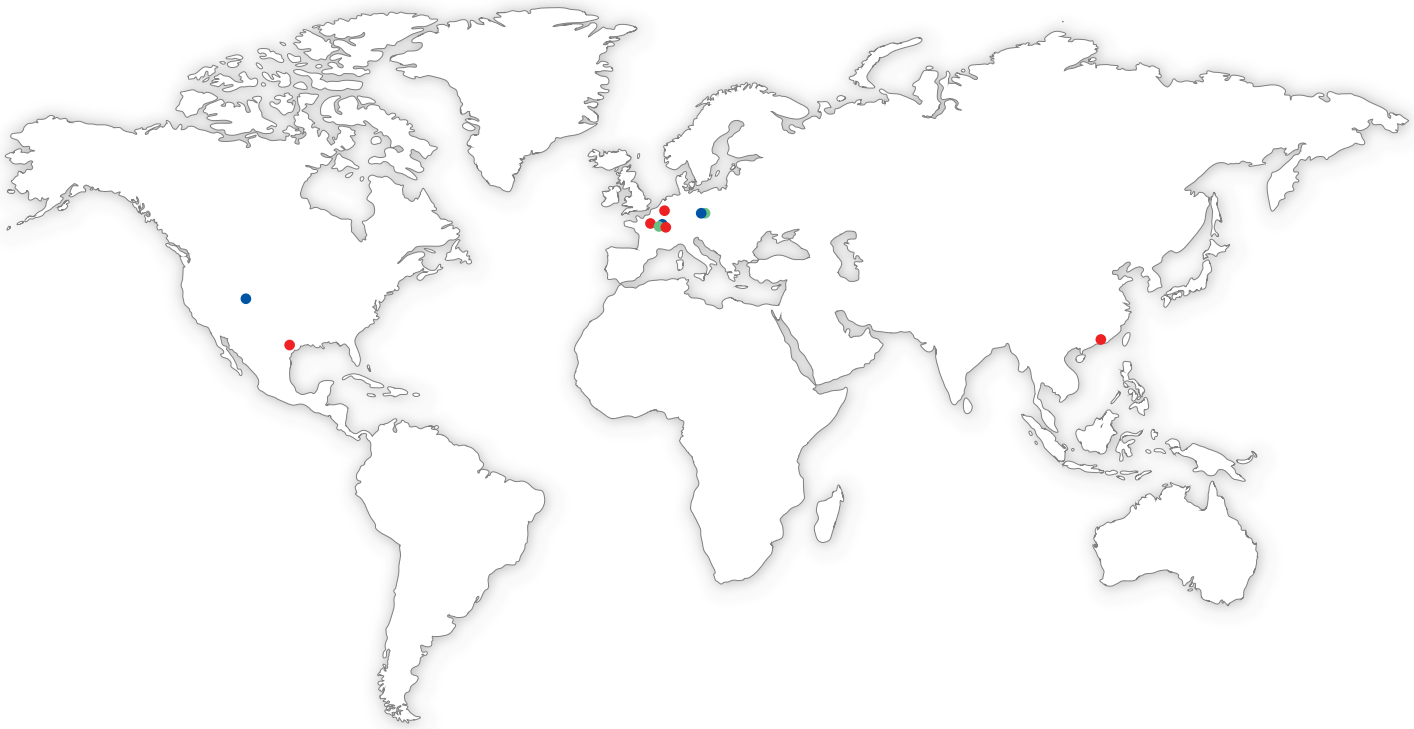

GLOBAL PRESENCE

● Commercial Offices

Brussels, Belgium
Carling, France
Guangzhou, China
Houston, TX, USA
Paris, France

● Laboratories

Carling, France
Kralupy, Czech Republic

● Manufacturing Sites

Carling, France
Grand Junction, CO, USA
Kralupy, Czech Republic

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