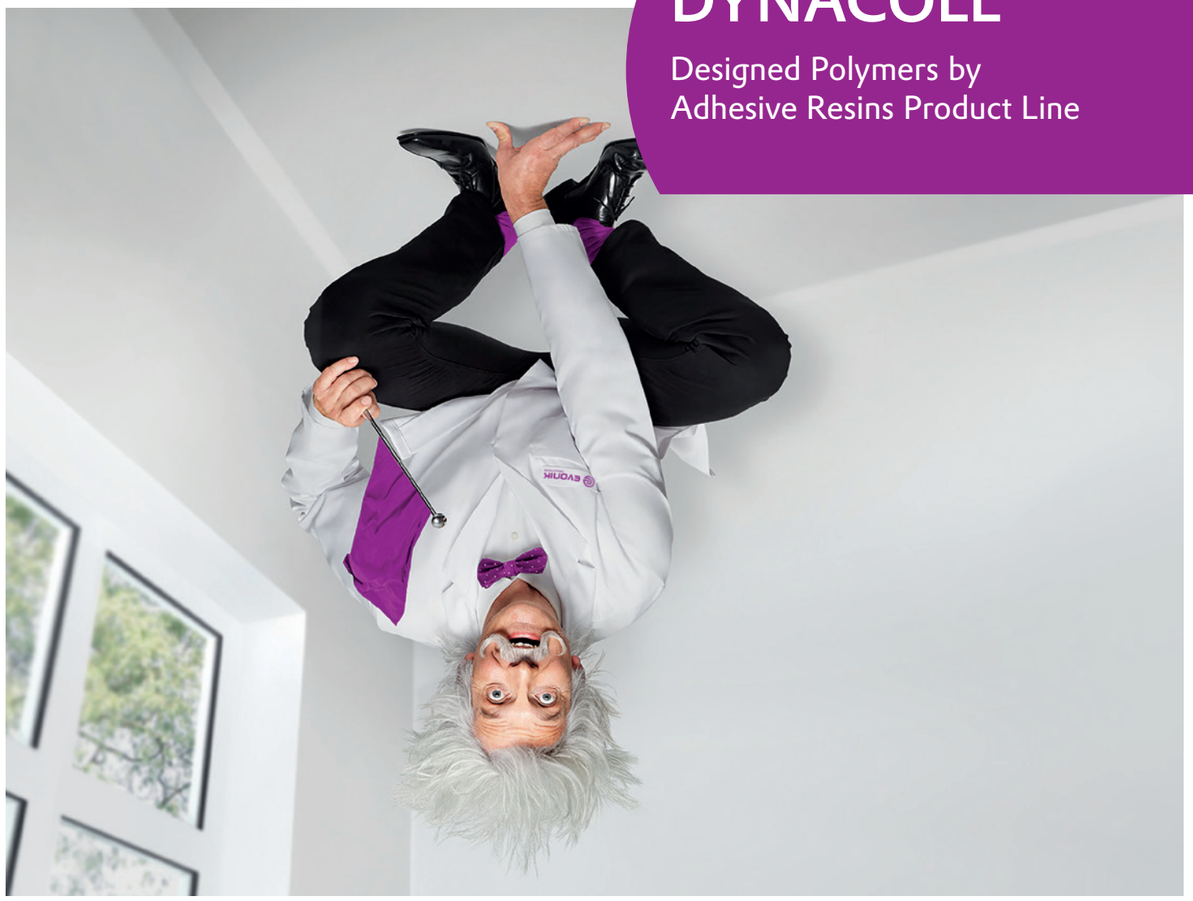
Evonik Resource Efficiency GmbH
Coating & Adhesive Resins
Paul-Baumann-Straße 1
45764 Marl
Germany

PHONE +49 2365-49 4843
www.evonik.com/adhesive-resins

Evonik. Power to create.

DYNACOLL®

Designed Polymers by Adhesive Resins Product Line



DYNACOLL®

Evonik. Power to create.

Welcome from the Adhesive Experts of Evonik

Discover our product portfolio designed for the Adhesives & Sealants Industry. Based on our different polymer backbone systems, we develop individual solutions according to your needs.

Your benefits – our values

Focus on customer orientation
We are a solution provider. Our mission is to create tailor-made solutions to ensure that every one of your projects is a success. That is why we are considered to be the first choice when it comes to solving your challenging tasks.
Thanks to our global presence we can respond promptly and make your individual wishes come true.

Perfectly targeted expertise
With our team of adhesive experts and our dedicated sales force, you can be assured that we offer a wealth of expertise. We do not only provide you with capabilities spanning from research and development through to logistics, but we can also offer you valuable market knowledge and in-depth technical expertise. That is why our know-how is spot-on, every time.

Absolute reliability
Any good business partnership is based on reliability. There is nothing more valuable than knowing that your business partner will be there for you. We take this to heart and offer you excellent product quality, security of supply and our continuous drive to make your challenges our own – this way we help you overcome any obstacle along the way.

Profiting from future orientation
Improving performance and efficiency can only be accomplished if you constantly stay ahead. That is why we identify future trends as early as possible, collaborating with you to develop innovative solutions.
Our foresight is valued by customers and partners alike, because they know that we always keep an eye on the future to guarantee long lasting success.

Your markets – our focus

We offer custom-made Adhesive & Sealant solutions for a broad spectrum of industries. If you don't find your line of business here, just talk to us. Our team will gladly help you accomplish your project.

- **Automotive**
- **Construction**
- **Packaging**
- **Electronics**
- **Processing Aides**
- **Product Assembly**

Your solutions – our brands

DYNACOLL®
Polyester-Polyols, Copolyesters, Polyacrylates

VESTOPLAST®
Amorphous Poly-Alpha-Olefins

VESTOWAX®
Fischer-Tropsch-Waxes

POLYVEST®
Liquid Polybutadienes

DEGALAN®
Methacrylate Binders for Heat Seal Lacquers

DYNACOLL® 7000

Designed Polymers for Adhesives & Sealants

Polyester-Polyols

With its DYNACOLL® 7000 polyester-polyols Evonik offers tailor-made raw materials for one-component moisture-curable hotmelt adhesives and sealants (RHM). DYNACOLL® 7000 products are linear copolyesters with primary hydroxyl functionality and medium molecular weight.

Depending on their morphology the product range is divided into three basic groups:

DYNACOLL® 7100 series amorphous, solid
DYNACOLL® 7200 series liquid, pasty
DYNACOLL® 7300 series partially crystalline, solid

The product group is designed as a building block system, most DYNACOLL® 7000 polyester-polyols are compatible with each other. Partially incompatible but miscible systems are, however, necessary in many applications as well.

DYNACOLL® 7000 copolyesters are usually supplied in 25 or 30 kg and 190 or 200 kg steel drums. Liquid bulk deliveries are available on special request.

Your benefits

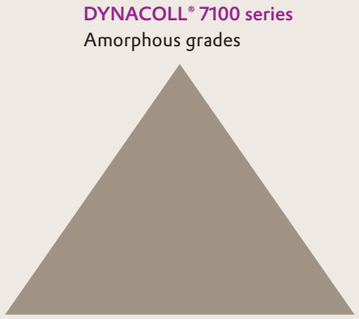
Our building block system allows a precise formulation of reactive PUR hot melts with low application temperatures and high heat resistance. Basic effects on the RHM properties are:

DYNACOLL® 7100 series
- shortens open time
- increases initial strength, melt viscosity and adhesion to polar substrates

DYNACOLL® 7200 series
- increases flexibility, open time and adhesion to non-polar substrates
- lowers melt viscosity

DYNACOLL® 7300 series
- shortens open time (depending on crystallinity) and lowers melt viscosity
- increases initial strength

DYNACOLL® 7000 building block system allows a precise formulation of your RHM



Example to adjust setting time

DYNACOLL® 7150	- 40 pbw
DYNACOLL® 7250	- 30 pbw
DYNACOLL® 73XX	- 30 pbw
4,4' MDI [OH/NCO 1/2.2]	

Influences of DYNACOLL® on RHM properties

Series	7100	7200	7300
Open time / setting time	↓	↑	↓↑
Green strength	↑	↓	↑
Viscosity	↑	↓	↓
Flexibility	↓	↑	↓↑

DYNACOLL® 7000

Product Range DYNACOLL® 7000

	Properties					
	Hydroxyl Number [1]	Acid Number [1]	Molecular Weight	Glass Transition Temperature	Melting Point	Softening Point (R&B)
Grade	[mg KOH/g]	[mg KOH/g]	[g/mol]	[°C]	[°C]	[°C]
Amorphous						
7110	50 - 60	8 - 12	2,000	10		55
7111	27 - 34	max. 4	3,500	20		64
7130	31 - 39	max. 2	3,000	30		79
7131	31 - 39	max. 2	3,000	30		78
7140	18 - 24	max. 2	5,500	30		87
7150	38 - 46	max. 2	2,600	50		95
Liquid						
7210	27 - 34	max. 2	3,500	-15		
7230	27 - 34	max. 2	3,500	-30		
7231	27 - 34	max. 2	3,500	-30		
7250	18 - 24	max. 2	5,500	-50		
7255	27 - 34	max. 2	3,500	-60	32	40
Crystalline						
7362	47 - 54	max. 2	2,000	-60	53	60
7360	27 - 34	max. 2	3,500	-60	55	63
7363	18 - 24	max. 2	5,500	-60	56	63
7365	14 - 20	max. 2	6,500	-60	57	63
7361	10 - 16	max. 2	8,500	-60	57	65
7381	27 - 34	max. 2	3,500		65	73
7380	27 - 34	max. 2	3,500		70	77
7330	27 - 34	max. 2	3,500		85	90
7320	27 - 34	max. 3	3,500	-20		92
7340	27 - 34	max. 2	3,500	-40	96	102
7331	27 - 34	max. 2	3,500	-30	110	115
7390	27 - 34	max. 3	3,500	-30	115	118
7321	27 - 34	max. 2	3,500	-25	123	126

[1] Hydroxyl Number and Acid Number represent delivery specifications

Product Range DYNACOLL® 7000

Properties		Melt Viscosity		Grade
Density at 23 °C	Flash Point	80 °C	130 °C	
[kg/dm³]	[°C]	[Parallel plate] [Pa s]	[Parallel plate] [Pa s]	
1.08	>300		1	7110 [1]
1.23	>300		3	7111
1.17	>300		10	7130
1.23	>300		10	7131
1.21	>300		50	7140
1.26	>300		50	7150
1.29	>200	11		7210
1.17	>200	10		7230
1.21	>200	8		7231
1.15	>200	5		7250
1.11	>200	2		7255
1.15	>200	0.5		7362
1.16	>300	2		7360
1.16	>300	5		7363
1.16	>300	10		7365
1.16	>300	15		7361
1.16	>300	2		7381
1.10	>300	2		7380
1.17	>300		0.3	7330
1.23	>300		4	7320
1.19	>300		1	7340
1.19	>300		2	7331
1.29	>300		0.7	7390
1.20	>300		3	7321

DYNACOLL® 7000

Preparation of Reactive Hot Melts

The product of the reaction between DYNACOLL® 7000 polyesters and an excess of diisocyanates is a reactive hot melt (RHM). The reaction occurs in the melt. For characterization of the RHM data in this brochure the preparation was carried out under the following constant laboratory conditions.

The polyester melt was evacuated in a flask, regardless of the actual (normally low) water content of the DYNACOLL® 7000 products, in a vacuum of less than 10 mbar for 45 minutes at 130°C. The polyesters are then reacted in an inert gas atmosphere (dried nitrogen or carbon dioxide) with the calculated amount of diisocyanate at 130°C.

The reaction is complete when the theoretical free isocyanate content is obtained. After 45 minutes the melt was degassed until it is free of bubbles. The reactive hot melt was then filled into containers and stored under exclusion of moisture and light. Under production conditions, the reaction times should be individually adapted to the adhesive formulations. Drying is determined by the water content of all the components of the formulation, and is generally recommended in order to prevent side reactions.

The following data should be determined for quality control: isocyanate content, melt viscosity, melting point or softening point (R&B), open time, and setting time. Calculation of initial weight of diisocyanate:

Calculation:

$$\text{Weight of diisocyanate} = \frac{(WPES1 \cdot OH1 + WPESn \cdot OHn) \cdot EW \cdot R}{56110}$$

WPES1 = initial weight of polyester 1
OH1 = hydroxyl number of polyester 1
WPESn = initial weight of polyester n
OHn = hydroxyl number of polyester n
EW = equivalent weight of the diisocyanate used
R = ratio of isocyanate to hydroxyl groups

Benefits of Reactive Hot Melt adhesives based on DYNACOLL® 7000

- Excellent stability of viscosity and color in processing
- Exceptionally good adhesion to a variety of substrates
- Solutions for a wide range of applications in various industries and fields such as the automotive, packaging, textile industries and wood processing, as well as for book-binding applications and sandwich bonding
- Suitable for standard hot melt equipment such as rollers and spray, screen, and melt print applicators.

Reactive Holt Melt Data

Reaction products of DYNACOLL® with 4,4'- diphenylmethane diisocyanates (MDI) as a ratio of OH : NCO = 1 : 2.2

	Properties					Melt Viscosity
	Softening Point (R&B)	**Open Time**	**Setting Time**	**Tensile Strength**	**Elongation at Break**	**130 °C**
Grade	[°C]	[s]	[s]	[N/mm²]	[%]	[Parallel plate] [Pa s]
Amorphous						
7110	64	10	1		brittle	3
7111	71	6	1		brittle	13
7130	88	1	1		brittle	45
7131	88	1	1		brittle	50
7140	102	1	< 1		brittle	700
7150	105	< 1	< 1		brittle	400
Liquid						
7210	45	several hours	several hours	15	800	5
7230		several hours	several hours	15	900	9
7231		several hours	several hours	15	900	8
7250		several hours	several hours	15	1,500	9
7255	40	several hours	several hours	30	1,100	5
Crystalline						
7362	55	130	35	25	500	2
7360	59	80	15	25	500	4
7363	61	50	15	25	500	11
7365	63	50	15	20	550	18
7361	63	50	10	20	550	30
7381	67	35	3	20	80	5
7380	73	20	1	20	20	5
7330	85	35	3	25	15	3
7320	87	40	35	35	600	48
7340	97	120	60	30	700	12
7331	110	90	30	30	500	20
7390	118	20	10	30	10	4
7321	123	40	15	35	400	30

DYNACOLL® 7000

Compatibility of DYNACOLL® 7000

Grade	7110	7111	7130	7131	7140	7150	7210	7230	7231	7250	7255	7320	7321*	7330	7331	7340	7360	7361	7365	7380	7381	7390
7110		+	+	+	■	+	+	+	+	+	+	+	■	■	●	+	+	+	+	●	●	+
7111	+		+	+	■	■	+	+	+	+	+	+	■	■	■	■	+	+	+	−	−	+
7130	+	+		+	+	+	+	+	+	+	+	+	+	+	●	+	+	●	●	●	●	+
7131	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	■	+	+
7140	−	−	+	+		+	●	+	+	■	−	+	+	■	+	+	●	■	■	●	●	■
7150	●	■	+	+	+		+	+	+	+	+	●	+	■	+	+	+	+	+	■	■	■
7210	+	+	+	+	−	+		+	●	+	■	+	■	■	●	+	●	■	■	●	●	●
7230	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	●	●	+
7231	+	+	+	+	+	+	+	+		+	+	+	+	●	+	+	+	+	+	●	●	+
7250	+	+	+	+	−	+	+	+	+		+	+	■	+	■	●	+	+	+	■	+	+
7255	+	+	+	+	−	+	−	+	+	+		+	+	+	+	+	+	+	+	−	+	−
7320	+	+	+	+	+	+	+	+	+	+	+		+	−	+	+	+	−	−	●	■	■
7321*	−	−	+	+	+	+	+	+	+	−	+	+		+	+	+	+	+	+	+	+	■
7330	+	−	+	+	−	+	−	+	−	+	+	+	+		+	+	+	+	+	+	+	■
7331	−	−	+	+	+	+	−	+	+	−	+	+	+	+		+	+	●	●	−	+	■
7340	−	−	+	+	+	+	+	+	+	−	+	+	+	+	+		+	+	+	●	+	■
7360	+	+	+	+	+	+	−	+	+	+	+	+	+	+	+	+		+	+	■	+	+
7361	+	+	+	+	−	+	−	+	+	+	+	+	+	+	+	+	+		+	+	+	−
7365	+	+	+	+	−	+	−	+	+	+	+	+	+	+	+	+	+	+		+	+	■
7380	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−	+	+	+		+	■
7381	−	−	−	−	−	−	−	−	−	−	+	−	+	+	+	+	+	+	+	+		−
7390	+	+	−	+	■	−	−	+	+	+	−	−	■	−	■	■	−	−	−	−	−	

Visual evaluation of the melt after storing 24 hours at 130 °C (*at 140 °C):

+ = transparent
■ = opaque
● = cloudy
− = phase separation

1:1 Mixtures of polyesters
1:1 Mixtures of polyesters reacted with MDI (OH : NCO = 1 : 2.2)

Analytical Methods

Hydroxyl Number
Determination according to DIN 53 240-02.
Approx. 2 – 3 g of polyester are dissolved in dichloromethane or THF. The OH groups are esterified at RT with acetic anhydride, using 4-dimethyl-aminopyridine as catalyst. After hydrolysis of the unreacted anhydride, titration is carried out with 0.5 N methanolic KOH.

Acid Number
Determination according to DIN EN ISO 2114.
Approx. 4 g of polyester are dissolved in 50 ml of tetrahydrofuran. Following addition of 50 ml of a mixture of equal parts by weight of tetrahydrofuran and ethanol, titration is carried out with methanolic or ethanolic KOH against phenolphthalein.

Molecular Weight
The molecular weight is calculated based on the sum of hydroxyl number and acid number.

Glass Transition Temperature
Determination according to DIN 53 765.
The glass transisition temperature is determined as for the melting point.

Melting Point
Determination according to DIN 53 765.
The melting point is determined using a DSC instrument. The sample and an empty reference crucible are heated at 20 °C/min. The melting point corresponds to the maximum of the melting peak. To ensure better reproducibility, it is customary to use the values from the second heating operation.

Softening Point (Ring and Ball)
Determination according to DIN ISO 4625.
The sample is casted as a melt into a ring and the ring, following the solidifaction of the melt (or the recrystallization in the case of crystalline substances), is inserted into a test frame. The sample is stressed concentrically with a chrome-plated steel ball and the test frame is immersed in a bath of glycerol. The glycerol is heated at a rate of approximately 5 °C/min. The softening point (R&B) is the temperature of the glycerol bath at the time when the steel ball contacts the baseplate of the test frame.

Density
Determination according to DIN 51 757.

Flash Point
Determination according to ISO 2592.

Open Time
Determination according to Evonik internal method.
The material is heated up to 130 °C and applied on paper as an approximately 0.5 mm thick film. Strips of open surface paper are pressed into the melt at certain intervals. After the adhesive film is tack-free the paper strips are removed. The open time is given by the time, when no fiber tear can be observed anymore.

Setting Time
Determination according to Evonik internal method.
The setting time is given by the time it takes until two bonded wooden cubes can no longer be twisted against each other by hand.

Melt Viscosity
Determination according to DIN EN ISO 3219, parallel plate method.

Tensile Strength / Elongation at Break
Determination according to DIN 53 504.
Dumbbell specimens are punched out from a 0.5 mm thick moisture cured RHM film. Curing conditions are 7 days, 20 °C and 65 % rel. humidity. Elongation at break denotes the percentage increase in length of an original section of 10 mm marked on the bar of the dumbbell specimen, at the moment of break.

DYNACOLL® *Terra*

Designed Polymers for Adhesives & Sealants

Bio-based Polyester-Polyols

With its DYNACOLL® *Terra* product range Evonik offers polyester-polyols made from renewable raw materials.

These bio-based polyesters contain between >30 and 100 pbw of renewable monomers.

According to our DYNACOLL® 7000 product range a building block system of medium molecular weight copolyesters for moisture curing PUR hot melts was developed. It is divided in three basic groups:

Amorphous Grades
Liquid Grades
Crystalline Grades

DYNACOLL® *Terra* bio-based polyesters are usually supplied in 25 or 30 kg and 190 or 200 kg steel drums.

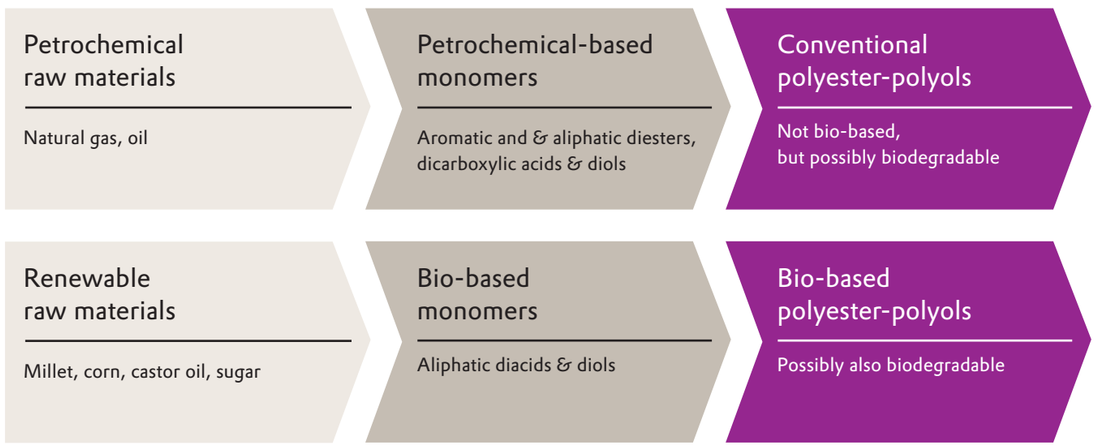
Your benefits

- Support of resource efficiency by using green components
- Modular combination of polyesters in RHM formulation possible
- Available grades exhibiting broad range of properties in formulations
- Well-balanced and versatile adhesion properties
- Implementation of new properties possible

Product Range DYNACOLL® *Terra*

	Properties						
	Proportion of Renewables	Hydroxyl Number	Molecular Weight	Glass Transition Temperature	Melting Point	Softening Point (R&B)	Melt Viscosity
Grade	[%]	[mg KOH/g]	[g/mol]	[°C]	[°C]	[°C]	[Pa s]
Amorphous							
EP 413.01	> 30	30	3,500	30		85	35 (130 °C)
EP 413.02	> 30	30	3,500	30		85	32 (130 °C)
EP 413.03	> 35	40	2,800	40		90	17 (130 °C)
EP 413.04	> 30	50	2,200	50		95	15 (130 °C)
Liquid							
EP 424.01	> 85	30	3,500	-40			4 (80 °C)
EP 424.02	> 75	30	3,500	-45			4 (80 °C)
Crystalline							
EP 481.01	100	30	3,500	-45	55	65	2 (80 °C)
EP 480.01	100	30	3,500	-20	65	75	2 (80 °C)
EP 480.02	> 60	30	3,500		70	80	2 (80 °C)
							Acid number < 2mg KOH/g

Comparison of conventional and bio-based polyester polyols



DYNACOLL® *Terra*

Reactive Hot Melt Data

Reaction products of DYNACOLL® *Terra* with: 4,4' – MDI as a ratio of OH : NCO = 1 : 2.2

	Properties					
	Softening Point (R&B)	**Open Time**	**Setting Time**	**Melt Viscosity at 130 °C**	**Trensile Strength**	**Elongation at Break**
Grade	[°C]	[s]	[s]	[Pa s]	[N/mm²]	[%]
Amorphous						
EP 413.01	102	1	1	200		brittle
EP 413.02	103	1	1	400		brittle
EP 413.03	100	1	<1	65		brittle
EP 413.04	100	<1	<1	40		brittle
Liquid						
EP 424.01				4	10	1,300
EP 424.02				4	15	1,300
Crystalline						
EP 481.01	60	600	200	5	22	500
EP 480.01	70	100	15	5	25	500
EP 480.02	75	10	1	5	22	200

Compatibility

Grade	EP 413.01	EP 413.02	EP 413.03	EP 413.04	EP 424.01	EP 424.02	EP 481.01	EP 480.01	EP 480.02
EP 413.01		●	+	+	●	●	■	■	■
EP 413.02	■		●	●	■	–	■	■	–
EP 413.03	+	■		+	–	+	+	–	■
EP 413.04	+	+	+		+	+	+	+	–
EP 424.01	–	■	–	+		+	●	●	●
EP 424.02	–	–	+	+	+		+	●	–
EP 481.01	–	■	+	+	+	+		+	+
EP 480.01	–	■	–	+	–	+	+		+
EP 480.02	–	–	–	–	–	–	+	+	

Visual evaluation of the melt after storing 24 hours at 130 °C

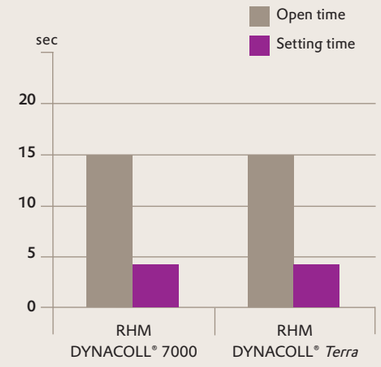
+ = transparent ■ = opaque
● = cloudy – = phase separation

1:1 Mixtures of polyesters
1:1 Mixtures of polyesters reacted with MDI (OH : NCO = 1 : 2.2)

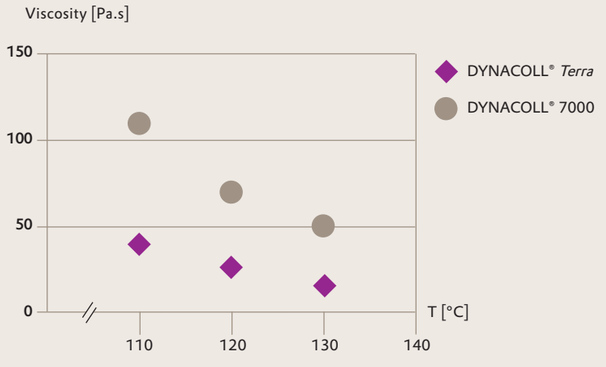
Sustainable RHM & Implementation of new properties

Guide formulation edge banding

35 ppw – DYNACOLL® *Terra* EP 413.04
20 ppw – DYNACOLL® *Terra* EP 424.02
10 ppw – DYNACOLL® *Terra* EP 480.01
25 ppw – DYNACOLL® *Terra* EP 480.02
10 ppw – DYNACOLL® S 1402
& 4,4' MDI [OH/NCO 1/2.0]



Biobased RHM allows lower application temperature, e.g. for edge banding applications



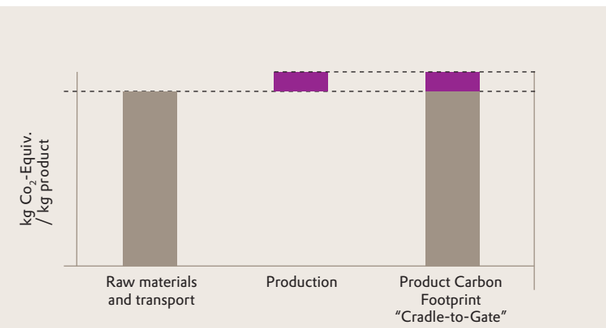
Carbon footprint evaluation

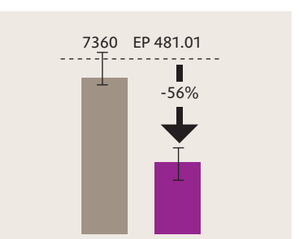
The use of renewable resources helps to slow down the climate change because less greenhouse gases are released. A lower global warming potential (GWP) and thus a lower carbon footprint lead to a reduction in global warming.

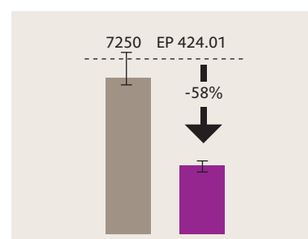
Considering the GWP of products measured in mass of CO_2 equivalents the "Cradle-to gate" carbon footprint is primarily influenced by raw materials. Therefore cooperations with suppliers are essential.

Carbon footprint assessements have been carried out for two example grades of DYNACOLL® *Terra*, in which the carbon footprint for the life cycle of the products was determined. The carbon footprint is reduced up to approximately 60% by using renewable resources compared to conventional petrochemical-based polyester polyols.

Data sources: Suppliers, GaBi database, CEFIC, own calculations







DYNACOLL® AC

Designed Polymers for Adhesives & Sealants

Polyacrylates

With its DYNACOLL® AC product range Evonik offers acrylics for one-component moisture curable hot melt adhesives.

Acrylics for adhesives are bead polymers made of methyl methacrylate and n-butyl methacrylate which are mainly used to modify reactive hot primarily for flat lamination applications.

Various DYNACOLL® AC grades with tailored glass transition temperature and molecular weight are available. They also differ according to their acid and hydroxyl functionality.

DYNACOLL® AC polyacrylates are supplied as beads in bags of 25 kg, big bags are possible on request.

Your benefits

DYNACOLL® AC provides outstanding quality and flow properties

- Low particle size
- Easy handling
- Short dilution time

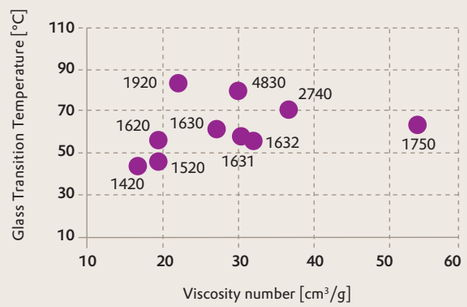
DYNACOLL® AC modified reactive hot melts for flat lamination provide

- Low viscosity
- Very long open time
- Aggressive tack
- High creep resistance directly after bonding

Product Range DYNACOLL® AC

	Properties						
	Glass Transition Temperature Tg	Molecular Weight Mw	Viscosity Number	Acid Number	Hydroxyl Number	Softening Point (R&B)	Melt Flow Rate 190 °C
	[°C]	[g/mol]	[cm³/g]	[mg KOH/g]	[mg KOH/g]	[°C]	[g/10 min]
Bead Polymers							
AC 1420	44	30,000	16	6		120	1,000
AC 1520	48	35,000	19	8.5		135	500
AC 1631	57	60,000	30	9		150	60
AC 1620	56	35,000	19	8		140	300
AC 1630	60	55,000	27	8		150	40
AC 1632	55	65,000	32	3.5		145	35
AC 1750	65	140,000	54	4		190	9
AC 1920	85	37,000	22	6		160	70
AC 4830	82	60,000	30			175	8
AC 2740	70	80,000	36		4	170	7

Product Portfolio DYNACOLL® AC



Analytical Methods

Glass Transition Temperature
Determination according to ISO 11357-1.

Molecular Weight
Determination according to DIN 55627-1.
Calibration standard polymethyl methacrylate (PMMA)

Viscosity Number
Determination according to ISO 1628-1.

Acid Number
Determination according to DIN EN ISO 2114.

Hydroxyl Number
Determination according to DIN 53 240-02.

Softening Point (Ring and Ball)
Determination according to DIN ISO 4625.

Melt Flow Rate 190 °C
Determination according to DIN ISO 1133 (21.6 N).

DYNACOLL® AC

Acrylic Modified Reactive Hot Melts

Reactive hot melts for flat lamination applications are typically prepared by reacting polymer mixtures of DYNACOLL® AC polyacrylates, mainly crystalline DYNACOLL® 7000 polyester polyols and polypropylene glycol (PPG) with molecular weight 1000 or 2000 with excess diisocyanates like MDI (Diphenylmethane diisocyanates) at elevated temperatures under exclusion of moisture. It is recommended to dissolve DYNACOLL® AC in PPG under strong stirring first and then add DYNACOLL® polyesters into the molten mixture. After drying and homogenization the reaction with MDI can be carried out until the theoretical NCO-content is reached. After degassing the adhesive is filled in sealed containers. These reactive hot melts can be applied e.g. by roll coater.

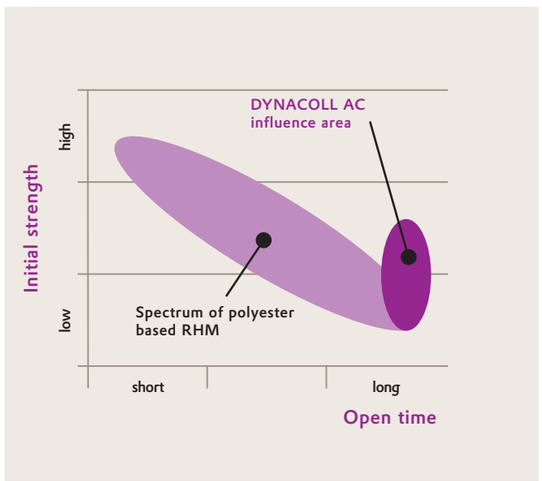
Flat Lamination Applications

The flat lamination technology is widely used for multilayer sandwich constructions and surface lamination of lightweight materials with decorative films to give them a solid or more valuable appearance. Core materials are mainly made from MDF fiber- board, particle- chipboard or plywood, cardboard or plastic foams while typically plastic films, high gloss films, paper, HPL or veneers are used as surface layers.

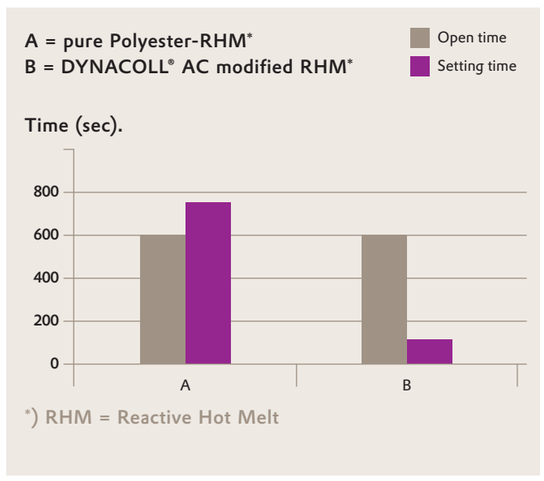
The adhesives need to provide low viscosity and long open times for sufficient wetting and long handling times for bonding large size panels. On the other hand, setting times should be short to allow fast production runs. Pure polyester polyol based RHM formulations with long open time often do also have long setting times and therefore do not provide sufficient initial strength. Instead, DYNACOLL® AC polyacrylates enable the formulation of moisture curing hot melts with long open times and high initial strength. Especially their high molecular weight leads to excellent creep resistance of the adhesive allowing to keep bonded parts in place without any further mechanical fixation.

Therefore, DYNACOLL® AC modified RHM provide new opportunities for flat lamination applications.

Initial strength – influence of DYNACOLL® AC



Lab results – setting time comparison



*) RHM = Reactive Hot Melt

Flat Lamination

Enhance properties of your RHM with DYNACOLL® AC

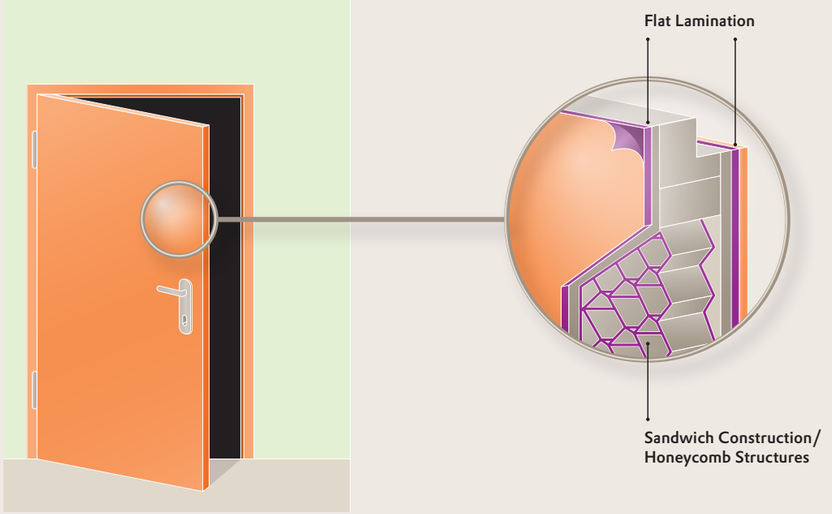
DYNACOLL® AC modifed reactive hot melts are the first choice for flat lamination purposes.

Typical areas of application are:

- Sandwich composites
  of aluminium, FRP panels, foam or wood-based substrates
  e. g. for recreational vehicals
- Honeycomb structures
  e.g. for door manufacturing
- Foil laminated particleboard
  e.g. for furniture
- Medium density fiberboard panels
  e.g. for furniture

Bonding of panels or sandwich composites require

- Long open time
  Large assembly parts need long handling times
- High initial strength
  Bonding without further mechanical fixation saves time
- Short setting time
  Cost-efficient production runs need short cycle times



DYNACOLL® S

Designed Polymers for Adhesives & Sealants

Copolyesters

With its DYNACOLL® S product range Evonik offers thermoplastic copolyesters of high molecular weight for use in thermoplastic hot melt and solvent based adesives. The product range includes amorphous as well as crystalline grades of different melting points and various degrees of crystallinity or hardness.

The crystalline grades are distinguished particularly by high adhesive strength as well as good resistance to chemicals and solvents. For solvent based applications the amorphous grades are recommended; these have good solubility in non-chlorinated and excellent adhesion to a wide range of substrates.

Applications

	Crystalline Grades								Amorphous Grades		
	S 243	S 1272	S 1252	S 1218	S 1227	S 1402	S 1401	S EP 1408	S 1606	S 1611	S 1426
Textile Industry											
Hot Melts		•	•	•	•						
Adhesive film		•	•	•	•	•	•				
Adhesive web and net		•	•	•	•						
Profile Wrapping											
PVC Window frames						•	•	•			
Metal / Plastics bonding							•	•		•	•
Metal primer									•	•	
Electronic Industry											
Solvent based adhesives							•	•	•		•
Hot Melt adhesives					•		•	•			
Automotive Industry											
Interior textile lamination		•			•						
Decorative film lamination		•	•	•	•		•				
Packaging Industry											
Flexible packging								•	•	•	•
Polymer Modification											
Additive for Reactive Hot Melts						•	•				
Masterbatches	•										

Product Range DYNACOLL® S

	Crystalline Grades								Amorphous Grades		
	S 243	S 1272	S 1252	S 1218	S 1227	S 1402	S 1401	S EP 1408	S 1606	S 1611	S 1426
Properties											
Softening Point [°C]	195	140	135	130	115	100	97	90	155	130	140
Melting Point [°C]	195	128	120[1)]	115	100	90[1)]	85[1)]	80[1)]			
Glass Transition Temp. [°C]	35	0	20	15	10	-10	-25	-30	65	50	35
Hydroxyl Number [mg KOH/g]						5	6	4	4	4	4
Acid Number [mg KOH/g]						3	2	2	2	2	2
Viscosity Number [cm^3/g]	68	84	94	80	80	78	80	85	62	61	90
Shore D Hardness	79	53	64	63	63	27	19	17	80	79	78
Open Time [s]	5	10	5	20	5	15	15	50	15	10	20
Tensile Strength [N/mm^2]	40	25	20	20	15	10	5	2	60	20	50
Elongation at Break [%]	7	400	450	300	350	400	500	300	5	3	5
Melt Flow Rate (MFR) [g/10 min]											
160 °C		30	10	30	35	100	110	130			
180 °C		60	20	60	90	220	190	250	10	50	15
200 °C	130	120	45	110	150	360	290	400	30	100	30
220 °C	240	250	75	210	240				60	190	60
Melt Viscosity [Pa s]											
160 °C		330	900	300	240	80	80	55			
180 °C		140	360	150	120	50	40	30			
200 °C		65	180	80	60	30	25	15	150	70	270
220 °C	50					10	15	5	90	15	
Solubility											
Methylene chloride	-	+	+	+	+	+	+	+	+	+	+
Trichloroethylene	-	-	-	•	•	+	+	+	+	+	+
Ethyl acetate	-	-	-	-	-	-	•	+	+	+	+
MEK (methylethyl ketone)	-	-	-	-	-	-	•	+	+	+	+
Toluene	-	-	-	-	-	•	+	+	-	+	+
Dioxolane (Dioxacyclopentan)	-	-	-	-	-	+	+	+	+	+	+

1) optical method
+ = > 10% (soluble)
• = < 10% (slightly insoluble)
- = < 1% (virtually insoluble)

DYNACOLL® S

Analytical Methods

Softening Point (Ring and Ball)
Determination according to DIN ISO 4625.

Melting Point
The melting point is determined by DSC according to DIN 53765 or an optical method (Mettler FP 82).

Glass Transition Temperature
Determination according to DIN 53 765.

Hydroxyl Number
Determination according to DIN 53 240-02.

Acid Number
Determination according to DIN EN ISO 2114.

Shore D Hardness
Determination in accordance with DIN 53 505.
All values refer to crystallized products.

Viscosity Number
Determination according to DIN 53 728.
0.5 g of the test substance are dissolved in 100 ml of a mixture of 50 % by weight phenol and 50 % by weight 1,2-dichlorobenzene. The viscosity of the solution and the solvent is determined by the Ubbelohde method. The viscosity number J is determined using the formula:

$$J = \left[\frac{t_1}{t_2} - 1\right] \times \frac{1}{c}$$

t_1 = flow time of solution [s]
t_2 = flow time of solvent [s]
c = concentration of test substance [g/cm3]

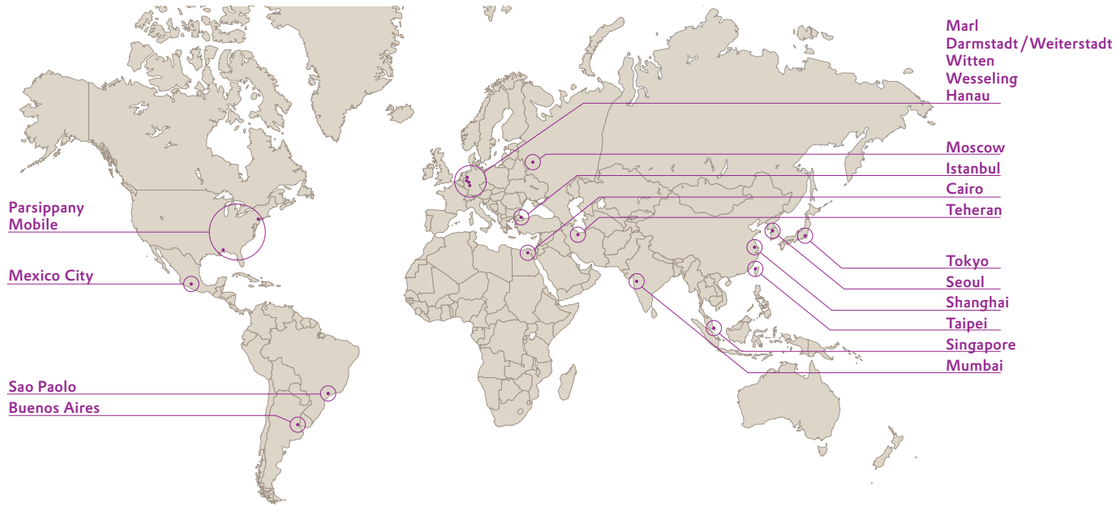
Open Time
Determination according to Evonik internal method.
The open time is defined as the time between the application of the adhesive and the start of recrystallization – or in case of amorphous products until the surface becomes tack-free.

Tensile Strength / Elongation at Break
Determination in accordance with DIN EN ISO 527-1/3.
It is determined on standard dumbbell-shaped specimens. The elongation at break denotes the percentage increase in length of an original section of 10 mm marked on the bar of the dumbbell specimen, at the moment of rupture.

Melt Flow Rate (MFR)
Determination according to DIN ISO 1133.
Approx. 10 g of the test sample are placed in a temperature-conditioned metal cylinder. Via a cylindrical die, a force of 21.6 N acts on the melted sample. The weight of sample flowing through the standardized nozzle within a measured time is used to calculate the MFR. The MFR is expressed as the weight of sample extruded in 10 minutes.

Melt Viscosity
Determination according to DIN EN ISO 3219, parallel plate method.

Designed Polymers: Discover our global network



Your global contacts:

North & Central America
Evonik Corporation
Resource Efficiency
Coating & Adhesive Resins
299 Jefferson Road
Parsippany, NJ 07054
USA
PHONE +1 973 929-8453
adhesives@evonik.com

South America
Evonik Degussa Brasil Ltda.
Resource Efficiency
Coating & Adhesive Resins
Alameda Campinas 579-10
01404-000 Sao Paulo
Brazil
PHONE +55 11 3146-2156
adhesives@evonik.com

Europe
Evonik Resource Efficiency GmbH
Coating & Adhesive Resins
Paul-Baumann-Straße 1
45764 Marl
Germany
PHONE +49 2365 49-4534
adhesives@evonik.com

North Asia
Evonik Japan Co., Ltd.
Resource Efficiency
Coating & Adhesive Resins
Shinjuku Monolith 12F
2-3-1, Nishi-Shinjuku, Shinjuku-ku
Tokyo 163-0938
Japan
PHONE +81 3 5323-7409
adhesives@evonik.com

China, South-East Asia
Evonik Specialty Chemicals Co., Ltd.
Resource Efficiency
Coating & Adhesive Resins
55 Chundong Road
Xinzhuang Industry Park
Shanghai, 201108
China
PHONE +86 21 6119-3274
adhesives@evonik.com

Middle East, Africa, India
Evonik Gulf FZE
Resource Efficiency
Coating & Adhesive Resins
Dubai Silicon Oasis
Office E-107
P.O. Box 341256
Dubai, UAE
PHONE +971 4372-4173
adhesives@evonik.com

Find your regional contact:
http://evonik.com/adhesive-resins-contacts