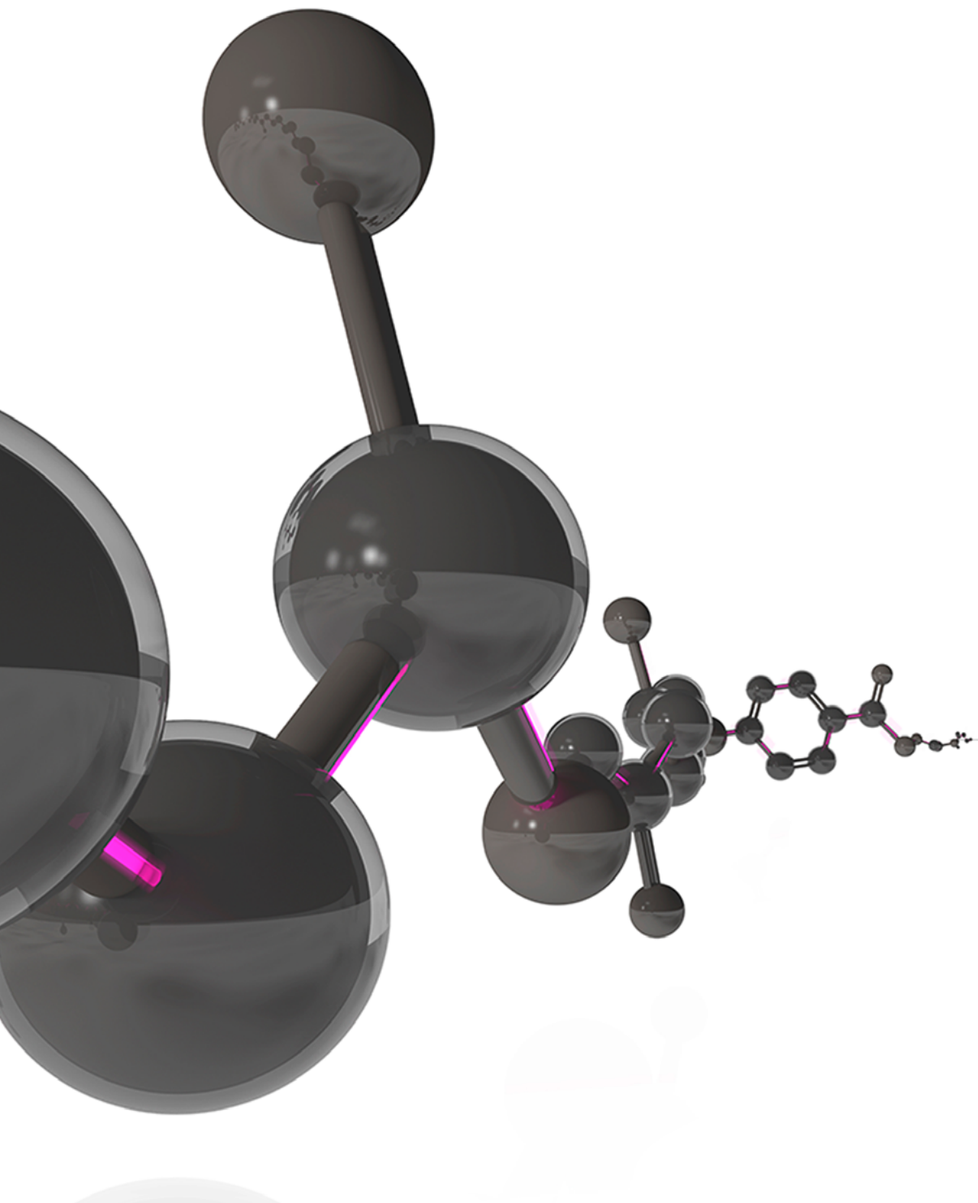
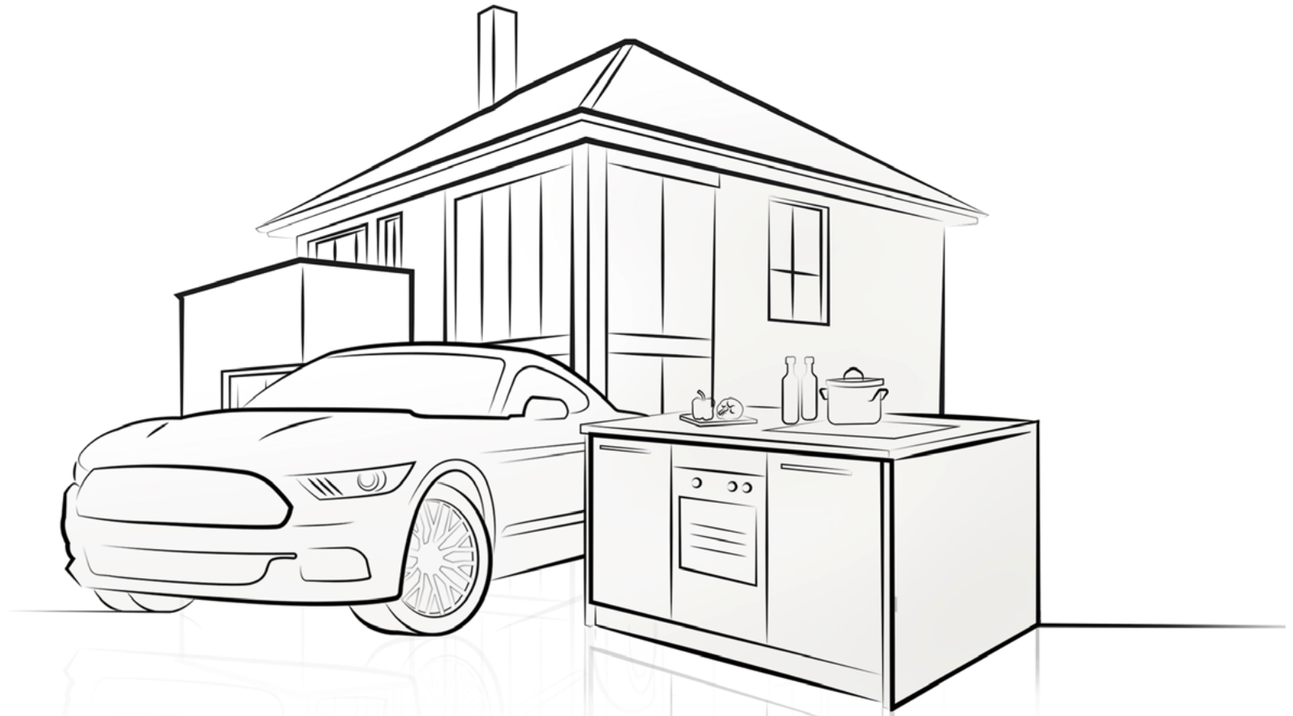
We design polymers.

Discover our world of **polyesters for the adhesives and sealants industry.**

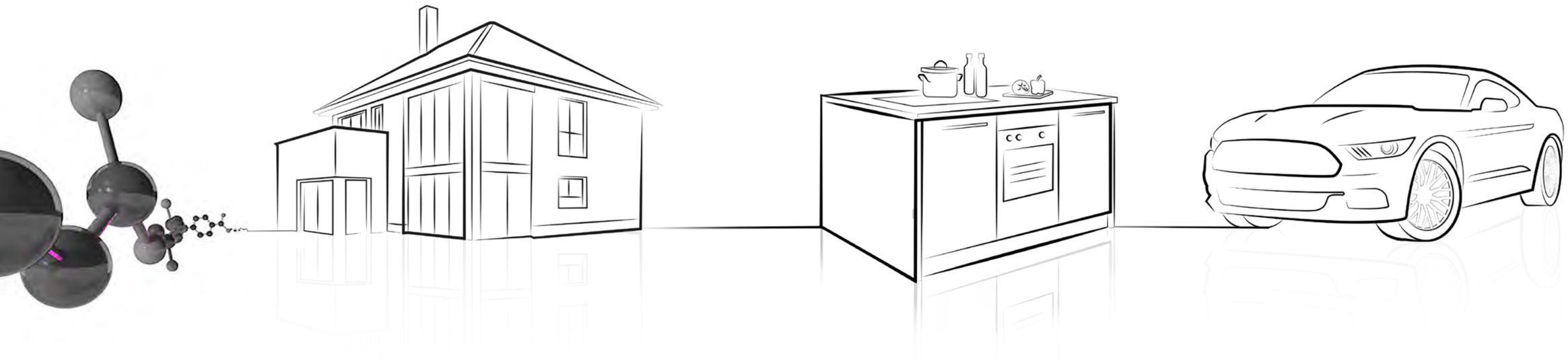




DYNACOLL®

EVONIK
Leading Beyond Chemistry

DYNACOLL®



With more than 40 years of experience in polyester technology, we are working on smart solutions for a sustainable future.

DYNACOLL® stands for high quality polyesters and polyacrylates for the Adhesives & Sealants industry. Our product portfolio includes conventional and bio-based polyester-polyols, co-polyesters and polyacrylates that are used in a wide range of applications:

DYNACOLL® 7000 & **DYNACOLL®** ***Terra*** building block systems of polyester-polyols are ideal raw materials for reactive hot melts. They are used in several industries, such as wood-working and automotive.
DYNACOLL® AC polyacrylates are used for one-component, moisture curable hot melt adhesives.
DYNACOLL® S high molecular weight, thermoplastic co-polyesters used as hot melts for the automotive and textile industries.

Come to discover our world of polyesters!

DYNACOLL®

POLYESTER-POLYOLS, CO-POLYESTERS & POLYACRYLATES

DYNACOLL® 7000

POLYESTER-POLYOLS

Evonik's DYNACOLL® 7000 product portfolio offers tailor-made raw materials for one-component, moisture curable hot melt adhesives and sealants (RHM). DYNACOLL® 7000 grades are linear, medium molecular weight co-polyesters with primary hydroxyl functionality.
The product group is designed as a building block system. Most DYNACOLL® 7000 polyester-polyols are compatible with each other. However, partially incompatible but miscible systems are necessary in many applications as well.

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**

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**

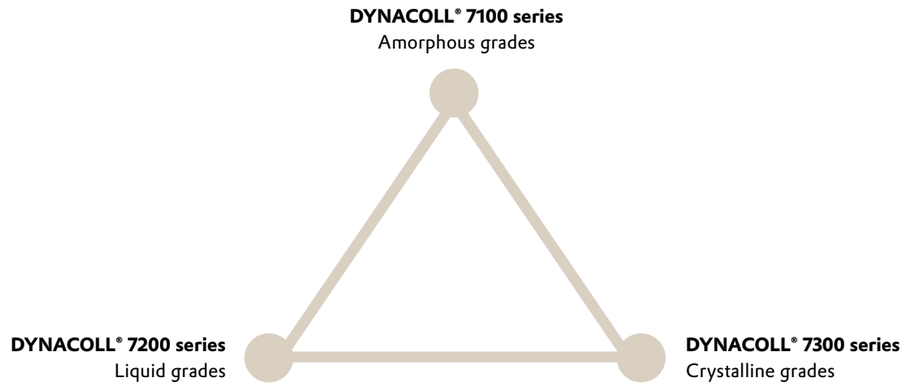
DYNACOLL® 7200 series

- **Increases flexibility, open time and adhesion to non-polar substrates**
- **Lowers melt viscosity**

DYNACOLL® 7300 series

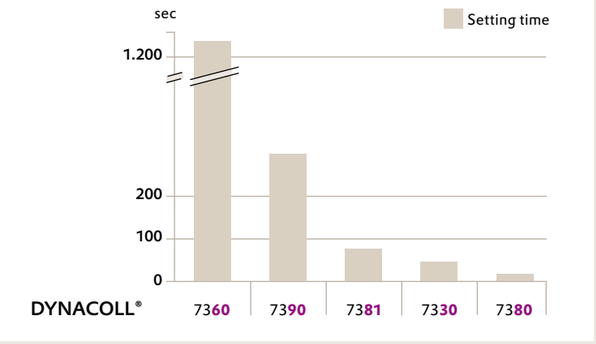
- **Shortens open time (depending on crystallinity) and lowers melt viscosity**
- **Increases initial strength**

DYNACOLL® 7000 BUILDING BLOCK SYSTEM ALLOWS FOR A PRECISE FORMULATION OF YOUR RHM



EXAMPLE TO ADJUST SETTING TIME

DYNACOLL® 7150	- 40 pbw
DYNACOLL® 7250	- 40 pbw
DYNACOLL® 73XX	- 40 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

Grade	Properties								Melt Viscosity		Grade
	Hydroxyl Number[1)] [mg KOH/g]	Acid Number[1)] [mg KOH/g]	Molecular Weight [g/mol]	Glass Transition Temperature [°C]	Melting Point [°C]		Softening Point (R&B) [°C]	Density at 23 °C [kg/dm³]	Flash Point [°C]	80 °C [Parallel plate] [Pa•s]	130 °C [Parallel plate] [Pa•s]	
Amorphous												
7110	50 - 60	8 - 12	2000	10			55	1.08	> 300		1	7110
7111	27 - 34	max. 4	3500	20			64	1.23	> 300		3	7111
7130	31 - 39	max. 2	3000	30			79	1.17	> 300		10	7130
7131	31 - 39	max. 2	3000	30			78	1.23	> 300		10	7131
7140	18 - 24	max. 2	5500	30			87	1.21	> 300		50	7140
7150	38 - 46	max. 2	2600	50			95	1.26	> 300		60	7150
Liquid												
7210	27 - 34	max. 2	3500	-15				1.29	> 200	11		7210
7230	27 - 34	max. 2	3500	-30				1.17	> 200	10		7230
7231	27 - 34	max. 2	3500	-30				1.21	> 200	8		7231
7250	18 - 24	max. 2	5500	-50				1.15	> 200	5		7250
7255	27 - 34	max. 2	3500	-60	32		40	1.11	> 200	2		7255
Crystalline												
7360	27 - 34	max. 2	3500	-60	55		63	1.16	> 300	2		7360
7363	18 - 24	max. 2	5500	-60	56		63	1.16	> 300	5		7363
7365	14 - 20	max. 2	6500	-60	57		63	1.16	> 300	10		7365
7361	10 - 16	max. 2	8500	-60	57		65	1.16	> 300	15		7361
7381	27 - 34	max. 2	3500		65		73	1.16	> 300	2		7381
7380	27 - 34	max. 2	3500		70		77	1.10	> 300	2		7380
7330	27 - 34	max. 2	3500		85		90	1.17	> 300		0.3	7330
7320	27 - 34	max. 3	3500	-20			92	1.23	> 300		4	7320
7340	27 - 34	max. 2	3500	-40	96		102	1.19	> 300		1	7340
7390	27 - 34	max. 3	3500	-30	115		118	1.29	> 300		0.7	7390

1) Hydroxyl Number and Acid Number represent delivery specifications

DYNACOLL® 7000

REACTIVE HOLT MELT DATA

Grade	Properties					Melt Viscosity
	Softening Point (R&B) [°C]	Open Time [s]	Setting Time [s]	Tensile Strength [N/mm²]	Elongation at Break [%]	130 °C [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	1500	9
7255	40	several hours	several hours	30	1500	5
Crystalline						
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
7390	118	20	10	30	10	4

Reaction products of DYNACOLL® 7000 with: 4,4' – MDI as a ratio of OH : NCO = 1 : 2.2

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 was 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.

For quality control, the following data should be determined: isocyanate content, melt viscosity, melting point or softening point (R&B), open time and setting time.

Calculation of initial diisocyanate weight:

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

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 viscosity and color stability during processing**
- **Exceptionally good adhesion to a variety of substrates**
- **Solutions for a wide range of applications in various industries and fields (i.e. automotive, packaging, textile, wood, book-binding and sandwich laminations)**
- **Can be applied with standard hot melt equipment, such as rollers and spray, screen and melt print**

DYNACOLL® 7000

COMPATIBILITY OF DYNACOLL® 7000

Grade	7110	7111	7130	7131	7140	7150	7210	7230	7231	7250	7255	7320	7330	7340	7360	7361	7363	7365	7380	7381	7390
7110		+	+	+	■	+	+	+	+	+	+	+	■	+	+	+	+	+	●	●	+
7111	+		+	+	■	■	+	+	+	+	+	+	■	■	+	+	+	+	-	-	+
7130	+	+		+	+	+	+	+	+	+	+	+	+	+	+	●	●	●	●	●	+
7131	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	■	+	+
7140	-	-	+	+		+	●	+	+	■	-	+	■	+	●	■	●	■	●	●	■
7150	●	■	+	+	+		+	+	+	+	+	●	■	+	+	+	+	+	■	■	■
7210	+	+	+	+	-	+		+	●	+	■	+	■	+	●	■	■	■	●	●	●
7230	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	●	●	+
7231	+	+	+	+	+	+	+	+		+	+	+	●	+	+	+	+	+	●	●	+
7250	+	+	+	+	-	+	+	+	+		+	+	+	●	+	+	+	+	■	+	+
7255	+	+	+	+	-	+	-	+	+	+		+	+	+	+	+	+	+	-	+	-
7320	+	+	+	+	+	+	+	+	+	+	+		-	+	+	-	●	-	●	■	■
7330	+	-	+	+	-	+	-	+	-	+	+	+		+	+	+	+	+	+	+	■
7340	-	-	+	+	+	+	+	+	+	-	+	+	+		+	+	+	+	●	+	■
7360	+	+	+	+	+	+	-	+	+	+	+	+	+	+		+	+	+	■	+	+
7361	+	+	+	+	-	+	-	+	+	+	+	+	+	+	+		+	+	+	+	-
7363	+	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+		+	+	+	■
7365	+	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+	+		+	+	■
7380	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	+	+	+		+	■
7381	-	-	-	-	-	-	-	-	-	-	+	-	+	+	+	+	+	+	+		-
7390	+	+	-	+	■	-	+	+	+	+	-	-	-	■	-	-	-	-	-	-	

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

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

Polyesters 1:1 Mixtures of polyesters

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

ANALYTICAL METHODS

- **Hydroxyl Number**
  Determination according to DIN EN ISO 4629-2.
  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 and acid number.

- **Glass Transition Temperature**
  Determination according to ISO 11357.
  Measurement of glass transition temperature following same procedure as described for the determination of the melting point.

- **Melting Point**
  Determination according to ISO 11357.
  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 the time when no fiber tear can be observed anymore.

- **Setting Time**
  Determination according to Evonik internal method.
  The setting time is 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*

BIO-BASED POLYESTER-POLYOLS

Evonik's DYNACOLL® *Terra* offers a range of bio-based polyester-polyols for manufacturing polyurethane hot melt adhesives. In addition to being made up of between 30 and 100 pbw of renewable feedstocks, DYNACOLL® *Terra* supports a distinct carbon footprint reduction when compared to petrochemical polyester-polyols.
Developed as a building block system of amorphous, liquid and crystalline types, DYNACOLL® *Terra* allows for the combination of various grades to meet the requirements of reactive hot melt formulations and applications.

YOUR BENEFITS

- **Carbon footprint reduction by use of renewables**
- **Modular combination of polyesters in RHM formulation possible**
- **Grades exhibit a broad range of properties in formulations**
- **Well-balanced and versatile adhesion properties**
- **Implementation of new properties possible**

COMPARISON OF CONVENTIONAL AND BIO-BASED POLYESTER-POLYOLS

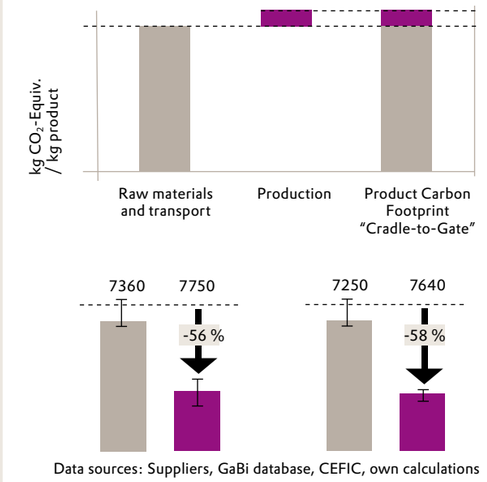
Petrochemical feedstock E.g. Natural gas, oil	**Petrochemical-based monomers** Aromatic & aliphatic diesters, dicarboxylic acids & diols	**Conventional polyester-polyols** Not bio-based, but possibly biodegradable
Renewable feedstock E.g. Millet, corn, castor oil, sugar	**Bio-based monomers** Aliphatic diacids & diols	**Bio-based polyester-polyols** Possibly also biodegradable

CARBON FOOTPRINT EVALUATION

The use of renewable resources helps to slow down 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 foot-print is primarily influenced by raw materials. Therefore cooperation with suppliers is essential.

A carbon footprint assessment, comparing two conventional polyester polyols, from our DYNACOLL® 7000 portfolio, with two DYNACOLL® *Terra* polyester-polyols, with similar physical properties, showed a carbon foot print reduction of almost 60%.



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

DYNACOLL® *Terra*

PRODUCT RANGE

Grade*	Properties						
	Proportion of Renewables [%]	Hydroxyl Number [mg KOH/g]	Molecular Weight [g/ mol]	Glass Transition Temperature [°C]	Melting Point [°C]	Softening Point (R&B) [°C]	Melt Viscosity [Pa•s]
Amorphous							
EP 413.01	min. 30	30	3500	30		85	35 (130 °C)
EP 413.02	min. 30	30	3500	30		85	32 (130 °C)
7540	min. 35	40	3000	35		85	15 (130 °C)
EP 413.04	min. 30	50	2000	50		95	15 (130 °C)
Liquid							
7640	min. 75	30	3500	-40			4 (80 °C)
EP 424.02	min. 50	30	3500	-45			4 (80 °C)
Crystalline							
7750	100	30	3500	-50	55	65	2 (80 °C)

Acid number < 2mg KOH/g * Make to order products

COMPATIBILITY OF DYNACOLL® 7000

Grade	EP 413.01	EP 413.02	7540	EP 413.04	7640	EP 424.02	7750
EP 413.01		●	+	+	●	●	■
EP 413.02	■		●	●	■	■	■
7540	+	●		+	-	+	+
EP 413.04	+	+	+		+	+	+
7640	-	■	-	+		+	●
EP 424.02	-	-	+	+	+		+
7750	-	■	+	+	+	+	

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

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

Polyesters 1:1 Mixtures of polyesters

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

REACTIVE HOT MELT DATA

Grade	Properties					
	Softening Point (R&B) [°C]	Open Time [s]	Setting Time [s]	Melt Viscosity at 130 °C [Pa•s]	Tensile Strength [N/mm²]	Elongation at Break [%]
Amorphous						
EP 413.01	100	1	1	200		brittle
EP 413.02	105	1	1	400		brittle
7540	100	1	< 1	60		brittle
EP 413.04	100	< 1	< 1	40		brittle
Liquid						
7640				4	10	1.300
EP 424.02				4	15	1.300
Crystalline						
7750	65	800	300	4	20	450

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

DYNACOLL® AC

POLYACRYLATES

Evonik's DYNACOLL® AC polyacrylates are specifically designed as main polymers inside one-component, moisture curable hot melt adhesives, often used in flat lamination applications.
DYNACOLL® AC polyacrylates are bead polymers, made mainly from methyl-methacrylate and n-butyl methacrylate.
The DYNACOLL® AC product portfolio offers grades with different glass transition temperatures, molecular weights and acid and hydroxyl functionalities.

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

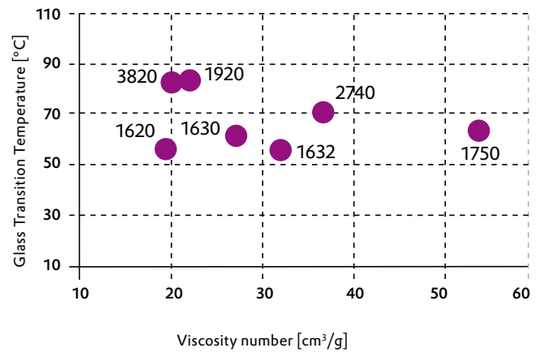
- **Low viscosity**
- **Very long open time**
- **Aggressive tack**
- **High creep resistance directly after bonding**

PRODUCT RANGE

	Properties						
Bead Polymers	Glass Transition Temperature [°C]	Molecular Weight [g/ mol]	Viscosity Number [cm³/g]	Acid Number [°C]	Hydroxyl Number [mg KOH/g]	Softening Point (R&B) [°C]	Melt Flow Rate 190°C [g/10min]
AC 1632	55	65000	32	3.5		145	25
AC 1620	56	35000	19	8		140	300
AC 1630	60	55000	27	8		150	40
AC 1750	65	130000	54	4		190	9*
AC 1920	85	37000	22	6		160	20
AC 2740	70	80000	36		4	170	7
AC 3820	83	30000	20	5	8	150	35

* Melt Flow Rate at 210 °C

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 EN ISO 4629-2.
- **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

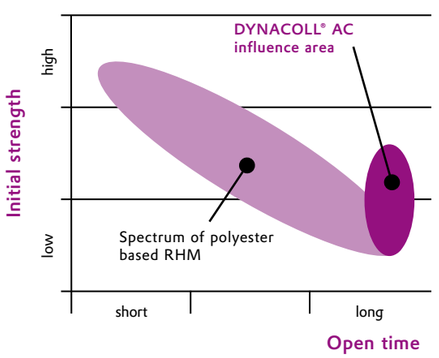
ACRYLIC MODIFIED REACTIVE HOT MELTS

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

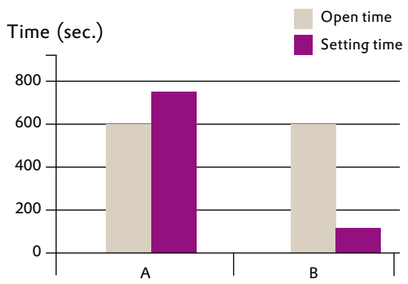
The flat lamination technology is widely used for multilayer sandwich construction and surface lamination of lightweight materials with decorative films, which give them a solid or more valuable appearance. Core materials are mainly made from MDF fiber- board, particle- chipboard or plywood, cardboard or plastic foams while, plastic films, high gloss films, paper, HPL or veneers are typically used for surface layers.
For bonding large size panels, the adhesives need to provide low viscosity and long open times for sufficient wetting and long handling times. On the other hand, setting times should be short to allow for fast production runs. RHM formulations based on pure polyester-polyols with long open time often also have long setting times and, therefore, do not provide sufficient initial strength. By using DYNACOLL® AC polyacrylates inside the formulation of moisture curing hot melts, longer open times and higher initial strength are achieved. Additionally, their high molecular weight leads to excellent creep resistance of the adhesive, keeping bonded parts in place without the need for any further mechanical fixation.

Initial strength – influence of DYNACOLL® AC



Lab results – setting time comparison

A = pure Polyester-RHM*
B = DYNACOLL® AC modified RHM*



*) RHM = Reactive Hot Melt

FLAT LAMINATION

ENHANCE PROPERTIES OF YOUR RHM WITH DYNACOLL® AC

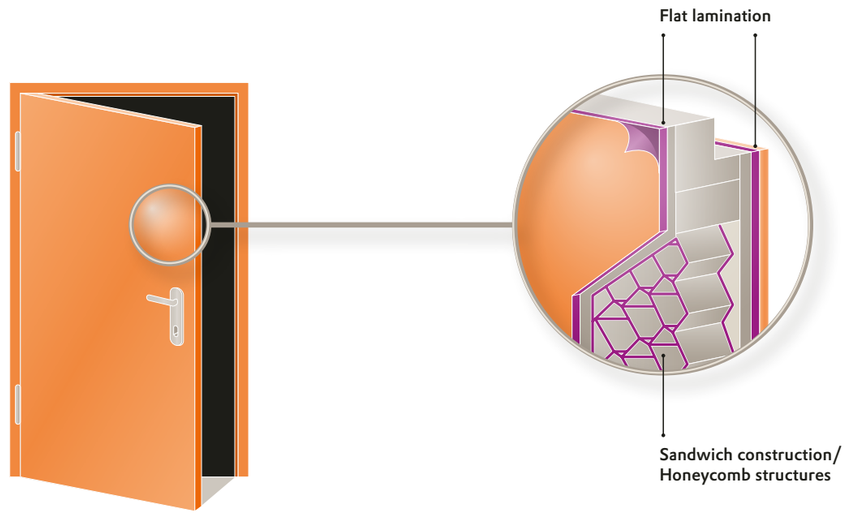
DYNACOLL® AC modifed reactive hot melts are the first choice for flat lamination purposes.

Typical areas of application are:

- **Sandwich composites** of aluminum, FRP panels, foam or wood-based substrates e. g. for recreational vehicles
- **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 NEED

- **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

CO-POLYESTERS

Evonik's DYNACOLL® S product range offers high molecular weight thermoplastic co-polyesters, used in hot melt and solvent-based adhesives and sealants. The product range includes amorphous and crystalline grades with different melting points and various degrees of crystallinity or hardness.
The crystalline grades provide high adhesive strength and good resistance to chemicals and solvents. For solvent based applications, amorphous grades are recommended due to their good solubility in non-chlorinated solvents and excellent adhesion to a wide range of substrates.

APPLICATIONS

	Crystalline Grades		Amorphous Grades		
	S 1272	S 1402	S 1606	S 1611	S 1426
Textile Industry					
Hot Melts	●				
Adhesive film	●	●			
Adhesive web and net	●				
Profile Wrapping					
PVC Window frames		●			
Metal / Plastic bonding				●	●
Metal primer			●	●	
Electronic Industry					
Solvent based adhesives			●		●
Automotive Industry					
Interior textile lamination	●				
Decorative film lamination	●				
Packaging Industry					
Flexible packging			●	●	●
Polymer Modification					
Additive for Reactive Hot Melts		●			

PRODUCT RANGE

	Crystalline Grades		Amorphous Grades		
	S 1272	S 1402	S 1606	S 1611	S 1426
Properties					
Softening Point [°C]	140	100	155	130	140
Melting Point [°C]	128	90[1)]			
Glass Transition Temp. [°C]	0	-10	65	50	35
Hydroxyl Number [mg KOH/g]		5	4	4	4
Acid Number [mg KOH/g]		3	2	2	2
Viscosity Number [cm^3/g]	84	78	62	61	90
Shore D Hardness	53	27	80	79	78
Open Time [s]	10	15	15	10	20
Tensile Strength [N/mm^2]	25	10	60	20	50
Elongation at Break [%]	400	400	5	3	5
Melt Flow Rate (MFR) [g/10 min]					
160 °C	30	100			
180 °C	60	220	10	50	15
200 °C	120	360	30	100	30
220 °C	250		60	190	60
Melt Viscosity [Pa•s]					
160 °C	330	80			
180 °C	140	50			
200 °C	65	30	150	70	270
220 °C		10	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)

ANALYTICAL METHODS

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

- **Melting Point**
  The melting point is determined by DSC according to ISO 11357 or an optical method (Mettler FP 82).

- **Glass Transition Temperature**
  Determination according to ISO 11357.

- **Hydroxyl Number**
  Determination according to DIN EN ISO 4629-2.

- **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 material is dissolved in 100 ml of a 50/50 by weight mixture of phenol and 1,2-dichlorobenzene. The viscosity of the solution and 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/cm^3]

- **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 tested using standard dumbbell-shaped specimens. The elongation at break denotes the percentage increase in length of an original 10 mm section 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 is placed in a temperature-conditioned metal cylinder. Through a cylindrical die, a force of 21.6 N is placed on the melted sample. The weight of the sample flowing through the standardized nozzle within a measured time is used to calculate the MFR.
  The MFR is the weight of sample extruded in 10 minutes.

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

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