VISIOMER®
Specialty Methacrylates

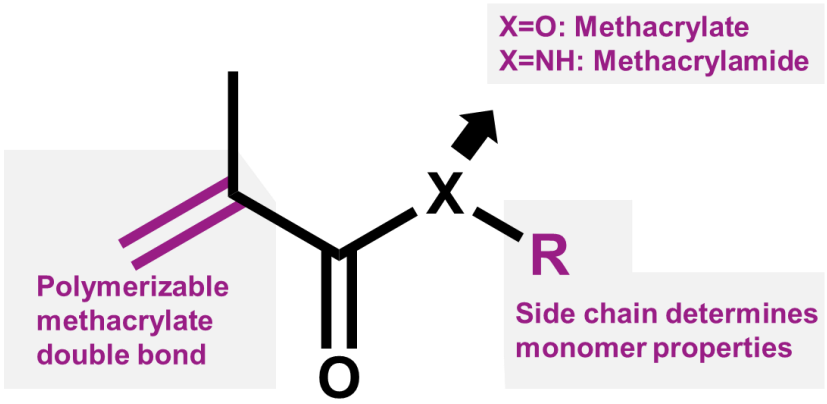
Innovating the future with sustainable
VISIOMER® Specialty Methacrylates

Dr. Christine Breiner
Dr. Gerold Schmitt

EVONIK
Leading Beyond Chemistry

Selection of VISIOMER® for Customized (Meth)acrylic Coatings

Versatile building block



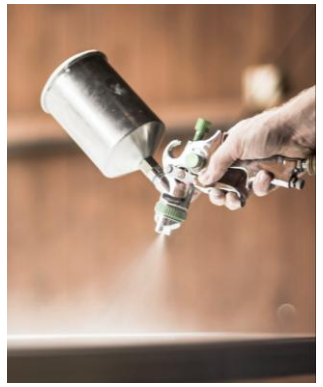
Selection of monomers to balance different coatings characteristics

Monomer properties

- Structure (linear, branched, …)
- Polarity
- Multifunctional methacrylates (crosslinker)
- Additional chemical functionalities in the side chain

Resin properties

- Hardness
- Flexibility
- Adhesion
- Tackiness
- Scratch resistance
- Chemical resistance
- Weatherability
- Reactivity



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The Standard Portfolio Offers a Versatile Toolbox to Solve Literally any Challenge in a Broad Range of Application Areas

Alkyl/Aryl Methacrylates	Crosslinker Methacrylates	Ether/Acetal Methacrylates	Amino Methacrylates	Phosphate Methacrylates	High Purity Methacrylates	Adhesion Monomers	Specialty Intermediates	Specialty Methacrylamides
EHMA	AMA	ETMA	MADAME	HEMA-P 70M	UHP-HEMA	MEEU 50 W	MAAH	N-MMAA
IDMA	EGDMA	THFMA	DMAPMA	HEMA-P 100		MEEU 25 M	ECH	N-IPMAA
Terra C13-MA	TRGDMA	BDGMA	TMAEMC					
Terra C17,4-MA	PEG200 DMA	C18 PEG 1105 MA W	MAPTAC					
c-HMA	1,3-BDDMA	MPEG 500 MA						
IBOA	1,4-BDDMA	MPEG 750 MA W						
Terra IBOMA	1,6-HDDMA	MPEG 1005 MA W						
BNMA	GDMA	MPEG 2005 MA W						
*TMCHMA	TMPTMA	MPEG 5005 MA W						
	HEMATMDI	*Terra IPGMA						
	*Terra ISDMA							
	*Terra CARMA							

VISIOMER®

VISIOMER® products are made from raw materials with Bio-Carbon content. VISIOMER® Terra products are friendly-labelled and contribute to sustainable solutions with high Bio-Carbon content.

* developmental

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Sustainability

VISIOMER® Methacrylates with Reduced Carbon Footprint

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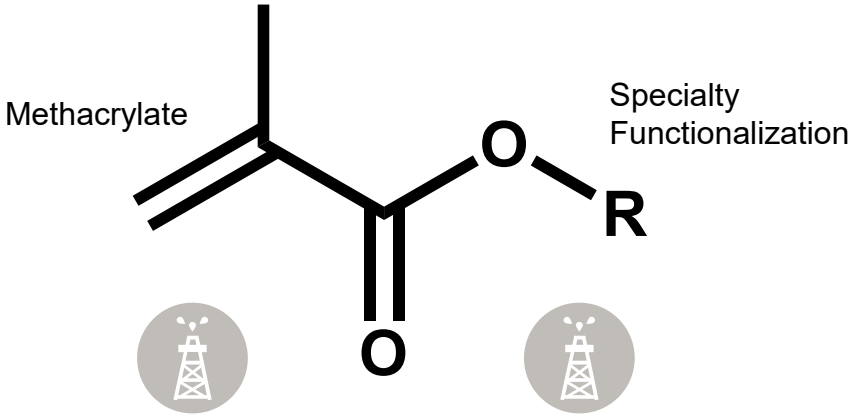
One Alternative:

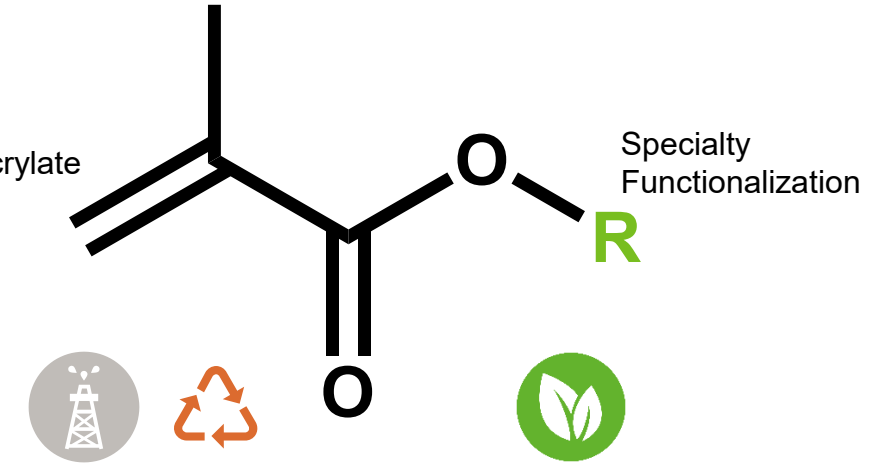
Sustainable Methacrylates Using Bio-Based Raw Materials

100% petroleum-based monomer



Batch production

up to **85% bio-based** monomer



Cradle to Gate Life Cycle Assessments (LCAs) are calculated for each monomer

Circular or biobased methacrylate groups are not yet available but are expected to reduce the carbon footprint.

- Increase bio content
- Decrease carbon footprint

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Another Alternative:

Sustainable Methacrylates Using the Mass Balance Approach

VISIOMER® eCO sustainable methacrylates

- Carbon footprint reduced
- Made with circular and/or biobased feedstocks
- Mass balance approach ensures that sustainability benefits are correctly attributed
- Third-party verified

Producing sustainable monomers in a shared manufacturing plant

Traceable, audited, and 3rd-party verified

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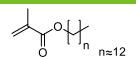
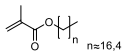
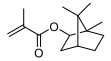
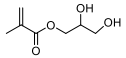
Our Sustainable Portfolio

Two Families of VISIOMER® Sustainable Methacrylates

VISIOMER® Terra family
Bio-based segregated and low hazard

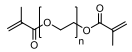
Established Bio-based Monomers

Commercially available bio-based specialty methacrylate monomers

VISIOMER® Products	Bio Content
Terra C13-MA 	76 %*
Terra C17,4-MA 	81 %*
Terra IBOMA 	72 %*
Terra GMMA 	43 %*

Drop-in Bio-based

Bio-based structural equivalents produced from readily available feedstocks

VISIOMER® Products	Bio Content
Terra PEG200DMA 	50 %*

replacing fossil 1:1 by biobased

advantage: no qualification and re-formulation necessary

Next Generation

New structures based on readily-available feedstocks

Active Developments	Bio Content
Terra CARMA	84 %
Terra ISDMA	43 %*
Terra OCMA[1]	66 %
Terra IPGMA	30 %*

*Third-party, independently certified by DIN CERTCO ASTM D6866

VISIOMER® eCO family
Reduced carbon footprint

Significantly Reduced Carbon Footprint

Circular or biobased feedstocks using a **mass balance approach**

Active Developments	Carbon Footprint
eCO EHMA	reduction

Structural equivalents with identical specifications and significantly reduced carbon footprints.

Mass balance is externally certified according to the ISCC PLUS standard.

[1] Not yet REACh registered

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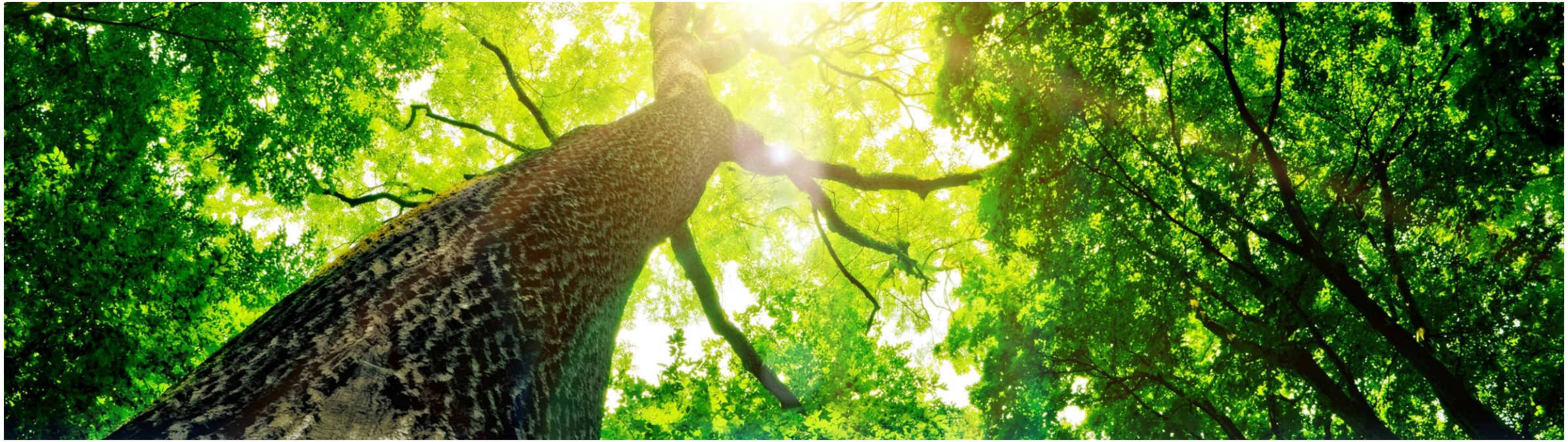
Next VISIOMER® Terra generation



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VISIOMER® Can Support You with Different Biobased Solutions

We can go beyond!

VISIOMER® Terra family
Bio-based segregated and low hazard

Established Bio-based Monomers

Commercially available bio-based specialty methacrylate monomers

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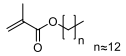
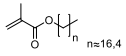
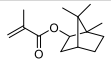
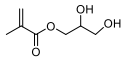
Terra C13-MA		76 %*
Terra C17,4-MA		81 %*
Terra IBOMA		72 %*
Terra GMMA		43 %*

Drop-in Bio-based

Bio-based structural equivalents produced from readily available feedstocks

VISIOMER® Products	Bio Content
Terra PEG200DMA	50 %*

replacing fossil 1:1 by biobased

advantage: no qualification and re-formulation necessary

Next Generation

New structures based on readily-available feedstocks

Active Developments		Bio Content
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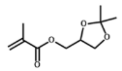
Terra IPGMA		30 %*

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[1] Not yet REACh registered

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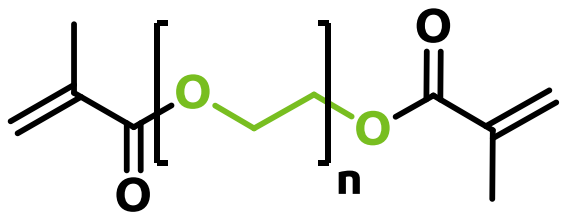
Drop-in Bio Based – VISIOMER® Terra PEG 200 DMA

VISIOMER® Terra PEG 200 DMA



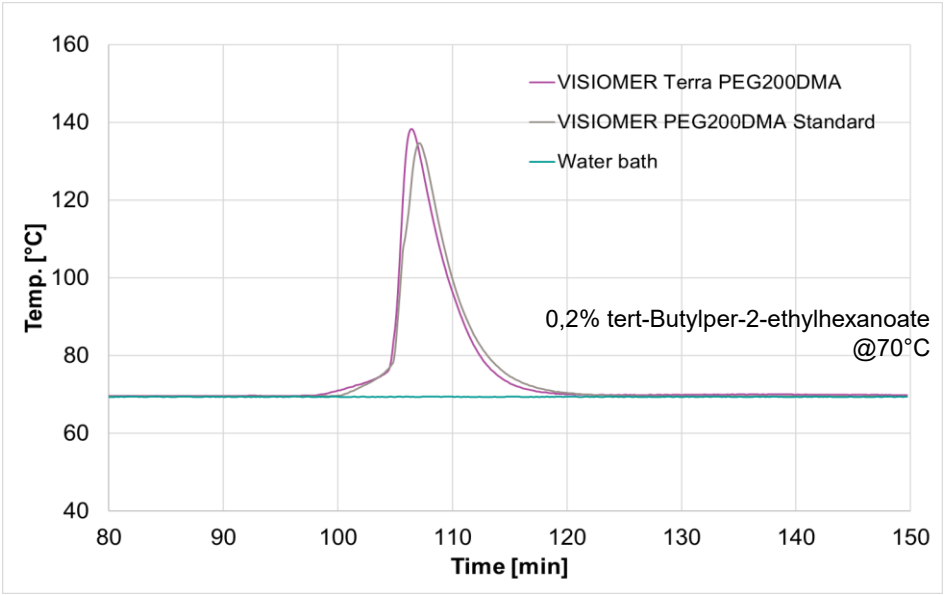
n≈4

Benefits:

- Bio carbon content 50 % with 21 % GWP reduction
- Raw material based on agricultural waste*

hydrophilic — hydrophobic

* customer letter available



No difference in reactivity compared to our standard fossil-based quality.

Applications:


Adhesives


Composites


Construction


Plastics

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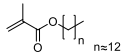
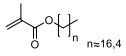
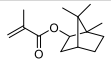
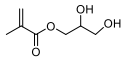
Terra C13-MA		76 %*
Terra C17,4-MA		81 %*
Terra IBOMA		72 %*
Terra GMMA		43 %*

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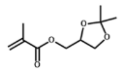
Terra IPGMA		30 %*

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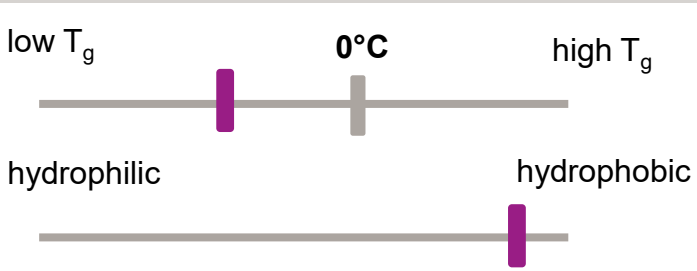
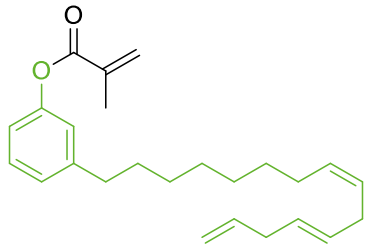
VISIOMER® Terra CARMA
for coatings and reactive resins



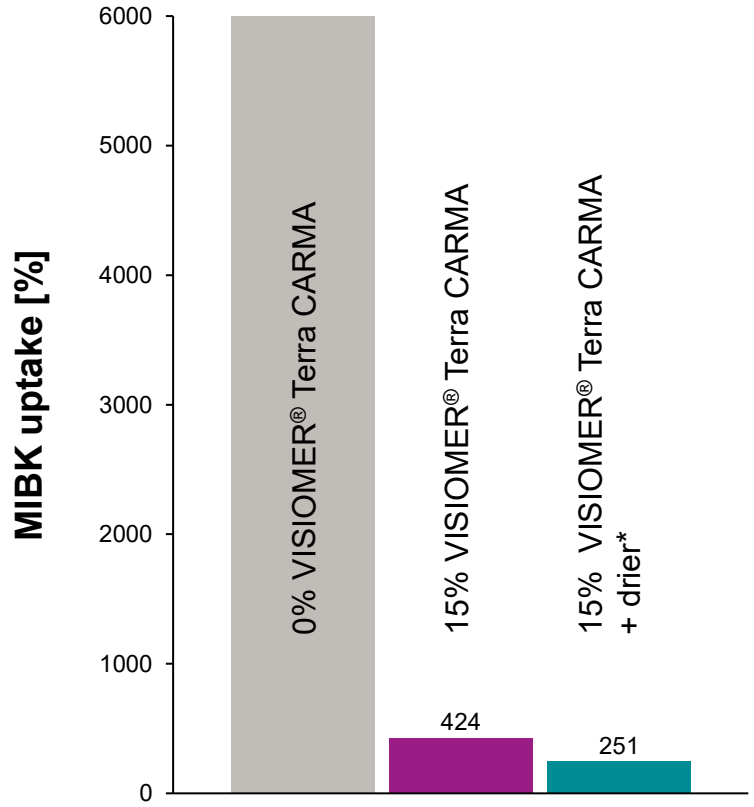


Main Application Areas:

- Comonomer in emulsion polymerization for acrylic binders providing functionality for post-crosslinking by oxygen
- Use as oxygen scavenger to prevent oxygen inhibition in gel coat applications

Special Features:

- Bio carbon content: 84 %
- Oxidative crosslinker for post-crosslinking



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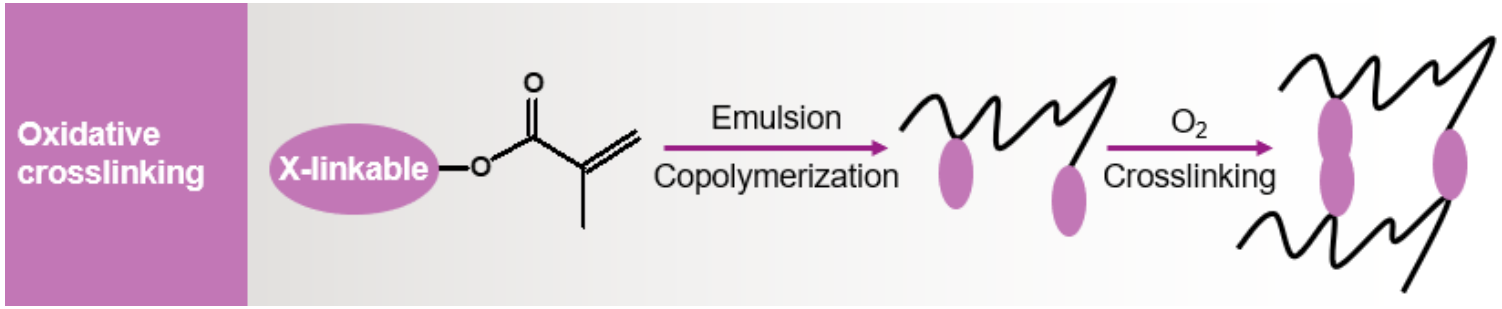
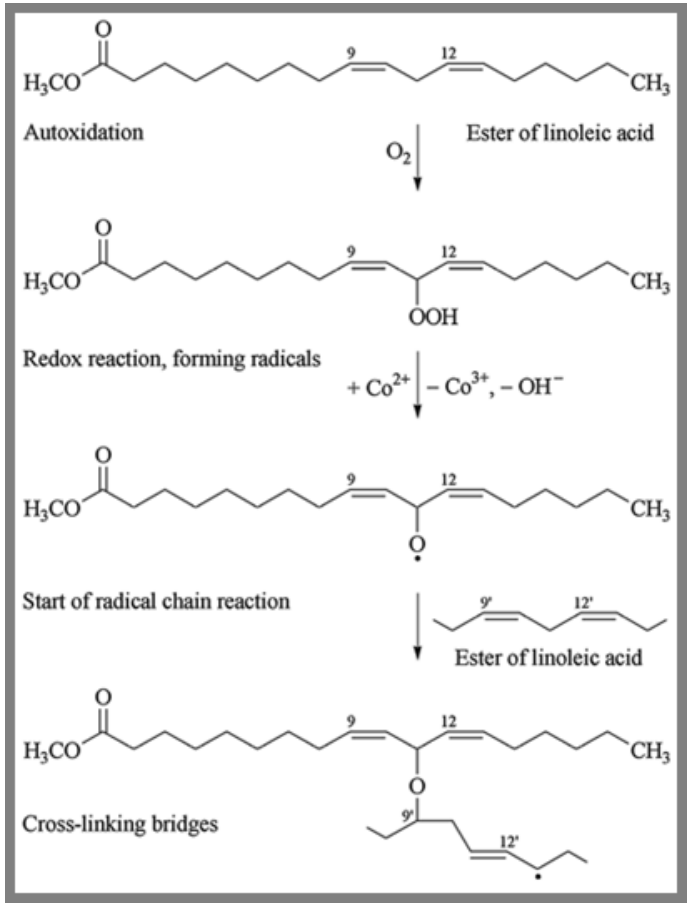
What is Oxidative Crosslinking?



- crosslinking mechanism comparable to alkyd resins
- crosslinking by oxidation with atmospheric oxygen at RT
- crosslinking process can be accelerated using drying agents

  (e.g. metal salts often based on Cobalt)

Post-crosslinking at ambient temperature allows for adjustment of the final coating properties in combination with good film formation at low temperatures.



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VISIOMER® Terra CARMA

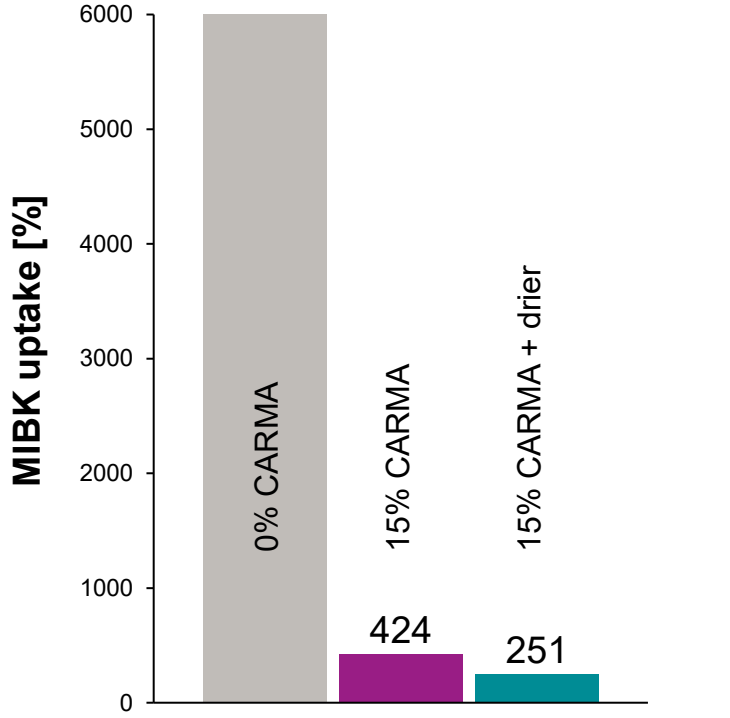
Crosslink Density of Emulsion Polymer Films

- VISIOMER® Terra CARMA films oxidatively self-crosslink at room temperature
- Drying agents further increase crosslink density
- Films incorporating 15% CARMA were colorless & nearly transparent

Film Appearance

0% CARMA 15% CARMA

Solvent Uptake of Polymer Films



*Polymer composition: 15% Terra CARMA, 45% BuA, 39% MMA, 1% GMAA

VISIOMER® Terra CARMA provides post-crosslinking functionality in emulsion polymers

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Comparison of Different Driers

	Emulsion with 15wt% VISIOMER® Terra CARMA					
Siccative	Nuodex Web Combi AQ	Co-Naphthenate	Additol dry CF100	Additol VXW 4940 N	Oxy-Coat 1101	Octa-Soligen 144 aqua
Metal ion	Co, Li, Zr	Co	Mn	Co, Ba, Zr	Fe	Co, Zn, Zr
Added amount	2,5%	1,25%	3%	2,5%	3%	7,5%
Film appearance	slightly brownish	slightly brownish	yellow	slightly brownish	slightly yellow	slightly brownish

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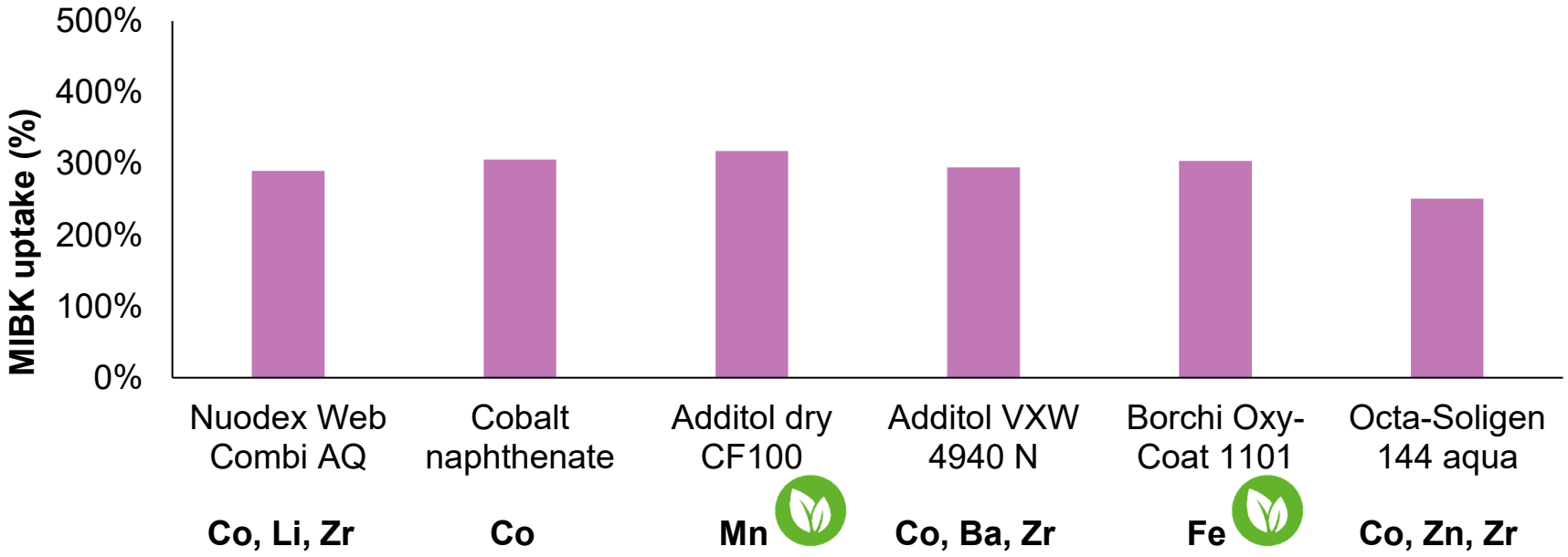
Comparison of Different Driers

Solvent uptake of VISIOMER® Terra CARMA containing polymer films prepared with various drying agents



VISIOMER® Terra CARMA can be efficiently crosslinked with various drying agents

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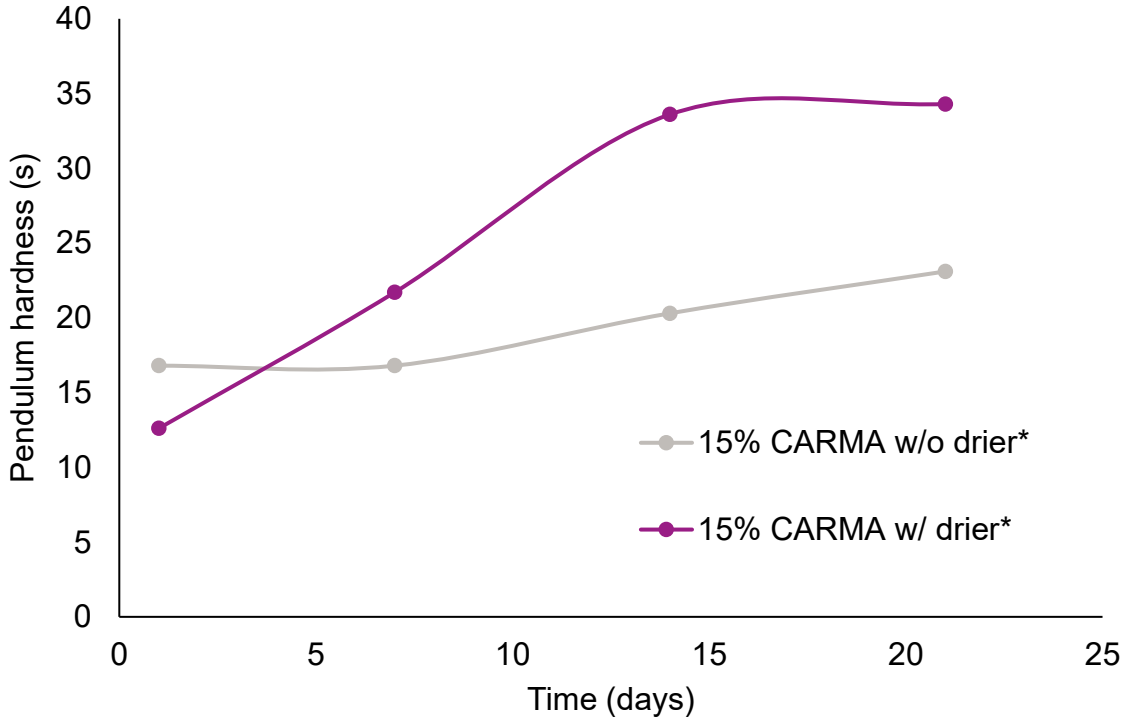
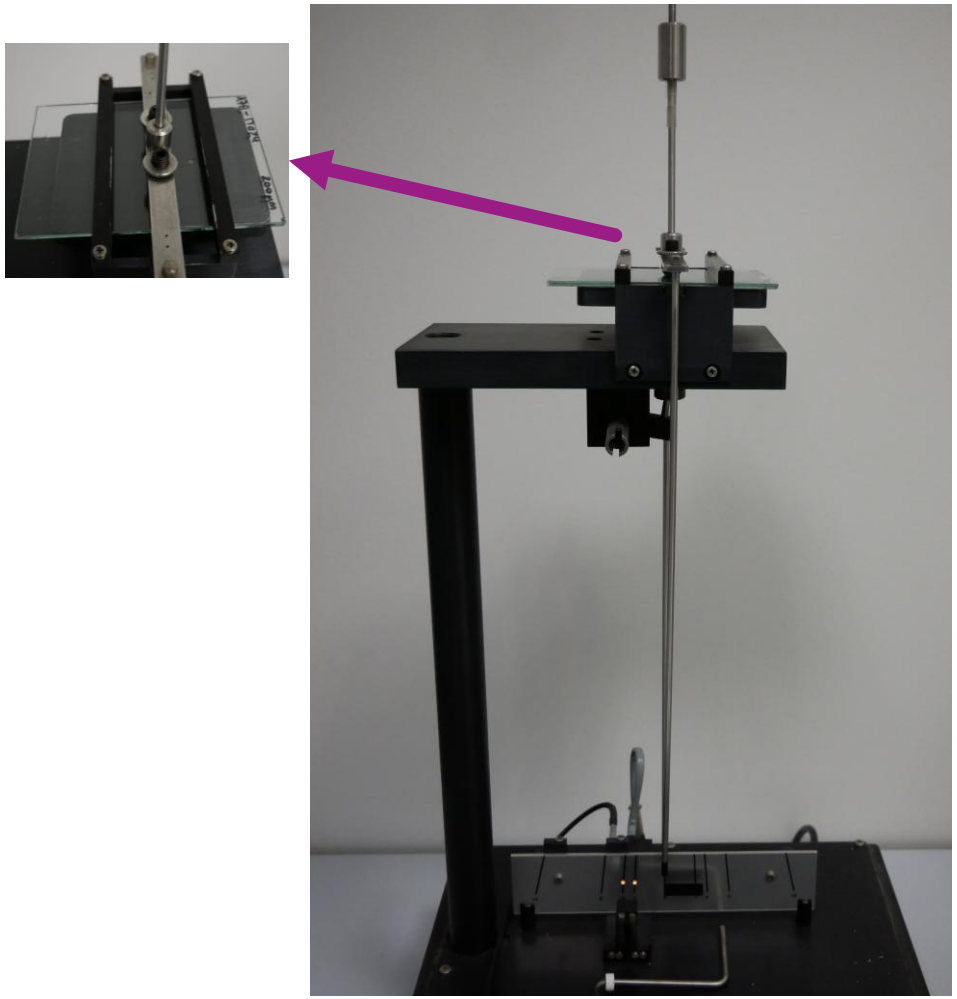
Crosslinking Kinetics

- Crosslinking in relation to time expressed by pendulum hardness



*ADDITOL VXW 4940N used as drier



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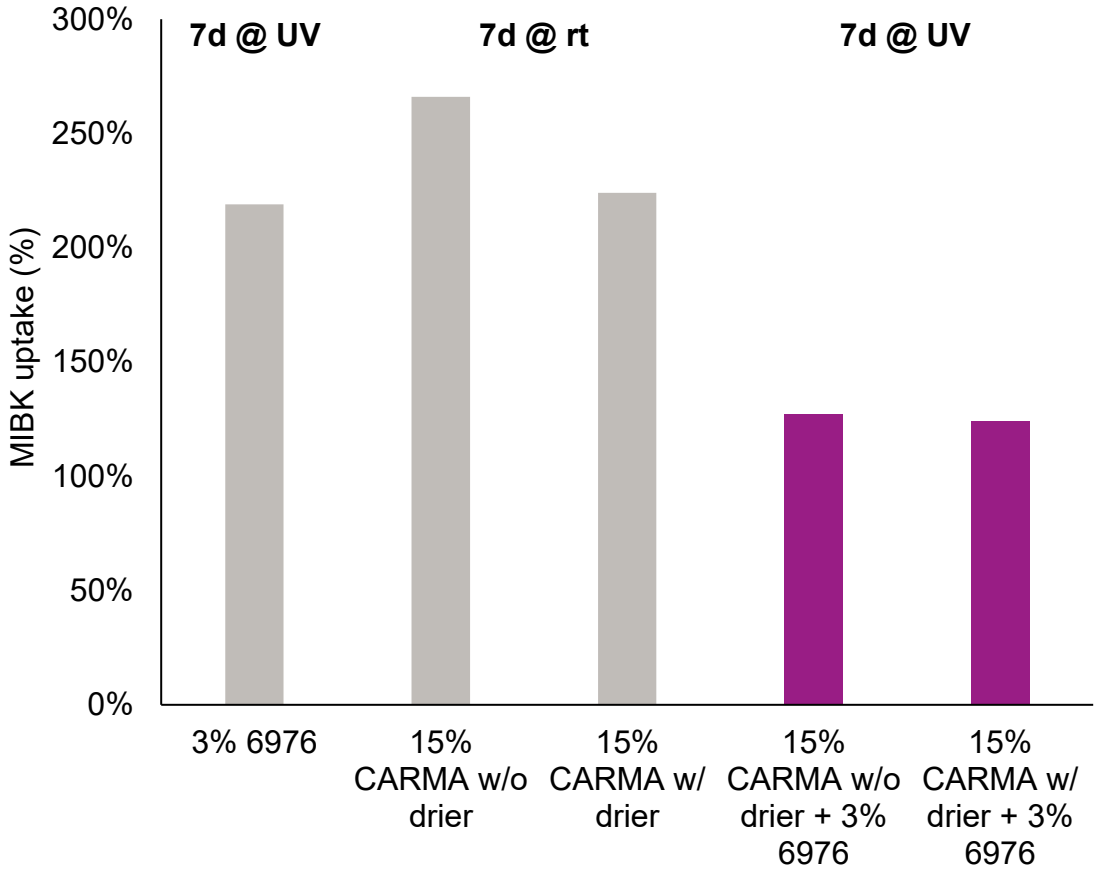
Combination of Different Crosslinking Technologies

- Combination and comparison of VISIOMER® Terra CARMA (oxidative crosslinking) with VISIOMER® 6976 (UV crosslinking)
- The combination of the two technologies results in a synergism leading to a significantly higher crosslinking efficiency
- VISIOMER® Terra CARMA shows similar performance w/ and w/o drier when VISIOMER® 6976 is present
- Comparative testing with DAAm/AAEMA (condensation crosslinking) shows performance on same level



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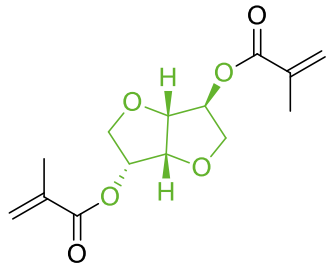
VISIOMER® Terra ISDMA
for coatings and reactive resins

hydrophilic — hydrophobic

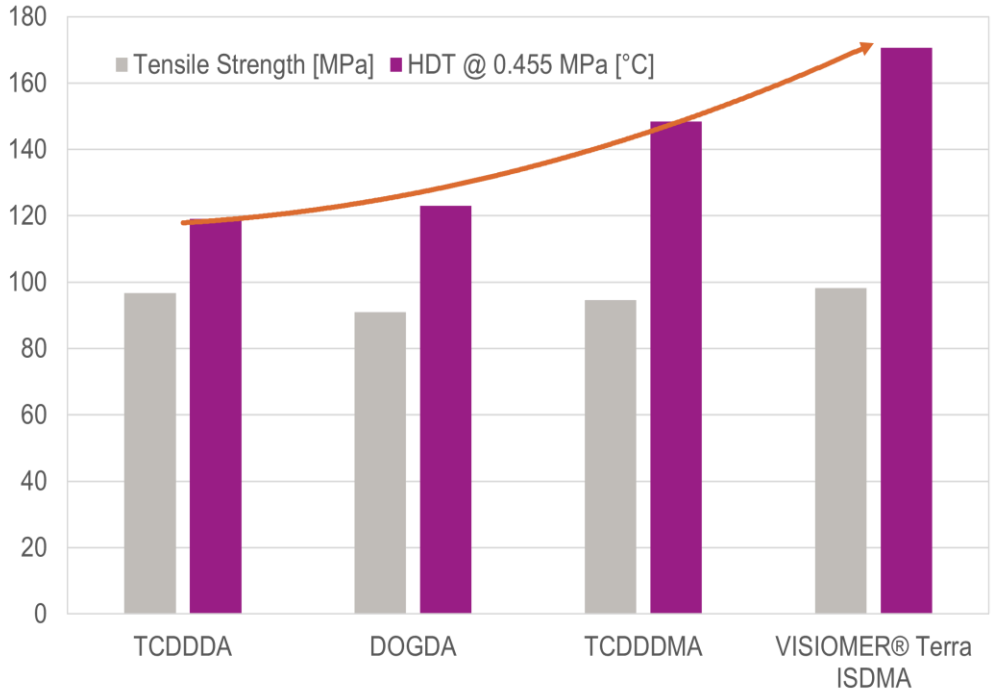


Main Application Areas:

- Crosslinker in reactive resin applications like adhesive, composites, chemical anchoring and artificial marble
- Comonomer in emulsion polymerization for core-shell acrylic binders

Special Features:

- Bio-carbon content: 43 %
- VISIOMER® Terra ISDMA performance comparable to EGDMA
- Low shrinkage: 8 %



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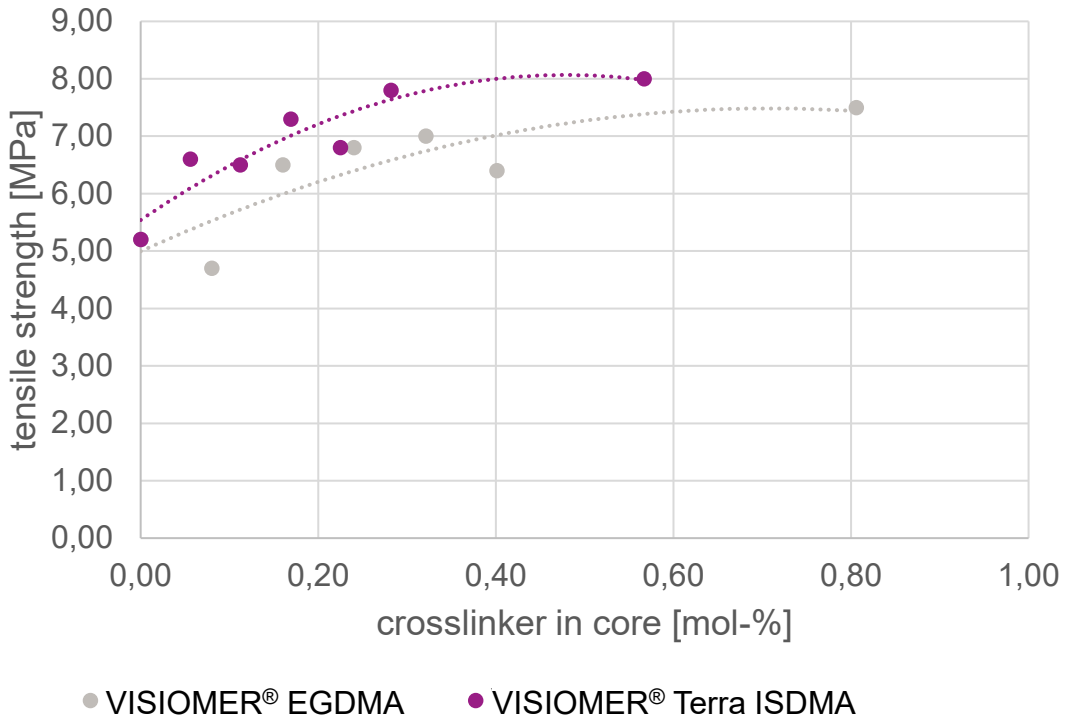
VISIOMER® Terra ISDMA
- improved mechanical properties compared to EGDMA



Core-shell emulsion polymerization with VISIOMER® Terra ISDMA vs. VISIOMER® EGDMA as cross-linker in the core

Films containing VISIOMER® Terra ISDMA show improved mechanical properties and higher crosslinking efficiency

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VISIOMER® Terra OCMA
biobased alternative to ethylhexyl methacrylate

low T_g **0°C** high T_g

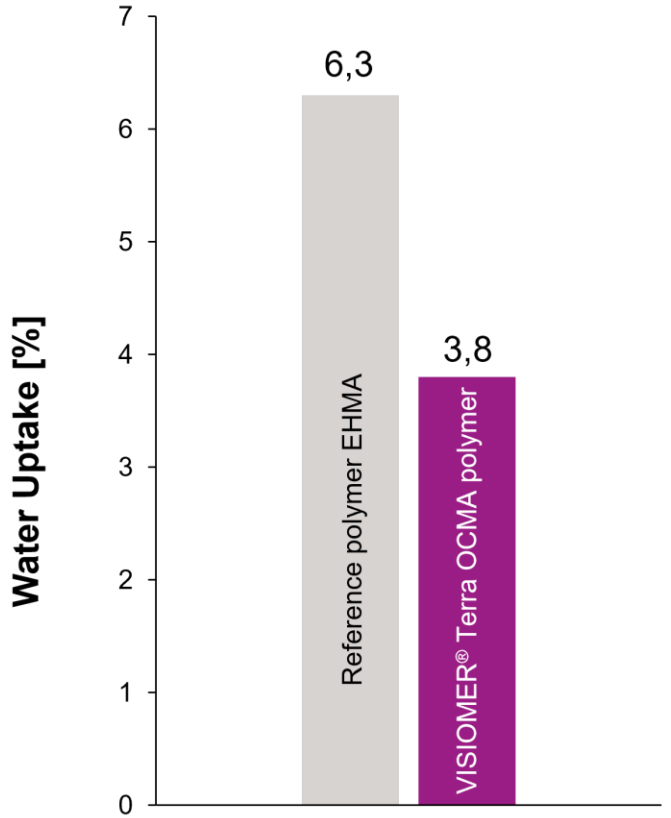
hydrophilic hydrophobic

Main Application Areas:

- Co-monomer in emulsion based acrylic binders for coatings to improve flexibility, hydrophobicity and scratch resistance
- Co-monomer in pressure-sensitive adhesives

Special Features:

- Bio carbon content: 66 %
- Soft alkyl methacrylate comparable to EHMA
- Improved water resistance, water solubility < 0.5 g/l



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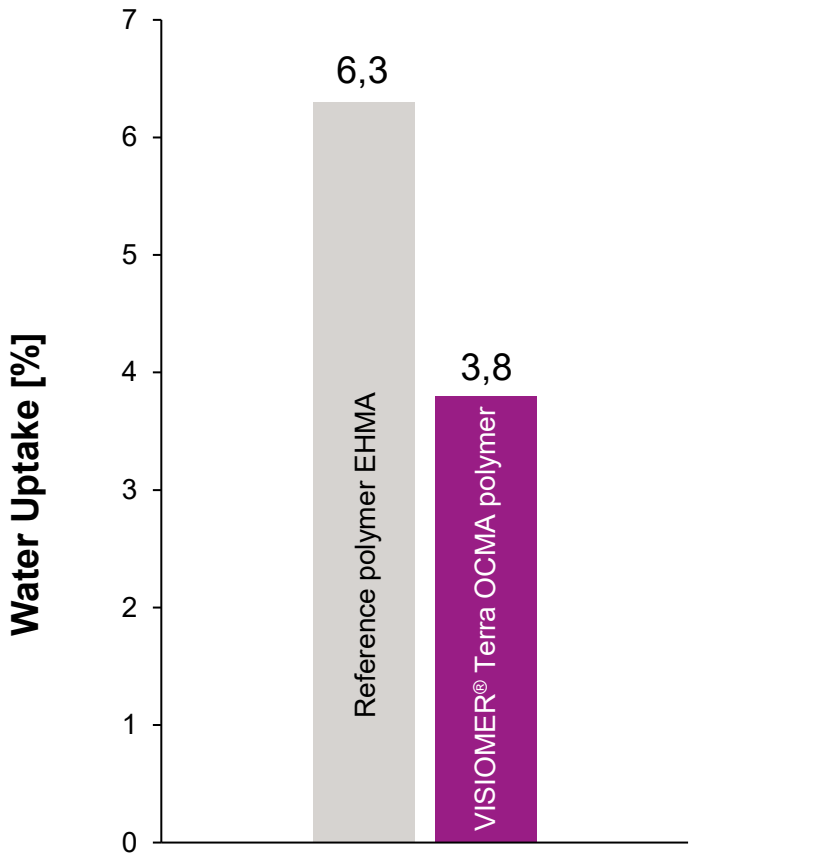
VISIOMER® Terra OCMA
Improved Water Resistance Using Sustainable Monomers



Film preparation: 7d @RT on glass plate, film thickness (dry) : 0.5mm

- New, biobased VISIOMER® Terra OCMA reduced film water uptake by 40%
- Films were transparent and colorless
- The biobased Terra OCMA and EHMA were both incorporated at 50%
- Emulsion polymerization was comparable to EHMA

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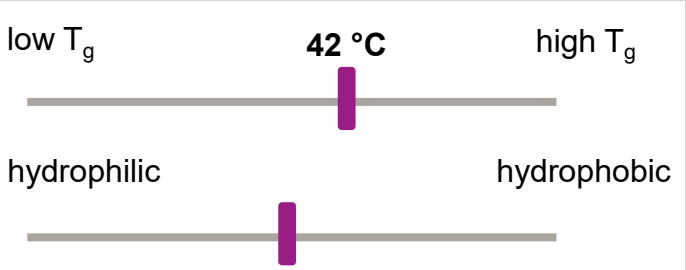
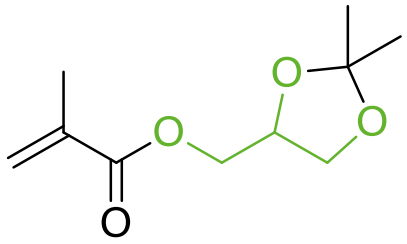
VISIOMER® Terra IPGMA
nearly odorless methacrylate for reactive resins



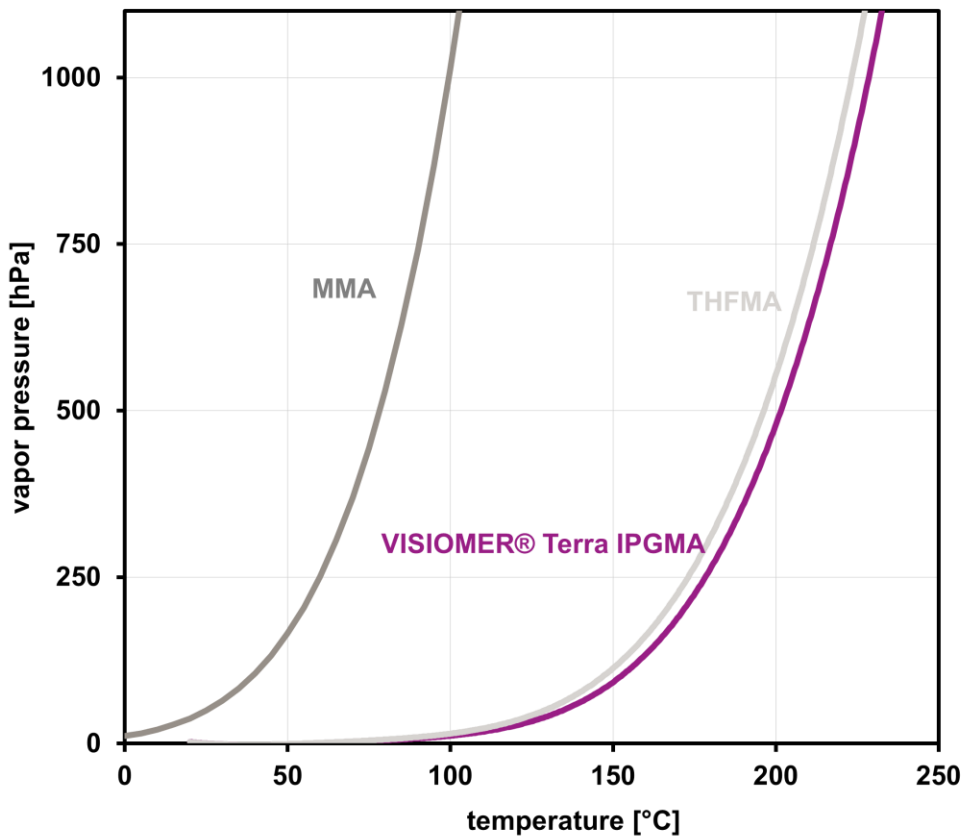


Main Application Areas:

- Co-monomer for low-odor, label-friendly structural adhesives
- Co-monomer for use in floor coatings

Special Features:

- Bio carbon content: 30 %
- Low hazard
- Low odor



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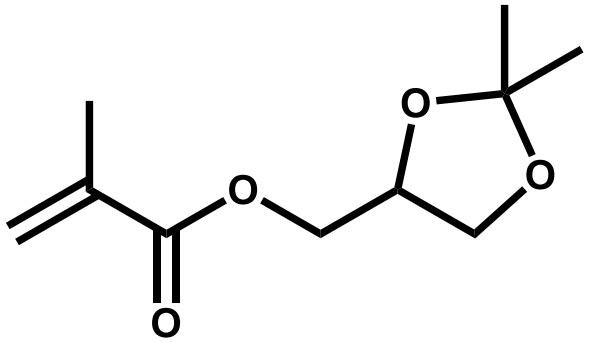
VISIOMER® Terra IPGMA (Isopropylideneglycerine methacrylate)

- Low odor
- Low hazard (only )
- Bio-content: 30 %
- TSCA, REACh, and NDSL listed



Standard Specification	
Degree of Purity	min. 98,5 %
Water Content	max. 0,20 %
Color	max. 50
Stabilization	200 ± 20 ppm MEHQ

Physical Data	
Boiling Point	100,1 °C at 10 mbar
Refractive Index	1,445 at 20 °C
Density	1,051 g/cm^3 at 20 °C
Viscosity (kinematic)	4,73 mPas at 20 °C
T_g	42 °C

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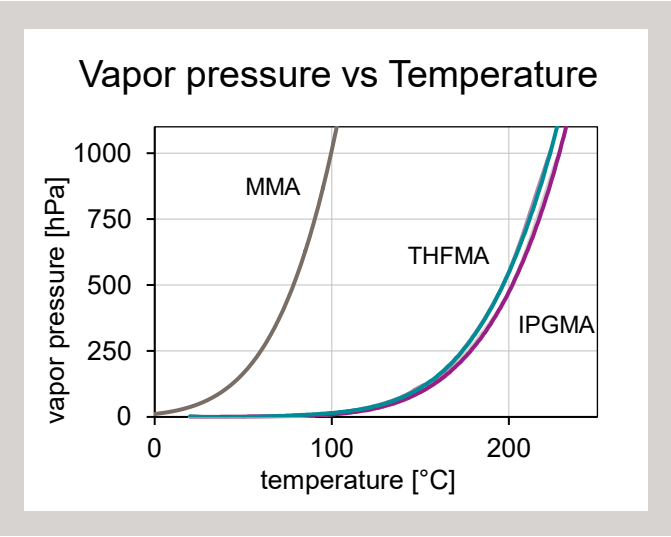
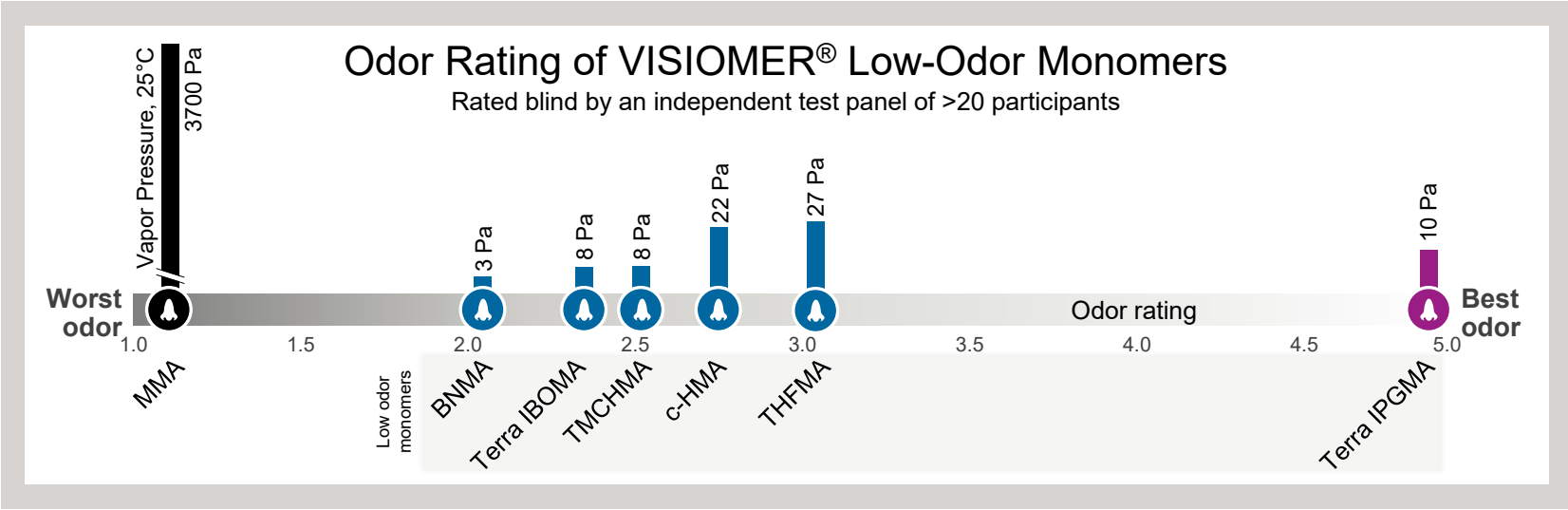
Odor of Methacrylate Monomers

- All low-odor VISIOMER® methacrylates have vapor pressures much lower than MMA and styrene
- Favorable odor also depends on the structure
- VISIOMER® Terra IPGMA is nearly odorless and unobjectionable





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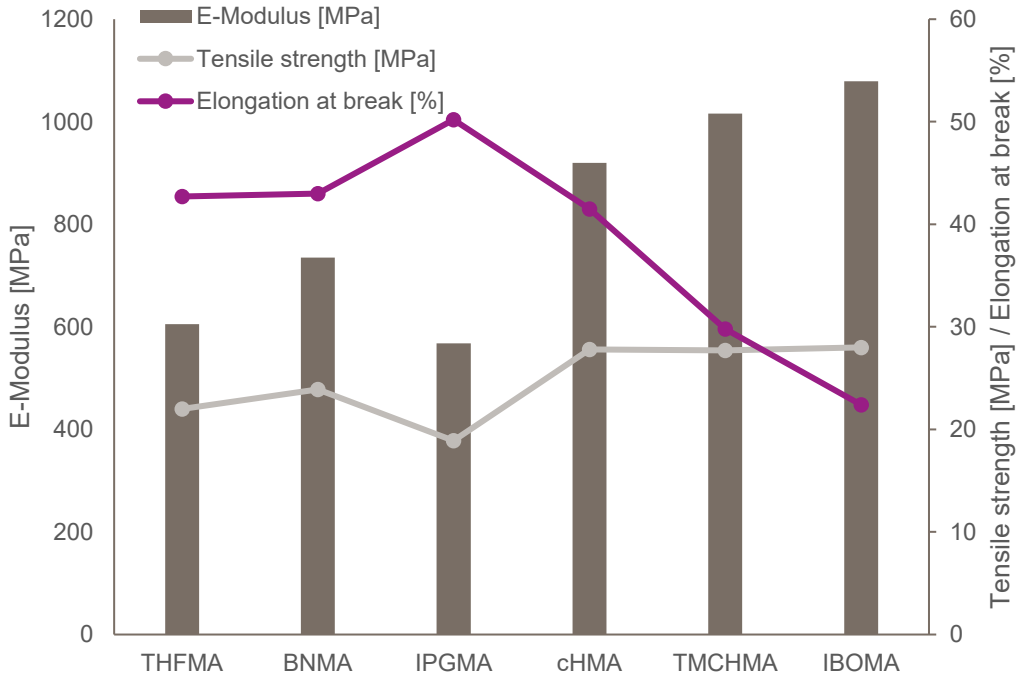
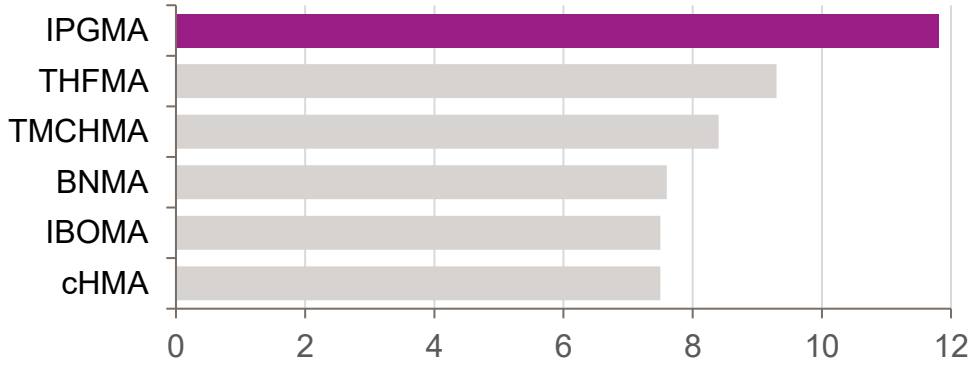
Understanding Monomer Performance in Adhesives

Monomer Mechanical & Adhesion Properties
in a structural adhesive model formula*



Normalized shear strength
in a structural adhesive model formula*



(1000* lap shear [MPa] / E-modulus [MPa])

VISIOMER® Terra IPGMA provides the highest shear strength per unit modulus

- Excellent adhesion
- Does not sacrifice flexibility

*Model formula: 32% subject monomer, 32% Rubber component, 21% MMA, 8% IBOMA, 6% TMPTMA, 1% t-BPEH

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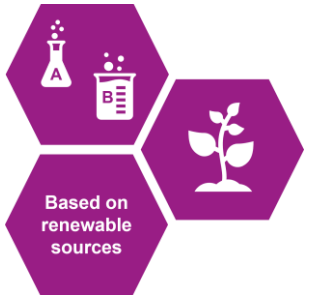
Truly sustainable solutions deliver positive effects for carbon footprint and handprint

Methacrylates based on Renewable Raw Materials



- VISIOMER® Terra C13-MA
- VISIOMER® Terra C17,4-MA
- VISIOMER® Terra IBOMA
- VISIOMER® Terra PEG 200 DMA
- … more under development

Methacrylates for Sustainable Processes

- Low-temperature curing (e.g., VISIOMER® 6976, Terra CARMA)
- Low VOC in High Solid coatings (VISIOMER® Terra IBOMA)
- Improved EHS and handling profile (tox/vapor pressure, e.g. Terra IPGMA)

Methacrylates for Sustainable End Markets

- Styrene replacement for composites in Light Weight Construction (e.g.,1,4-BDDMA)
- Electromobility (e.g., electrical insulation resins using VISIOMER® 1,4-BDDMA, Terra PEG 200 DMA and TRGDMA)

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Beyond VISIOMER® Terra - VISIOMER® eCO

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Difference between Terra and eCO suffix

VISIOMER® Terra product line	VISIOMER® eCO product line
methacrylates with a bio carbon content of at least 20 %	applies mass balance approach to replace fossil by circular raw materials, in our production processes or in our supply chain
all relevant approved raw materials are bio-based (alcohol part of the monomer)	mass balance approach is externally certified (ISCC+ or RedCert)
only friendly labelled products*	products are not classified as Challenged or Transitioner in PARC** analysis
	the carbon footprint of eCO products is significantly lower than of the equivalent non-eCO products

*only the **pictogram "Exclamation Mark" (GHS07)** is acceptable as hazardous pictogram - only the **signal word "Warning"** is accepted

** PARC = product application region combinations according to World Business Council for Sustainable Development (WBCSD)

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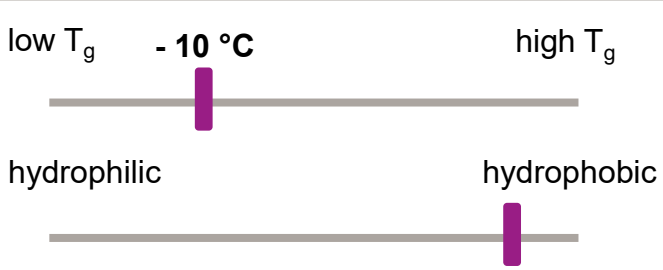
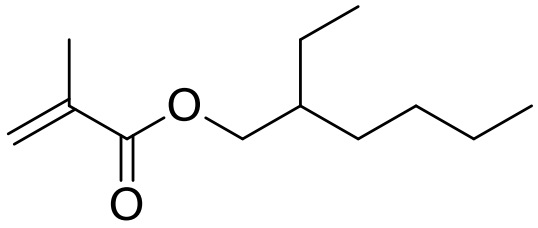
VISIOMER® eCO EHMA
low-carbon footprint EHMA





Main Application Areas:

- Co-monomer in emulsion based acrylic binders for coatings to improve flexibility, hydrophobicity and scratch resistance
- Co-monomer in pressure-sensitive adhesives

Features

- Carbon footprint reduced
- Made with circular and/or bio-based feedstocks
- Mass balance approach ensures that sustainability benefits are correctly attributed
- Third-party (ISCC PLUS) verified
- Same specification as standard product VISIOMER® EHMA

TÜVNORD

ISCC CERTIFIED PLUS

ISCC PLUS Certificate

Certificate Number: ISCC-PLUS-Cert-DE129-35380142

TÜV NORD CERT GmbH
Am TÜV 1, 45307 Essen
certifies that
Evonik Operations GmbH
Im Pfaffenwinkel 6
67547 Worms, Germany
(operating under a tolling agreement)
complies with the requirements of the certification system
ISCC PLUS
(International Sustainability and Carbon Certification)

Place of the audit
(if different from the legal address of the system user as stated above; only applicable for traders and traders with storage):
Same as above

This certificate is valid from 06.01.2025 to 05.01.2026.

The site of the system user is certified as:
Specialty chemical plant

The scope of the certificate includes the following chain of custody options:
Mass Balance

Essen, 06.01.2025
Place and date of issue

TÜVNORD
Stamp, Signature of issuing party

The issuing Certification Body is responsible for the accuracy of this document.
Version / Date: 1 (no adjustments) / 06.01.2025

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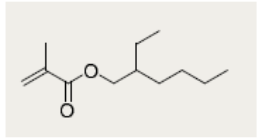
VISIOMER® eCO EHMA

Product Information
VISIOMER® eCO EHMA



2-Ethylhexyl methacrylate

CAS-No.: 688-84-6

same specification as our standard VISIOMER® EHMA

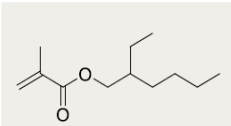
Quality on supply

Appearance: clear, colorless liquid
Odor: ester like

Standard specification

		Test Method	
Degree of purity	min. 98.00 %	M2-16	(GC)
Acid content	max. 0.010 %	M4	(acid-base titr., calculated as GMAA)
Water content	max. 0.050 %	M3	(according to K. Fischer)
Color	max. 10	M5	(Pt-Co)
Stabilization	50 ± 10 ppm MEHQ	M1-18	(HPLC)

Product Information
VISIOMER® EHMA



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Water content	max. 0.050 %	M3	(according to K. Fischer)
Color	max. 10	M5	(Pt-Co)
Stabilization	50 ± 10 ppm MEHQ	M1-18	(HPLC)

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VISIOMER® eCO EHMA - Features

- Carbon footprint reduced
- Made with circular and/or biobased feedstocks
- Mass balance approach ensures that sustainability benefits are correctly attributed
- Third-party ISCC PLUS verified
- Same performance and specifications as standard products

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Summary

- VISIOMER® Terra CARMA
  - for ambient-temperature curing using oxidative crosslinking
  - can be combined with other ambient temperature crosslinking technologies, e.g. with VISIOMER® 6976 or condensation crosslinking systems
- VISIOMER® Terra ISDMA is a new biobased rigid crosslinker providing excellent mechanical properties and low shrinkage
- VISIOMER® Terra IPGMA is a new biobased reactive diluent with very low vapor pressure, even at elevated temperatures
- VISIOMER® eCO family features mass-balanced monomers

- Life cycle analyses are available

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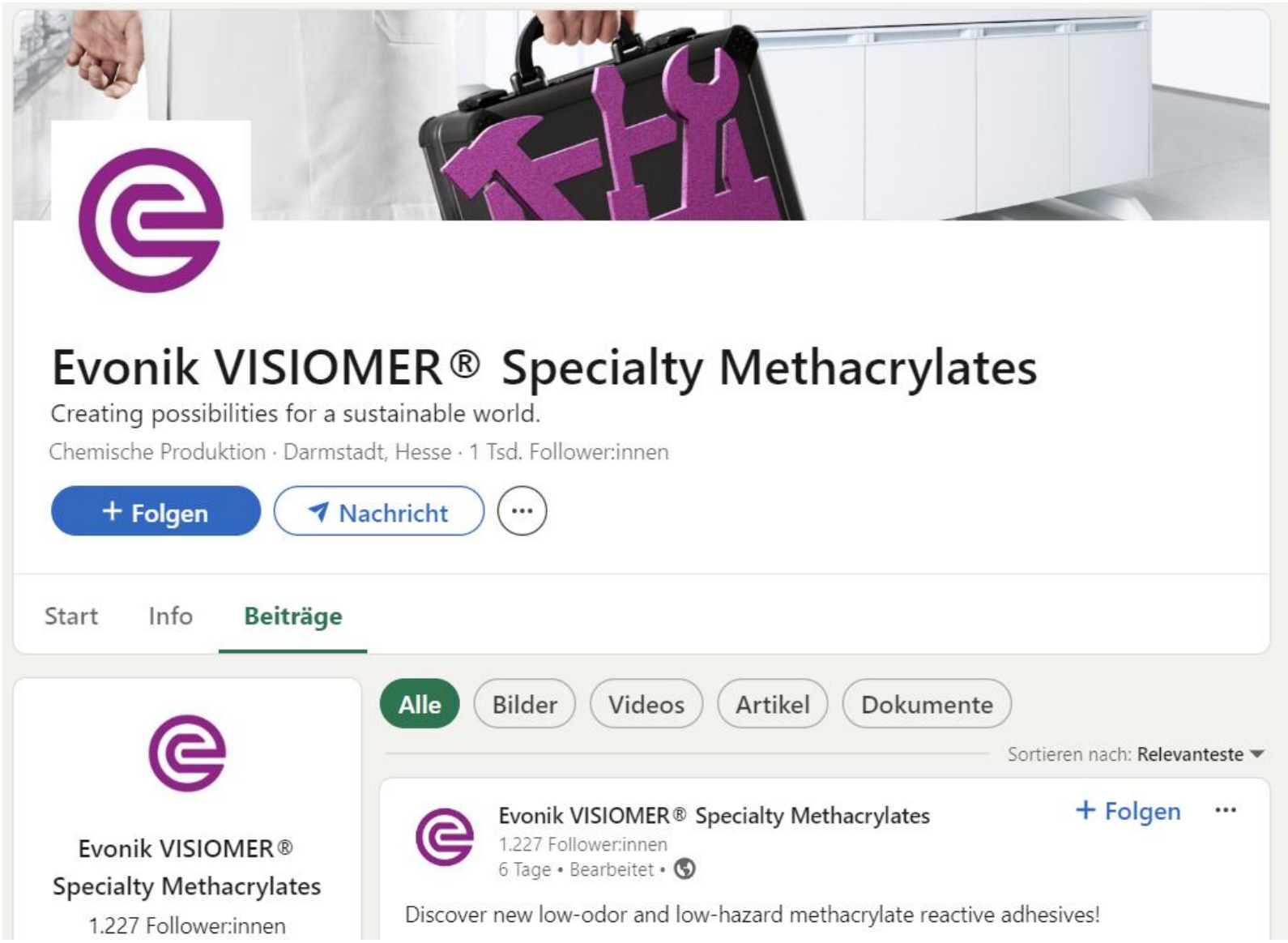
Also follow us on LinkedIn and stay up-to-date with upcoming events and webinars!



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Q&A

Please use the chat to submit your question to our experts!

Dr. Gerold Schmitt
gerold.schmitt@evonik.com

Dr. Christine Breiner
christine.breiner@evonik.com

Find more information in our VISIOMER® Toolbox

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