Low emission, formaldehyde & ammonia free binders with high performance

Daniele Zimmermann // Technical Service Manager Consumer Materials – Europe // Techtextil 2024

Our Agenda

- Introduction of Synthomer Group
- Formaldehyde & Ammonia regulation
- Polymer crosslinking and formaldehyde emission
- Synthomer Binder solution:
  Formaldehyde- and Ammonia-free
  - REVACRYL™ Design
  - LITEX™ QuickShield
  - LITEX™ SkyShield
- Q & A Session

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Synthomer Group

Synthomer – A Growing Supplier of Specialty Polymers

A publicly traded, global supplier of high-performance, speciality polymers

3 Divisions focused on end-use markets:

1. Coatings & Construction Solutions
2. Adhesive Solutions
3. Health & Protection + Performance Materials

4,400 employees across nearly **40** sites in **~20** countries

FTSE 250

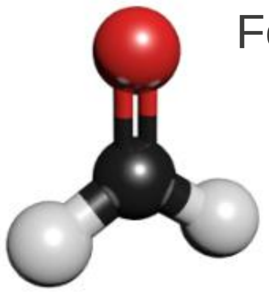
Listed on London Stock Exchange since **1971**

36% absolute reduction in Scope 1 and 2 GHG emissions since 2019

Regulation view and classification

Health and Safety Implication for the industry

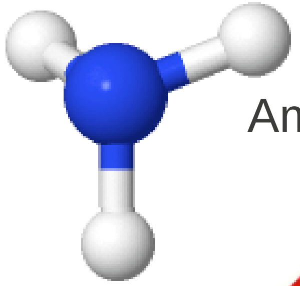
- Multiple regulations on end articles and product labels
- Workplace exposure, emission levels, air quality control requirements
- Limitation of Formaldehyde emissions to lowest possible level by process & technical measures
- Regular check on substitution potential



Formaldehyde
CH_2O

FA change of classification (2016):
from carcinogenic cat 2, H 351 →
carcinogenic cat 1B, H 350

Toxic
Corrosive



Ammonia
NH_3

Strong Smell
Ammonia emission regulation in the European Union (EU) is subject to specific standards and targets
Emissions lead to increased **damages aquatic ecosystems**

What can we do:

- No use of formaldehyde and ammonia in raw material formulations
- Ban of Formaldehyde emitting biocides
- Replace crosslinking reaction emitting Formaldehyde

Solutions with new products crosslinking with low emission, Formaldehyde-free, Ammonia-free

Key for high performance by polymer networks

Concept of crosslinking

Creation of **chemical bonds** leading to an increase of the molecular weight and the formation of **polymer networks**

A- Crosslinking during the polymer synthesis
- ➢ Monomers with 2 or more double bonds
- ➢ Process conditions

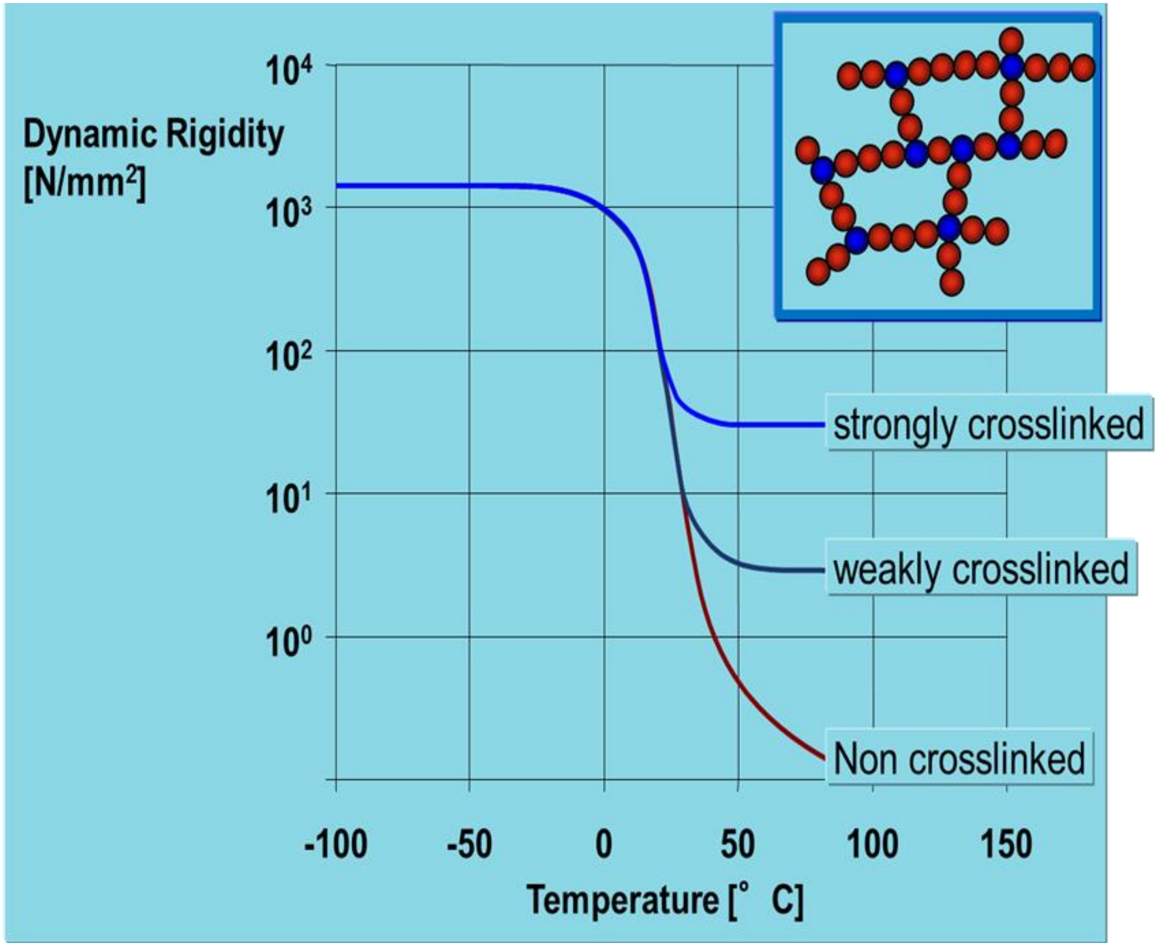
B-Crosslinking during the polymer film drying
- ➢ By functional group within the polymer backbone more sophisticated than A
- ➢ Allows ideal wetting and bonding to the fiber substrate

Crosslinking leads to high performance on:

- Elasticity and resilience
- Heat resistance
- Tensile / bonding strength
- Resistance against solvents, acids, chemicals
- Combination of soft handle & non blocking features
- Better abrasion resistance

Crosslinking

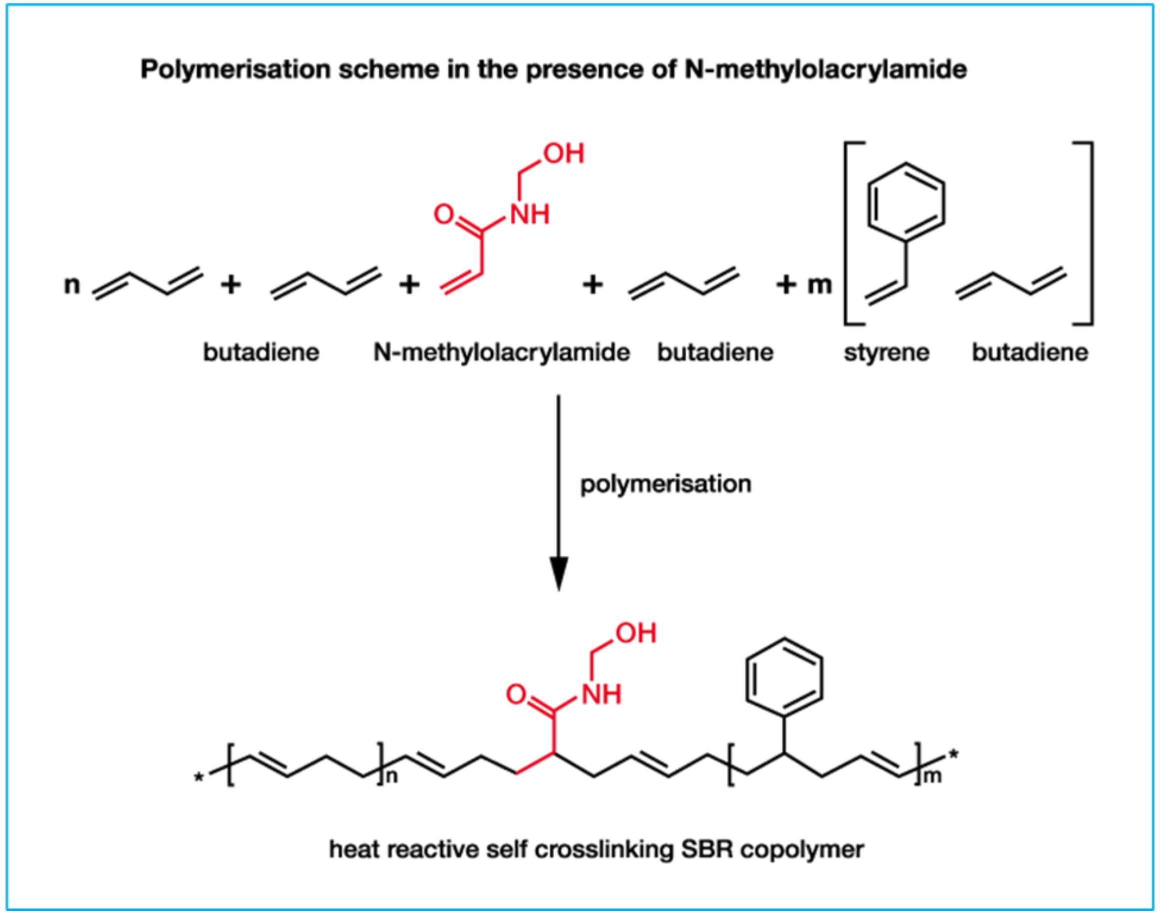
Impact on elasticity and resilience by DMA

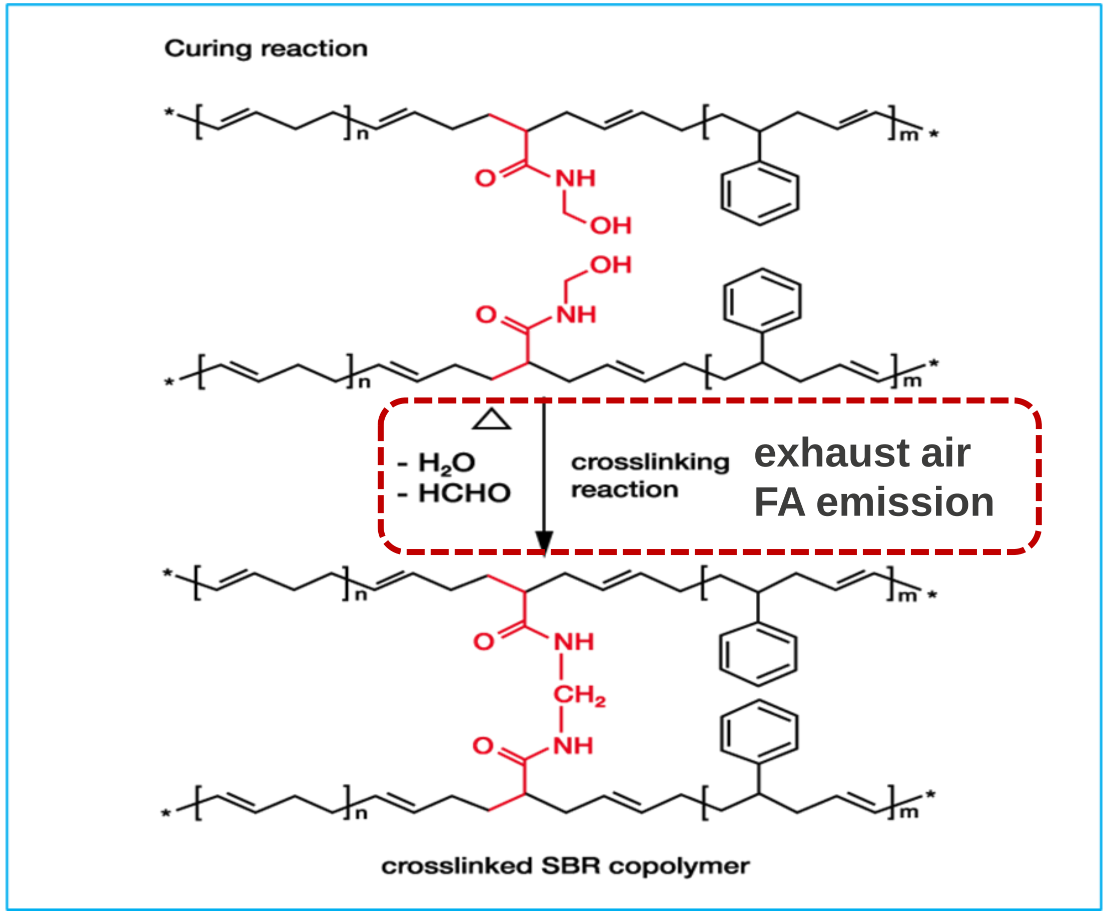


Crosslinking mechanism during polymer film formation

Formaldehyde (FA) Challenge

Standard crosslinking technology with *N*-methylolacrylamide... → results in FA emissions in ppm range





- Special heat reactive co-monomers are included in the polymer chain during polymerization
- Reaction at 130°C in the dry state after film formation

REVACRYL™ Design

High wet tear strength & Low emission binder

REVACRYL™ Design

Crosslinking solution for wet tear strength resistance and non-block features

Application

- Wallcovering glass fibres, nonwovens, technical paper for abrasives

Manufacturing process

- Foulard impregnation
- Size press coating
- 15-20% binder uptake

Product requirement

- Low water uptake/ good wet tear strength
- Absolute block free behavior
- Lightfast/ low yellowing
- Good filler tolerance
- Good fibre bonding/ self-crosslinked

Current state of art product offering:

SA, wide range Tg -15°C, +38 °C, TS: 50%, Curing >130°C

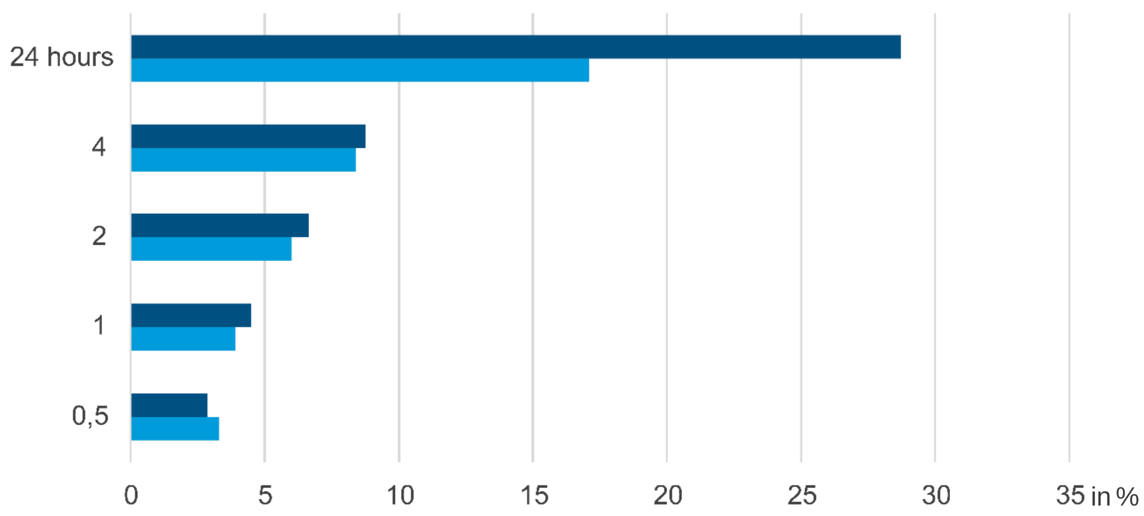
Targets

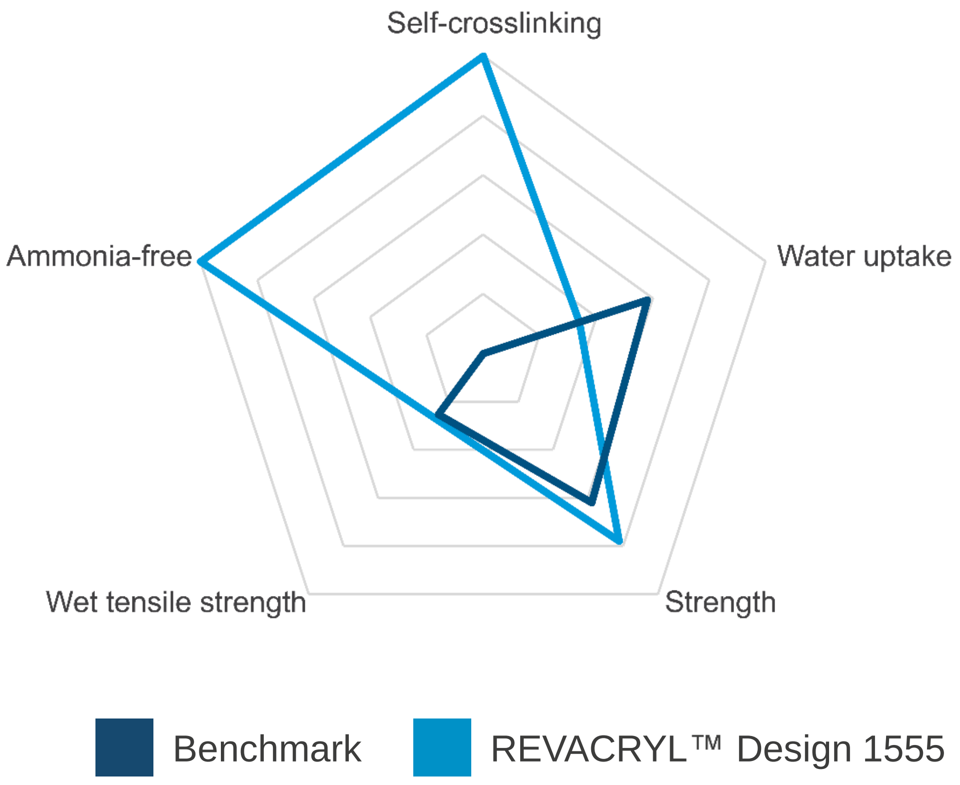
- Crosslinking without Formaldehyde emissions
- Ammonia-free binder process
- Hydrophobic binder from soft to stiff handle

High wet tear strength & Low emission binder - Styrene Acrylic SA

REVACRYL™ Design 1555

Water uptake





Performance comparison

High wet tear strength & Low emission binder - Styrene Acrylic SA

REVACRYL™ Design

Benefits

- Excellent wet tear strength
- Low foaming
- Low water uptake
- Soft & non-blocking
- Outstanding light fastness
- Compliant to OEKO-TEX Class I requirement

- Formaldehyde-free
- Ammonia-free
- Self-crosslinking

	Total Solid Content [%]	pH Value	Viscosity [mPa.s]	Tg [°C]	Handle
REVACRYL™ Design 1425	50	8.5	<2,000	-15	Very soft
REVACRYL™ Design 1490	50	7.5	<350	- 2	Soft
REVACRYL™ Design 1555	50	7.5	<1,000	11	Medium Soft
REVACRYL™ Design 1560	50	7.5	<350	12	Medium Soft
REVACRYL™ Design 1610	50	7.5	<500	22	Stiff
REVACRYL™ Design 1690	50	6.0	<2,200	38	Very stiff

LITEX™ QuickShield

Fast drying & Low emission XSBR binders

Fast drying & Low emission binder - Carboxylated styrene butadiene XSBR

LITEX™ QuickShield

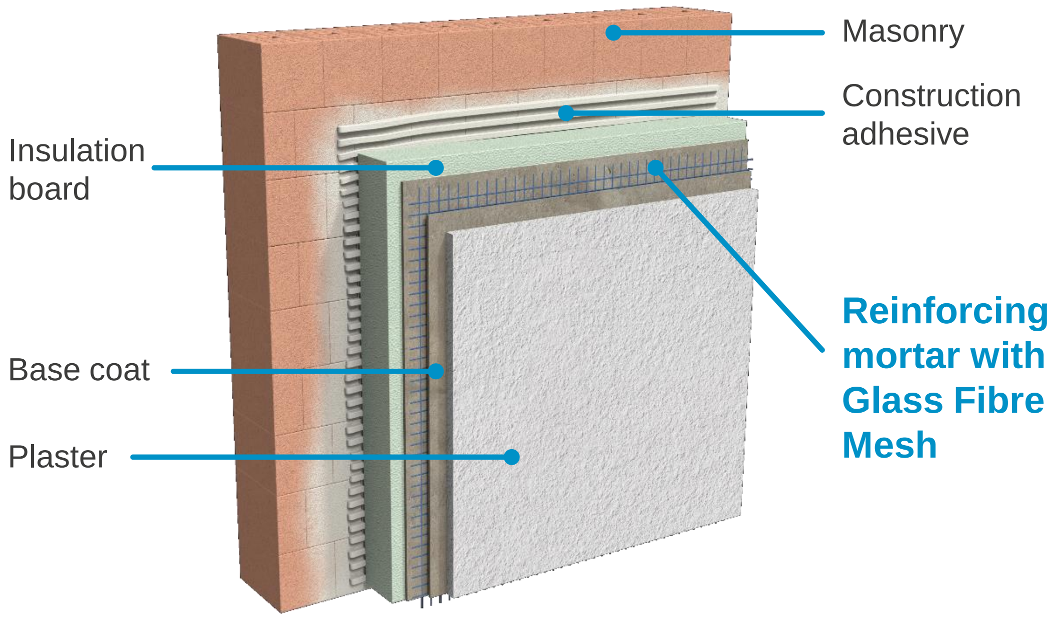
Crosslinking solution for combination of alkali resistance & flexibility & non block feature

Application
- Glass meshes for Exterior Insulation Finishing Systems (EIFS)

Manufacturing process
- Impregnation of glass mesh (woven) / Foulard units
- Warp direction: twisted glass yarns / weft direction: glass rovings

Product requirement
- Outstanding alkali resistance by complete glass mesh surface coating
- Binder penetration warp roving
- Bonding of threads for mesh sliding resistance
- Wide range of handle from very soft to hard, tailor-made solutions
- Very good run ability (impregnation line speeds up to 100 m/min)
- Non-blocking finishes for mesh handling during EIFS construction

Current state of the art product offering
- Self-crosslinking XSBR Latex (FA emissions in ppm range)
- Tg +8°C, TS: 50%, Viscosity: < 500 mPa.s

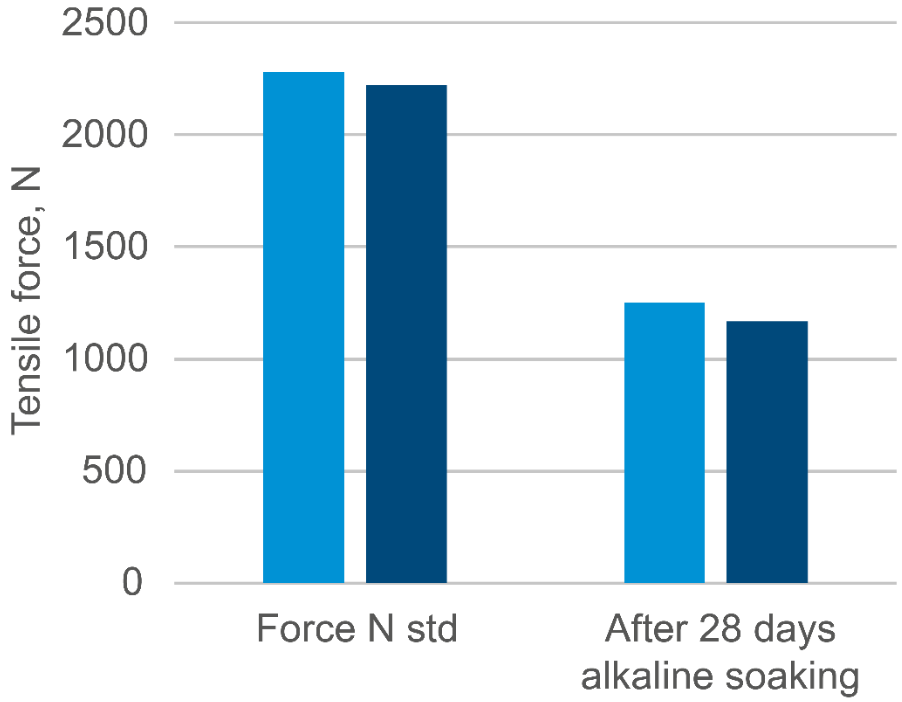


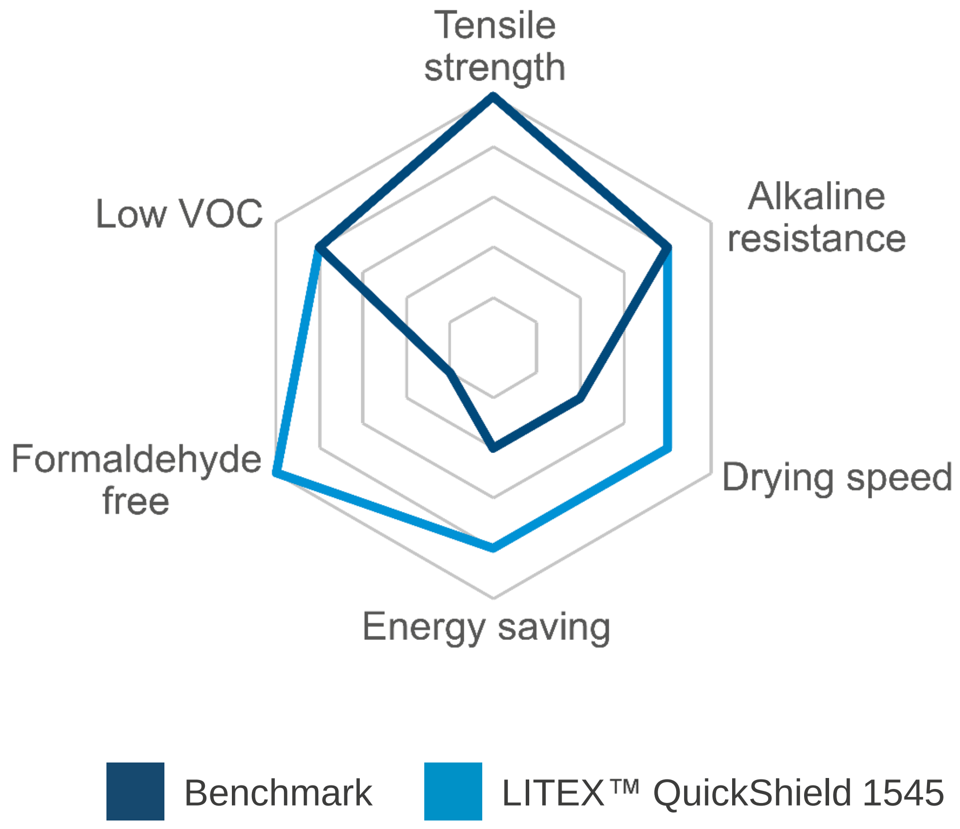
Targets
- Crosslinking without Formaldehyde emissions
- Optimised process ability
  - Speed of crosslinking / drying
  - Versatile use for different glass sizing

Fast drying & Low emission binder - Carboxylated styrene butadiene XSBR

LITEX™ QuickShield 1545

Tensile strength





Performance comparison

Fast drying & Low emission binder - Carboxylated styrene butadiene XSBR

LITEX™ QuickShield

Benefits

- Fast drying, lower energy needed
- Low foaming
- Good runnability
- Excellent alkaline resistance

- Formaldehyde-free
- Self-crosslinking

	Total Solid Content [%]	pH Value	Viscosity [mPa.s]	Tg [°C]	Handle	Ammonia-free
LITEX™ QuickShield 1547	50	7.5	<300	-44	Very soft	Yes
LITEX™ QuickShield 1545	50	7.5	<300	5	Medium stiff	No
LITEX™ QuickShield 1685	50	7.5	<500	37	Very stiff	Yes

LITEX™ SkyShield 4685

High thermo dimensional stable XSBR binder

High thermo dimensional stable & Low emission binder - XSBR

LITEX™ SkyShield 4685

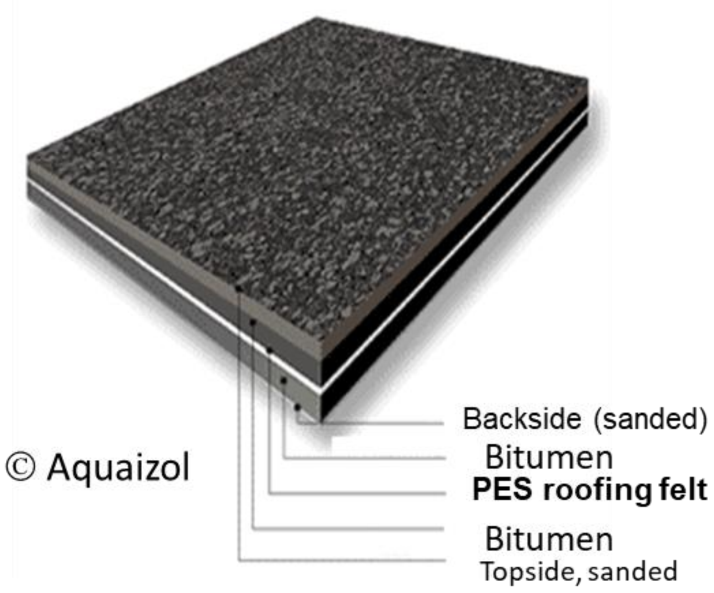
Crosslinking solution for high thermo dimensional stability

Application
- Non-woven carrier for bituminous roofing felt

Manufacturing process
- Staple fibre or spunbond nonwoven
- Foulard impregnation, foam or liquor
- Addition of up to 10 % Melamine formaldehyde resin

Product requirement
- Excellent thermo dimensional stability at 200°C according to DIN EN 18192
- Water resistance → max reduction of tensile strength of 5%
- Stiff handle but no kink or crack at flex test
- High aging stability and filler compatibility
- Broad compatibility with thermo-set resin
- starch tolerant

Current state of the art product offering
- Self-crosslinking XSBR Latex (FA emissions in ppm range)
- Tg +35°C, TS: 50%, Viscosity: < 500 mPa.s

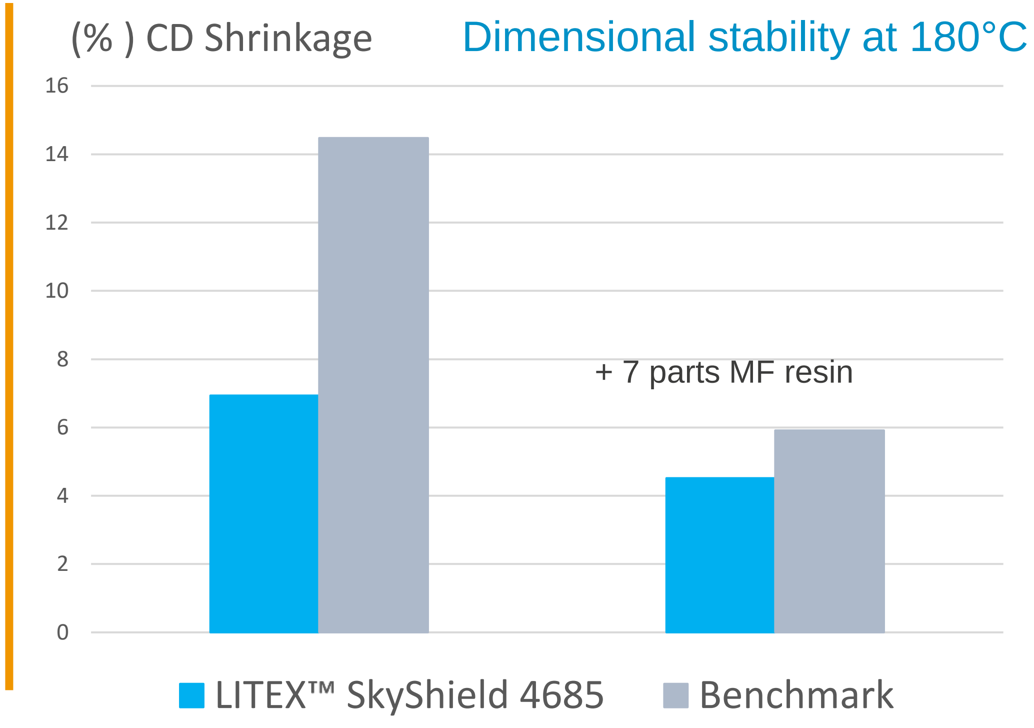


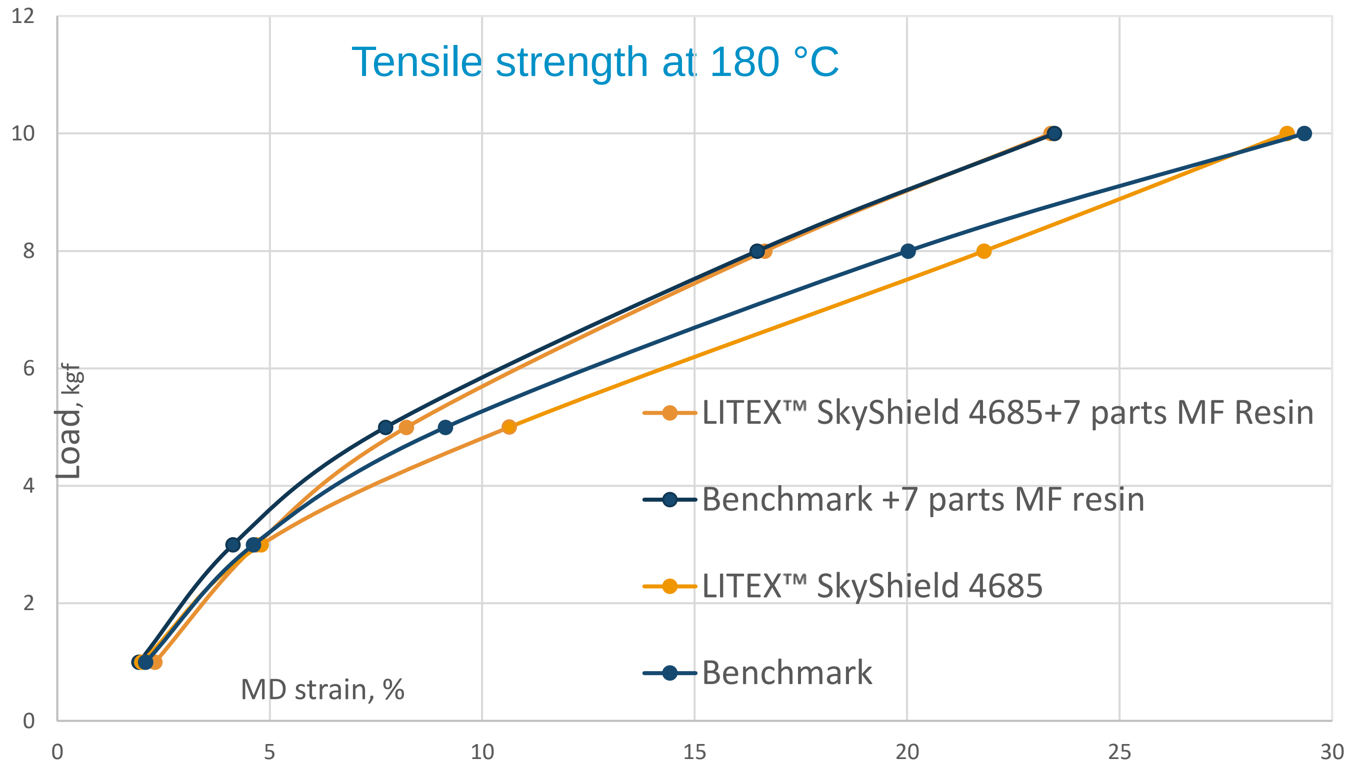
Targets
- Crosslinking without Formaldehyde emission
- No ammonia emission
- Optimized process ability

High Thermo-dimensional stable & Low emission binder - XSBR

LITEX™ SkyShield 4685

180 g spundbond nonwoven with 16,5% coatweight





	Total Solid Content [%]	pH Value	Viscosity [mPa.s]	Tg [°C]	Handle
LITEX™ SkyShield 4685	50	7.5	<500	37	Very stiff

- Formaldehyde-free
- Ammonia-free
- Self-crosslinking

Thank you for your attention

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