



# MS Polymer™ based PSA Technology

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# Outline

## A. Introduction

1. Kaneka Liquid Polymer Group
2. Chemistry
3. Activities in the Adhesive world
4. Characteristics of MS Polymer™

## B. Formulating Routes

1. Different roles of MS Polymer™
2. Performance of MS Polymer™ based PSA

## C. Manufacturing

1. Challenges
2. Co-Creation



# A. Introduction

## Kaneka Corporation

- ✓ **Established:** September 1st, 1949
- ✓ **Headquarters:** Tokyo and Osaka
- ✓ **Net Sales:** 555 billion yen (2016)
- ✓ **Employees:** 8500 (2016)
- ✓ **Operations in:** Japan, Belgium, United States, Germany, Singapore, Malaysia, Australia, China, India, ...
- ✓ **Business Units:** foodstuff products, life science products, expandable plastics, chemicals, synthetic fibres, electronic products, functional plastics



# KANEKA

The Dreamology Company  
— Make your dreams come true —

# A. Introduction

## Kaneka Belgium NV

- ✓ **Established:** 1970
  - ✓ **Turnover:** 290 M€ (2016)
  - ✓ **Employees:** 350 (2016)
  - ✓ **Size:** 260 000 m<sup>2</sup>
  - ✓ **Business Units:**
    - Modifiers
    - Expanded Plastics
    - Liquid Polymers
- Kane Ace™
  - Eperan™
  - Kaneka MS Polymer™



**Kaneka**  
KANEKA BELGIUM NV

The Dreamology Company  
—Make your dreams come true—

# A. Introduction

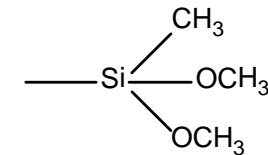
## 2. Chemistry

MS Polymer™ : modified silicone



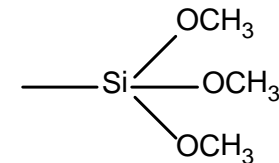
$R_1 = R_2 = \text{OCH}_3$   
 $R_3 = \text{CH}_3$

} dimethoxysilyl MS Polymer™ → DMS



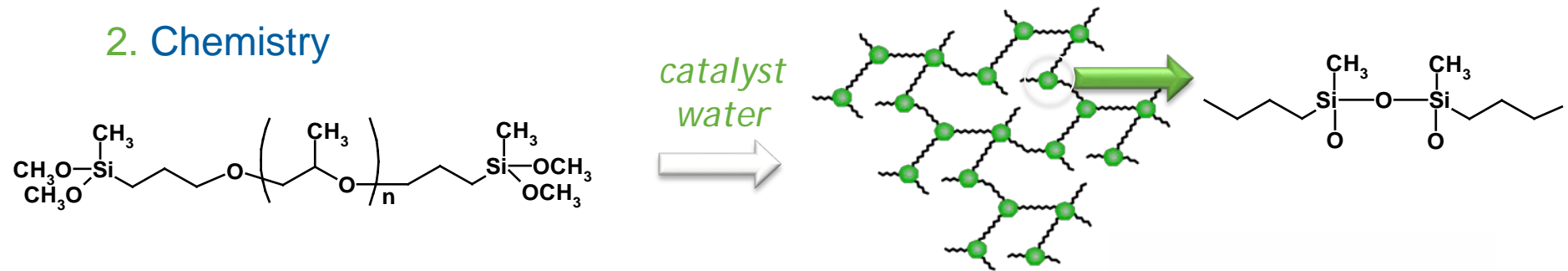
$R_1 = R_2 = R_3 = \text{OCH}_3$

} trimethoxysilyl MS Polymer™ → TMS

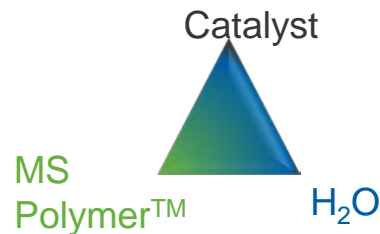


# A. Introduction

## 2. Chemistry

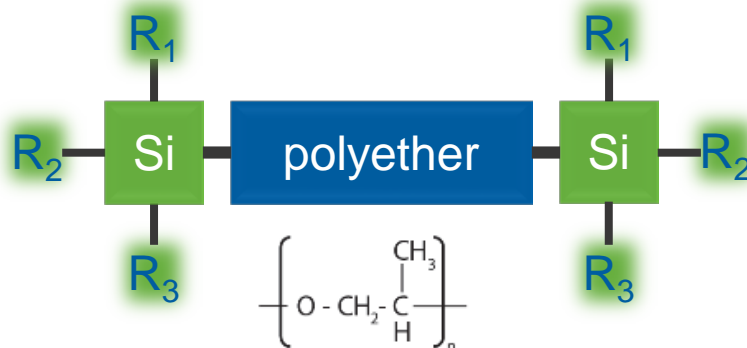


- Step 1: **Hydrolysis** of methoxysilyl with moisture in environment and initiated by catalyst
- Step 2: **Condensation** of silanol with methoxysilyl



# A. Introduction

## 2. Chemistry



### Chain length

Long



Short



### Functionality control

Telechelic



Single end



Special terminal =  
High strength technology

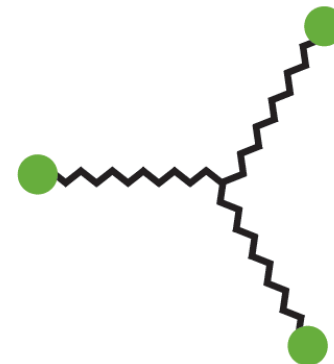


### Chain structure

Linear



Branched



# A. Introduction

## 3. Product Portfolio

Dimethoxymethylsilane MS Polymer™				
Grade	TYPE	Structure	Mw	Content of functional group in polymer
S203H	DMS-MS	↔	★★	★
S303H	DMS-MS	↕	★★↗	★★
S227	DMS-MS	↔	★★↗	★
S327	DMS-MS	↔	★★↗	★★
SAX220	DMS-MS	↔	★★★	★★
SAX260	DMS-MS	↕	★★	★★
SAX350	DMS-MS	↔	★★↗	★★
SAX400	DMS-MS	↕	★★★	★★★★
SAT010	DMS-diluent	↔	★	★★
SAX015	DMS-diluent	↕	★	★★★
SAT115	DMS-diluent	↔	★	★
SAT145	DMS-diluent	←	★	Monofunctional
SAX750	DMS High Strength	↔	★★★	★★

Trimethoxysilane MS Polymer™				
Grade	TYPE	Structure	Mw	Content of functional group in polymer
SAX510	TMS-MS	↔	★★★	★
SAX520	TMS-MS	↔	★★★	★★
SAX530	TMS-MS	↔	★★↗	★★
SAX580	TMS-MS	↕	★★★	★★
SAX590	TMS-MS	↕	★★	★★
SAX575	TMS High Strength	↔	★★★	★★

LOW	★	LINEAR	↔
LOW MEDIUM	★★↗	BRANCHED	↕
MEDIUM	★★	SPECIAL TERMINALS	↔
MEDIUM HIGH	★★↗		
HIGH	★★★		



# A. Introduction

## 3. Product Portfolio

TECHNOLOGY	FEATURE	TECHNOLOGY	FEATURE
<b>Dimethoxysilyl MS Polymer™</b> (DMS-MS)	<ul style="list-style-type: none"> <li>• Wide viscosity range</li> <li>• Various mechanical properties</li> <li>• Very good adhesion profile</li> <li>• Excellent stability</li> <li>• Varying workability</li> </ul>	<b>Trimethoxysilyl MS Polymer™</b> (TMS-MS)	<ul style="list-style-type: none"> <li>• Wide viscosity range</li> <li>• Fast cure / less catalyst</li> <li>• Various mechanical properties</li> <li>• Higher elastic recovery</li> <li>• Good adhesion profile</li> <li>• Excellent stability</li> <li>• Varying workability</li> </ul>
<b>Dimethoxysilyl MS Polymer™</b> acryl modified DMS-MA(X)	<ul style="list-style-type: none"> <li>• Excellent adhesion profile</li> <li>• High weather resistance</li> <li>• Excellent stability</li> </ul>	<b>Trimethoxysilyl MS Polymer™</b> acryl modified TMS-MA(X)	<ul style="list-style-type: none"> <li>• Excellent adhesion profile</li> <li>• Fast cure / less catalyst</li> <li>• High weather resistance</li> <li>• Excellent stability</li> </ul>
<b>Dimethoxysilyl MS Polymer™</b> (DMS-MS) Reactive Diluents	<ul style="list-style-type: none"> <li>• Very low viscosity</li> <li>• Modulus control</li> <li>• Non migrating</li> </ul>		
High strength <b>dimethoxysilyl</b> MS Polymer™ (HS-DMS)	<ul style="list-style-type: none"> <li>• High strength</li> <li>• Good elasticity</li> </ul>	High strength <b>trimethoxysilyl</b> MS Polymer™ (HS-TMS)	<ul style="list-style-type: none"> <li>• High strength</li> <li>• Fast cure / less catalyst</li> </ul>
		High strength <b>trimethoxysilyl</b> MS Polymer™ acryl modified (HS-A TMS)	<ul style="list-style-type: none"> <li>• Highest strength</li> <li>• Excellent adhesion</li> <li>• Fast cure / less catalyst</li> </ul>

# A. Introduction

## 4. Activities in the adhesive world

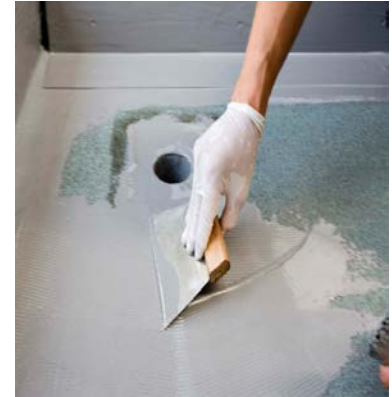
**Construction:** Sealant / Adhesive  
Waterproofing

Glazing  
Parquet adhesive

**Automotive:** Sealant / Adhesive  
NVH

**Civil Engineering:** Sealant / Adhesive

**Consumer DIY:** Sealant / Adhesive



## A. Introduction

### 5. Characteristics of MS Polymer™

#### Base polymer properties:

Clear solution

Liquid at room temperature

no smell

low volatile

low Tg

Chemical crosslinked matrix → good heat  
and chemical resistance

Compatible with high amount of SBC's,  
Acrylics, Resins (non aliphatic), various  
additives



## MS Polymer™ must be a suitable chemistry for PSA

## B. Formulating Routes

### 1. Different roles of MS Polymer™

#### a. MS Polymer™ as additive in a 'classic' PSA formulation

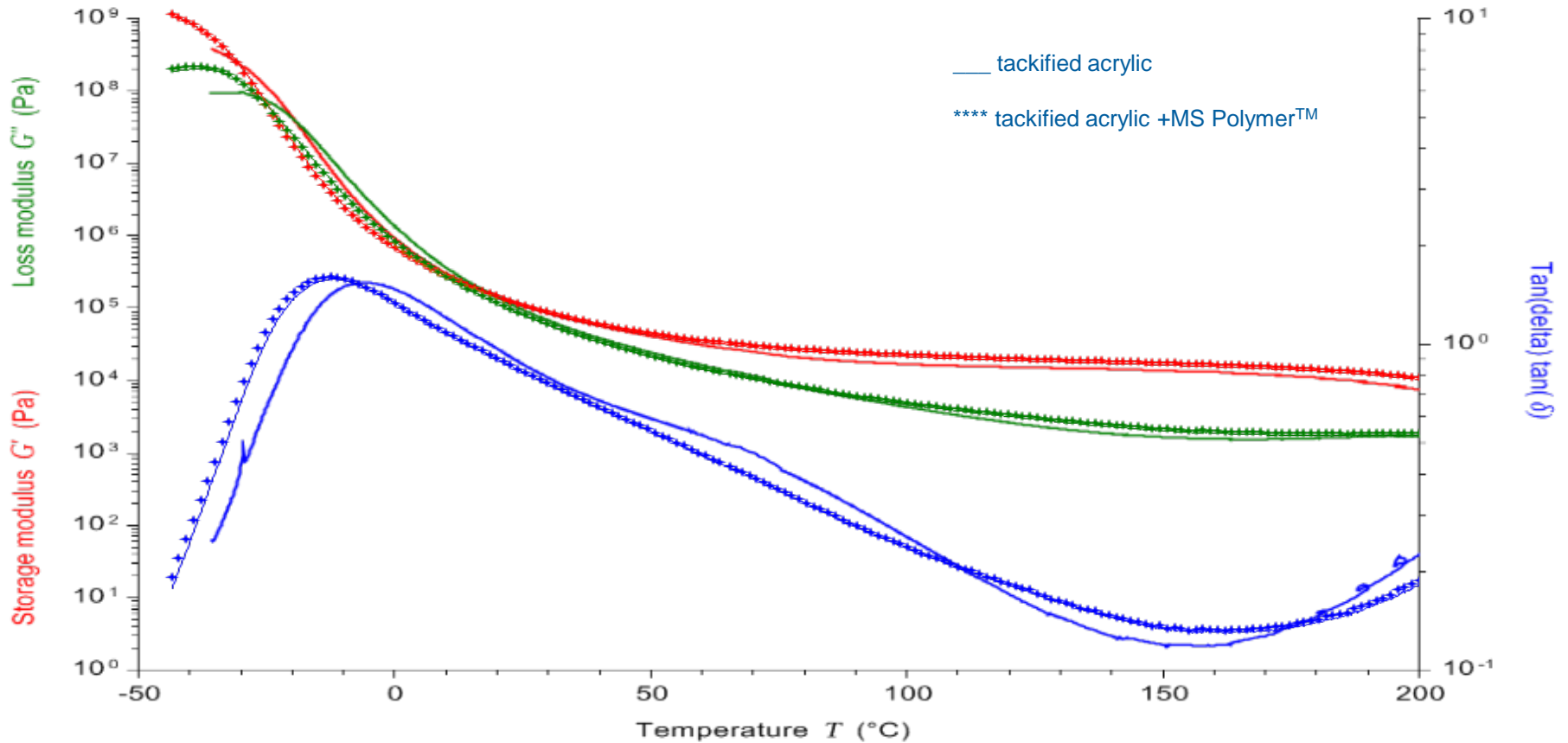
- 2 to 25 pph in a hotmelt or solvent rubber or acrylic formulation
- Example solvent 2EHAcrlyate + 20% terpene phenolic resin + 15% MS polymer™ with a Titanium based catalyst

60gr/m <sup>2</sup>	tackified Acrylic	tackified Acrylic + 15% MS Polymer™
Finat Tack on glass N/25mm	28	22
Finat Tack on glass 7°C	0,5 (sh)	14,2
180° PA SS N/25mm	20,8	19,8
180° PA PP            N/25mm	2,0 (sh)	9,1
RBT (rolling ball tack)    mm	300	160
Tg (measured with DMA,1hz) °C	-6	-19
Shear strength after solvent immersion (toluene)    N/144mm <sup>2</sup>	6	32
SAFT 1kg                    °C	147	170

Increase softness  
Improve wetting/bonding  
Expand temperature range

Improve cohesive network  
Increased temperature &  
chemical resistance

# Rheology (measured @1Hz)



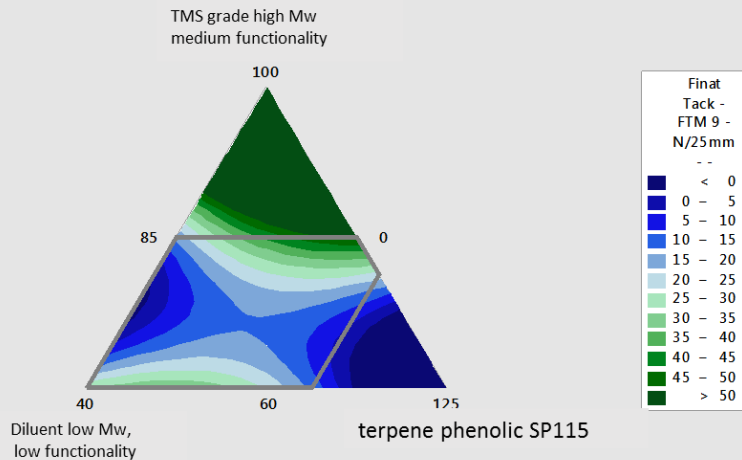
## B. Formulating Routes

### 1. Different roles of MS Polymer™

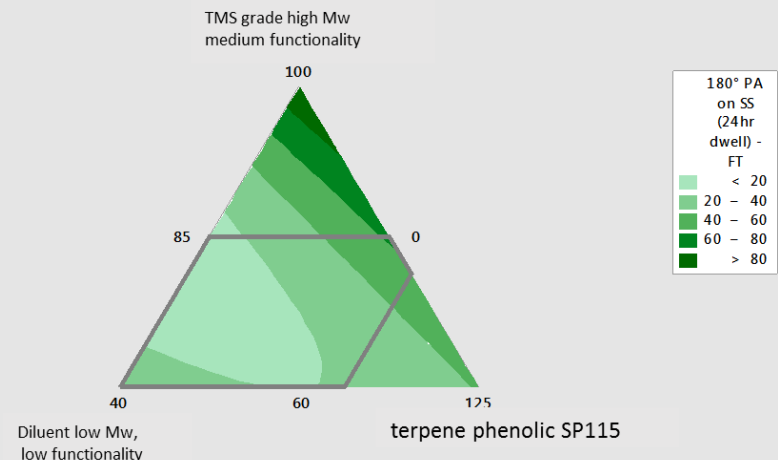
#### b. MS Polymer™ as the main polymer in a PSA formulation

- Example: Design Of Experiments 2 MS Polymer types (high Mw and low Mw) + terpene phenolic resin (fixed components Titanium based catalyst and Aox)
- Coatings 60gr/m<sup>2</sup> on a heated vacu-table at 70°C (cured 5min 130°C)

Mixture Contour Plot of Finat Tack - FTM 9 - N/25mm - -



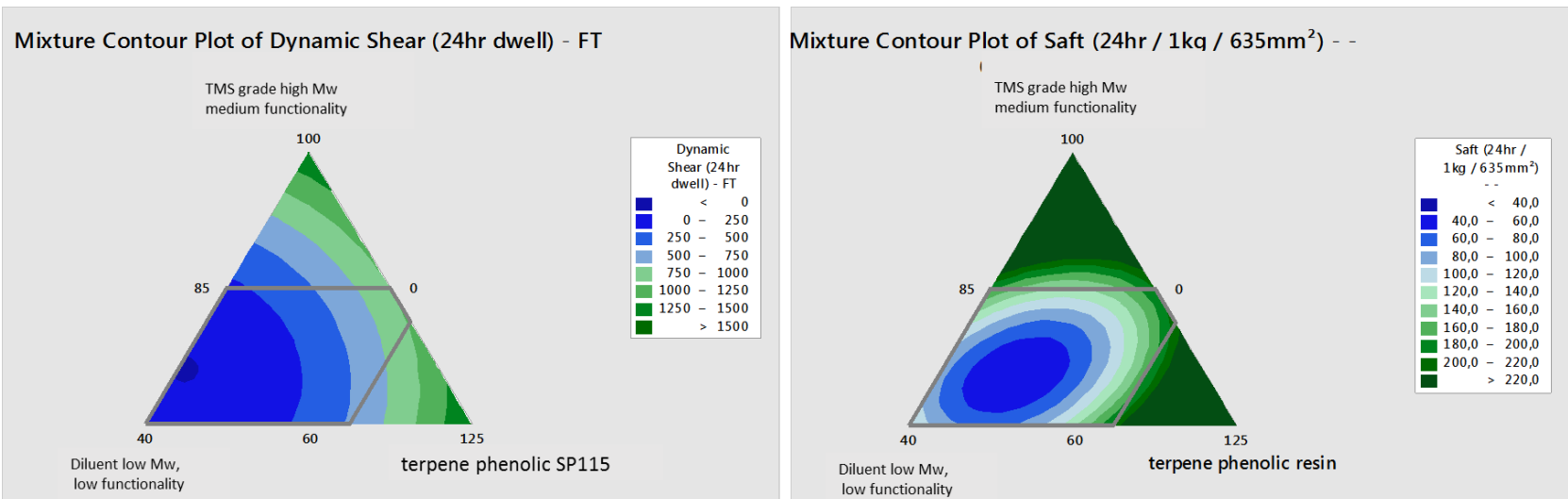
Mixture Contour Plot of 180° PA on SS (24hr dwell) - FT



## B. Formulating Routes

### 1. Different roles of MS Polymer™

#### b. MS Polymer™ as the main polymer in a PSA formulation



It is possible to generate various formulations resulting in soft (semi) removable adhesives or aggressive high adhesion versions and in between.

Chemical crosslinking of the matrix secures a wide temperature window (vs rubber based)

High loading of resins possible (vs modified acrylic)

## C. Manufacturing

### 1. Challenges

1. Non solvent route of a MS Polymer™ based Tape requires:
  1. Warm/Hot melt mixing (N<sub>2</sub> blanket or Vacuum) 90°C up to 150°C depending on used resins
  2. Inline mixing of Catalyst before coating (or extrusion mixing)
  3. Heated coating station (60°C up to 100°C)
  4. Curing oven
2. Moisture curing process is not common in psa world:
  1. Aside assets, lack of experience with the technology could be a roadblock
  2. Little to no examples or commercial available benchmark products available

### 2. Cooperation

1. To better introduce this new polymer in the ‘traditional’ PSA world a cooperation has been set up to increase knowledge and materialise the lab developments/evaluations in roll format (pilot- and/or production scale)



## C. Manufacturing

### 1. Cooperation for the MS Polymer™ based PSA



The Dreamology Company  
—Make your dreams come true—

- MS polymer recommendation
- Formulating
- Lab mixing/coating
- Testing
- Technical Service
- Design new polymer grades (psa-specific)



- Compounding
- Formulating
- Pilot mixing/coating



- Machine building
- ILM
- Production coating

# Good partnerships generate great results

Over the years, Kaneka has developed **very positive and long-term relationships** with customers, employees, community stakeholders.

We strongly believe that strong partnerships can generate great results!

Every day, we do our very best to focus on these relationships and we strive for a **first class partnership!**





# Thank You for your attention

MS Polymer based PSA technology

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