

The Dreamology Company -Make your dreams come true-

Kaneka MS Polymer[™]

Your premium polymer of choice



Introduction to Kaneka MS Polymer[™]

Kaneka MS Polymer™ Your Premium Polymer

of Choice!

Kaneka MS Polymer[™] is widely recognized as the premium choice of base resin for producing sealants, adhesives and coatings. The functionalized polyether backbone with silane terminal groups provides excellent performance and makes Kaneka MS Polymer[™] based products unique and highly valued.

The highly controlled, original production process can provide very high quality and unique variations. Kaneka MS Polymer[™] doesn't have any hydrolysable bonding in its backbone, which implies excellent storage stability, high durability and good resistance to reversion at high temperature. Its unique properties enable Kaneka MS Polymer[™] based products to deliver outstanding performance for a broad variety of markets, such as construction, industry, transportation, flooring, waterproofing, DIY and many others. A complete toolbox of polymers is available, differentiated by the backbone structure and in a wide viscosity range for designing moisture curable products matching desired requirements.

Structure of DMS type Kaneka MS Polymer™



Structure of TMS type Kaneka MS Polymer™

$$\begin{array}{ccc} \mathsf{OCH}_3 & \mathsf{CH}_3 & \mathsf{OCH}_3 \\ | & | \\ \mathsf{H}_3\mathsf{CO} - \overset{}{\mathsf{Si}} - & - (\mathsf{CH} - \mathsf{CH}_2 - \mathsf{O})_n - & - \overset{}{\mathsf{Si}} - & \mathsf{OCH}_3 \\ | \\ \mathsf{OCH}_3 & & \mathsf{OCH}_3 \end{array}$$



Chemistry

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The design of Kaneka MS Polymer[™] is controlled by chain length, chain structure and functionality. Because of the unique Kaneka process, very stable polymers can be produced. Even polymers with a single terminal silane group were produced, providing an ideal reactive plasticizer system. Recently, Kaneka developed a new original functionalizing technology, enabling special terminal polymer types with high strength properties.

Chain length

A long chain will provide the following characteristics :

- high viscosity
- soft
- high elongation

A short chain will provide the following characteristics :

- low viscosity
- hard
- low elongation

Chain structure

Polymers with a linear backbone imply high elongation. A branched backbone makes the polymer stronger, tougher, more rigid and faster curable.

Functionality control

Single end functionality enables to serve as an ideal reactive plasticizer which will lower the viscosity, decrease hardness and prevent bleeding. Kaneka's new functionalizing technology provides high strength, good elongation and toughness, improved weatherabillity and lower water uptake.



Comparison

Unique technology

Kaneka MS Polymer[™] combines the positive properties of both silicones and polyurethanes. It differentiates itself from these technologies as it consists of a functionalized polyether backbone with silane terminal groups, without the need for harmfull isocyanates.

It is a moisture curing system, however the curing mechanism will only initiate if both the catalyst and water are present. Blending MS Polymer[™] with only one of these two ingredients will render an unreactive mixture. This ensures a very robust and stable raw material over a long period of time. Once MS Polymer[™] is added to a formulation, moisture should be managed properly to avoid curing in the cartridge, bucket or other packaging material.

Compared to silicone

Although the name MS Polymer[™] is derived from Modified Silicone, the backbone itself is completely different. After curing the MS Polymer[™] backbone will only consist of 2 silicone bonds seperated by a polyether whereas the silicone backbone consists of multiple siloxane bonds.

Silicones can be used for sealing jobs, but the adhesion to substrates is poor. MS Polymer[™] based products can do both, sealing and bonding.

The UV stability of silicones is better than MS Polymer[™], but with the introduction of Kaneka's acryl modified grades, this has been improved remarkably.

The paintability of silicones is very poor, but with products based on Kaneka MS Polymer[™] this is no problem.

Compared to PU

The backbone of PU is similar to Kaneka MS Polymer^{TM,} but it has urethane bonds in between. The main benefit of MS PolymerTM against PU is the lack of harmful isocyanates and solvents.

PU is sligthly stronger, but the material is not as elastic as Kaneka MS Polymer[™]. Elasticity is important as the movement of different substrates might cause a bond to break, also at very low temperatures.

The UV stability of PU is not good compared to other technologies. Bubbling is also not seen with MS Polymer[™]. This could cause an inhomogeneous sealant surface, leading to cohesive failure in time.

Performance comparison of MS Polymer, PU and Silicone, 10 = excellent, 1 = very poor						
Property	MS Polymer PU		Silicone			
Environmental friendliness	10	5	9			
Non-bubbling	10	6	10			
Low temperature gunnability	10	8	10			
Slump resistance	10	10	10			
Quick cure	10	7	10			
Storage stability	10	7	9			
Body (tooling)	8	10	8			
Weather resistance	8	6	10			
Adhesion to various substrates	10	5	8			
Mechanical properties	10	10	10			
Heat resistance, mechanical stability	9	8	10			
Non-dirt pick up	10	10	5			
Stain resistance	8	8	5			
Paintability with water-based paint	10	10	3			
Totals	133	110	117			

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Fast mixing process

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> MS POLYMER DIVISION

While the Kaneka MS Polymer[™] portfolio is exhaustive, all grades enable the same ease of processing. Both dimethoxysilyl- (DMS-) and trimethoxysilyl- (TMS-) polymers exhibit an excellent stability, despite their differences. Both the more reactive TMS types and their less reactive DMS alternatives remain stable over an extensive period of time. Since the curing mechanism will initiate only if both the catalyst and water are present, blending Kaneka MS Polymer[™] with only one of these two ingredients will render an unreactive mixture. The latter ensures a very robust and stable raw material stock. Since Kaneka MS Polymer[™] is a moisture curable reactive technology, the moisture in the final sealant or adhesive should be managed properly. Although the polymer itself contains no significant amount of moisture, other raw materials, like inorganic fillers, can bring a substantial amount of moisture in the system. In order to speed up the mixing process, it is no longer necessary to use heat to evaporate the moisture, but chemical drying agents (e.g. moisture scavengers like vinyltrimethoxy-silane) can be used to dehydrate the product. This method is not only fast, but requires less energy which makes it more sustainable at the same time. This can contributes to the European commission's energy targets.



Kaneka MS Polymer[™] supports green!

Climate change and environmental degradation pose a critical threat to our world. The EU has taken a proactive approach in addressing this global challenge by implementing the European Green Deal. The goal is to promote sustainable and resource-efficient growth while keeping the economy modern and competitive. The EU Green Deal aims to reduce greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels, with the ultimate goal of achieving climate neutrality by 2050.

To support this transition towards sustainable and safe products, Kaneka has developed a range of innovative products.

Sustainable chemicals

Life Cycle Assessment Label- and tin-free formulations Biobased products Non bleeding sealants High weatherability products

Renovation wave

General purpose adhesive/ sealant High Tack adhesive Flooring adhesive D4 wood adhesive Repair adhesive Weathering solutions Low modulus sealant Glazing sealant PSA

Smart mobility

Plastic adhesive Assembly adhesive High strength/high elongation adhesive Thermal Interface Material (TIM)

Sustainable chemicals

PERFORMANCE POLYMERS SOLUTIONS VEHICLE

> MS POLYMER DIVISION

Chemicals are essential for the well-being and comfort of modern society. They are used in a big range of sectors, going from health care to energy, but also mobility and housing. Because they are being used everywhere, it is important that the chemicals are nonhazardous and therefore safe to use for our health, but also for the environment.

Life Cycle Assessment

A Life Cycle Assessment (LCA) determines the full environmental impact of a product over all its life cycle stages. To support Kaneka's ambitious sustainable development goals, the 3 Belgium product units (MS Polymer[™], KaneAce[™] and Eperan[™]) have undergone extensive "cradle to gate" LCA studies (according to EN15804+A2 & ISO14025) to identify the different impact categories during the life stages and not only the local production. The results of these LCA studies are the environmental footprint of the different product groups declared in an EPD (Environmental Product Declaration). EPD's of Kaneka MS Polymer[™] are available and potential actions are being researched to further reduce the CO2-emissions and energy consumption.

Label- and Tin-free

Products intended for the European market have to comply with the Classification, Labelling and Packaging (CLP) Regulation. To ensure the health and safety of our employees, customers, end-consumers and the environment, we strive vigorously to ensure that our MS Polymer[™] and the accompanying formulation guideline fulfill the CLP Regulation. Ongoing continuous development for safer and environmentally friendly raw materials have ensured safe use of the MS Polymer[™] in different applications. Kaneka Belgium has identified several solutions that allow tin-free formulations for sealants and adhesives, without any compromise on technical performance.

Biobased products

Lignin, a renewable, abundant and cheap biopolymer, shows a successful stabilizer action in MS Polymer[™] sealants. By incorporating molecularly engineered lignin bio-additives, new MS Polymer[™] based products could be designed with enhanced UV and thermal stability properties. Moreover, by functionalizing lignin oligomers and dimers with reactive silyl groups, lignin shows an excellent potential to be used as base material for moisture-curing, biobased hard coatings and primers. Adding a MS Polymer[™] reactive plasticizer and a low amount of silane, results in a well crosslinked, chemically resistant system, showing a good adhesion to different substrates.

Recently, we took the next step and started to study and develop a fully biobased polymer backbone.

Non bleeding sealants

Plasticizers are an important component of MS Polymer[™] based products to finetune the rheological and mechanical properties. However, migration and absorption into the surrounding environment can occur. To avoid these harmful migration effects, Kaneka Belgium has developed silane-functional plasticizers which react with the MS Polymer[™]. These reactive plasticizers have the same properties as standard plasticizers and will ensure a safer application, maximize the shelf-life of your formulations and reduce the overall maintenance.

High weatherability products

Different regions and climates require different properties to ensure adequate resistance to the outdoor elements. From freezing cold to hot and humid places, Kaneka MS Polymer[™] is able to withstand longterm exposure due to its unique polyether backbone. A low glass transition temperature (Tg) provides flexibility even at extreme subzero temperatures. To support several of the EU Green Deal goals, in terms of longevity of the end-product, the acrylic modified MS Polymer[™] provides an additional toolbox to increase the lifespan of several sun-exposed applications.

Renovation wave

Studies have shown that renovating old buildings in order to reduce the energy consumption is more sustainable than demolishing these old buildings and replace them with newly build low energy or even zero energy houses. The required energy and CO2emissions to produce construction materials to build new homes doesn't weigh up to the saving over the whole life span of the low energy or zero energy houses.

Already since the beginning, MS Polymer[™] proved to be successful in the construction market. In the meantime, the portfolio has expanded and Kaneka can guide you to develop different products that are crucial during construction and renovation.

General purpose adhesive/sealant

Always nice to have is a general product which can be used to glue or seal materials. Adhesion to most common substrates is good. It is a high quality, elastic, one-component adhesive/ sealant. Certain jobs require very fast strength build-up. Then it can be modified into a turbo adhesive where most of its very high final strength is already obtained after a couple of hours.

High tack adhesives

Another variant of a universal product is the high tack adhesive. The main difference is the extremely high initial tack. Because of the high initial adhesion, the material stays in place without external support. This type of product is ideal for bonding different building materials such as stone, insulation boards, gypsum board,

Flooring adhesive

The possibilities in flooring installation and design, both for parquet and vinyl floors, have increased dramatically. With Kaneka MS $\operatorname{Polymer^{\textsc{TM}}}$, we offer solutions for the entire market, ranging from elastic, hard elastic and even hard parquet adhesives. Even the more demanding rubber, vinyl and especially Luxury Vinyl Tile (LVT) application is a domain the MS Polymer[™] technology excels in. More recent developments, in the range of our acrylic modified MS Polymer[™], make it possible to even bind more demanding coverings to the subfloor. Besides the technical advantages, the MS $Polymer^{\mbox{\tiny TM}}$ technology allows safer work environments, due to strict control of the emissions, which is heavily regulated by the indoor air quality requirements in several European countries. Apart from the latter, the MS PolymerTM allows the formulator to work free of harmful isocyanates, commonly found in the Polyurethane (PU) adhesives.

D4 wood adhesive

D4 wood adhesive with Kaneka MS Polymer[™] is a very strong and solvent- and isocyanatefree system based on Kaneka's high strength technology. The result of several years of research, the adhesive provides a waterproof D4 grade wood adhesive (conform the European standard EN 204) with none of the safety issues associated with conventional isocyanate containing D4 grades.

Repair adhesive

With regard to the circular economy, repair adhesives can really make a difference since, after end-of-life, materials and components can be re-used. Repair jobs, both indoors and outdoors, require this strong and flexible adhesive. Many kinds of materials can be glued, making it a universal product. The bonding remains elastic and is resistant against vibrations, shocks, temperatures from -40°C to 90°C and UV. The adhesive is transparent and free of solvents and isocyanates.

Renovation wave

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MS POLYMER DIVISION

Weathering solutions

Detailing

While applications with torching or solvents are highly under stress, the safer and environmentally friendly alternatives like Kaneka MS Polymer[™] based liquid membranes are gaining market share. The new generation of waterproofing products manufactured with MS Polymer[™] technology is the first choice of professionals and projects in solving the most difficult waterproofing details that considered as "insoluble". The semi liquid, self-levelling product is environmentally friendly and easy to use. After hardening, a stretchable and 100% waterproof membrane is created. It can replace most products, such as liquid rubbers, tar coatings,... It can be applied with a spatula, floor squeegee, brush or foam roller.

Full Roof covering

When looking at full roof coverings, there are 2 possibilities : EPDM adhesive and a Liquid Applied Membrane (LAM) in combination with a fleece.

The EPDM adhesive is used in the DIY and waterproofing industry for adhering EPDM and TPO sheets to different substrates. The main advantage of this product is the capability of adhering different types of EPDM or TPO by using only one adhesive.

The Liquid Applied Membrane can be cold applied by brush or roller and forms a durable, flexible and reliable protective barrier. Besides its excellent crack-bridging and waterproofing performance, it can also repair cracks. Moreover, due to its optimal workability, it creates waterproof seals on difficult and complex roofing details.

Low modulus sealant

CE-marking is mandatory for construction sealants since 1 July 2014. With Kaneka MS Polymer[™], low modulus construction sealants can be produced, meeting the highest level of requirements for EN15651-1 and ISO11600 - 25LM. In combination with the broad primerless adhesion profile and excellent weatherability, a real 'workhorse' is born.

Glazing sealant

Also for glazing sealants, CE-marking is mandory since 1 July 2014. With Kaneka acryl modified MS Polymer[™], a glazing sealant can be produced, meeting the highest level of requirements for EN15651-2 and ISO11600-G-25 LM.

Other unique properties are the broad primerless adhesion profile and excellent workability, paintability and weatherability.

PSA

Kaneka MS Polymer[™] is a new technology in the world of PSA and tapes with a proven compatibility with various tackifying resins and raw materials common in the PSA market. There are 2 possibles routes to follow : Kaneka MS Polymer[™] as the base resin or add the Polymer to the acrylic PSA. In both cases, the benefits are stronger and softer adhesives with improved resistance to high temperatures, but also advanced adhesion at low temperatures is possible. Due to the crosslinking nature, high cohesion strength and improved chemical resistance can be obtained. Different properties can be tailored by selecting a specific MS grade.



Smart mobility

Also in the automotive industry, there is a clear shift from fossil-based engines to electric vehicles. Already in the last couple of years, car manufacturers have focused on weight reduction in order to limit the CO2-emission. Heavy metals are being replaced by lighter plastics and therefore screws and bolts are being replaced by adhesives.

Besides the lighter materials, also the engines are changing. Electric vehicles with a large set of batteries impose new challenges and solutions need to be found.

Plastic adhesive

Adhesion to different types of plastics, such as hard PVC, fibre reinforced plastic (FRP), polycarbonate (PC), polystyrene (PS), polymethylmethacrylate (PMMA), polyamide (PA) and acrylonitrile Butadiene Styrene (ABS) is an important feature of Kaneka's acrylic modified Polymer[™]. Strong adhesion to different plastics can be achieved with a single MS Polymer[™]. This unique property, combined with the excellent elasticity of Kaneka MS Polymer[™], makes it the polymer of choice for applications where hybrid adhesion is required.

Assembly adhesive

One- and two-component adhesive solutions are becoming more and more embedded in the production of light weight vehicles in the transportation industry. While windscreen adhesives based on Kaneka MS Polymer[™] are already available in the automotive industry, structural and semi-structural bonding of composite materials is in focus.

High strength/high elongation

Various applications are requiring challenging properties such as a high elongation, high tensile strength and excellent, primer-less adhesion. Therefore, by blending moisturecurable high strength acryl-modified Kaneka MS PolymersTM with functional fillers and specific crosslinking catalysts, highly flexible adhesives with a perfect balance between elongation and strength can be designed. Tensile strength values of 6 MPa and even higher, combined with an excellent elongation of more than 500% can easily be obtained. In the context of the European Green Deal strategy towards a toxic-free environment, these high strength acryl-modified Kaneka MS Polymers[™] will gain more market share as an ecofriendly resin for high-performance adhesives.

Thermal Interface Material (TIM)

Driven by the objective of a transition to a lowcarbon European economy, electric vehicles charged with electricity from renewable sources will play an important role. Hereby, thermal management is a key consideration in the battery design. To manage the heat dissipation in battery cells, MS Polymer[™] is blended with special fillers. This exhibits high thermal conductivities, making it suitable as gap filler, sealant or adhesive. Moreover, due to its silicone-free characteristics, these moisture-curable compositions can be painted, which is a critical factor of electrodeposition coating processes in automotive manufacturing.

Applications overview

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> MS POLYMER DIVISION

Application field	Type Polymer				
	DMS-MS + Acryl Modified	TMS-MS + Acryl Modified	Advanced DMS-MS	Advanced TMS-MS + Acryl Modified	
High weatherability products			-		
General purpose adhesive					
High tack adhesive			V		
Flooring adhesive					
Weathering solutions					
Plastic adhesive			-		
Assembly adhesive					
High strength/high elongation	-	-	-		
Thermal Interface Material (TIM)			-	-	

 \checkmark

Detailed information on polymertype can be provided



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