SILANES AND SILICONES FROM WACKER: BETTER YET – ADD PERFORMANCE TO YOUR PLASTICS!
Cars, cables, shoes, packaging, pipes, films, toys ... plastics are part of our world. And as our world changes, the demands for plastics change, too. At WACKER we help you meet these demands with unique expertise in organic and inorganic chemistry.
From lightweight constructions in cars or airplanes to toys or packaging: plastics continue to play an increasing role in everyday life. But as application areas become broader, the performance demands grow, too. With WACKER silicones and silanes it is possible to meet these demands cost efficiently.

New applications open up new possibilities for plastics. But they also require plastics with new characteristics. To meet these requirements, there are two options. One is to develop novel plastics with a greater property profile: a challenging task with usually high development costs, large capital investment and long development cycles. The other is to modify existing plastics through innovative additive technology: an option which is more and more popular due to its cost efficiency.

This is accentuated by the dynamic growth of the plastic additives market worldwide. Innovation in plastics has proven to come from additives and the performance enhancement that they provide. To realize this potential WACKER offers you a wealth of different solutions.

WACKER is a leading chemical company with extensive expertise in silane- and silicone-based chemistry. We understand organic and inorganic chemistry, offering you innovative additives which add superior characteristics to thermoplasts.

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GENIOPLAST® and GENIOSIL® are registered trademarks of Wacker Chemie AG.
There are various ways to enhance the performance of plastics. With WACKER you have them all at hand – from one single source.

**Your Benefit**
Dealimg with one partner is easier and provides better results faster. Our silicones and silanes can be used at different stages of the value chain, alternatively or combined. This opens up choices and makes our experts valuable partners: they know from experience what will work and what the effects will be. This know-how is part of our product offering.

**Our Offering**
Silanes and silicones are not only essential aids for designing polymers chemically; they can also be added to polymers to modify their properties, e.g. to enhance demolding properties and surface smoothness, to maximize impact strength and flexibility, even at low temperatures, to raise resistance to environmental influences, and to distribute the filler more uniformly in the polymer while reinforcing the bond between them.

Silanes and silicones from WACKER can be used:
- For polymerization catalysis
- As process chemicals and additives
- For polymer modification
- As the crosslink mechanism

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**WACKER’s Contribution Along Value Chain Plastics**

<table>
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<tr>
<th>Monomers</th>
<th>Polymers</th>
<th>Compounds</th>
<th>Semifinished product</th>
<th>Product</th>
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</thead>
<tbody>
<tr>
<td>Polymer Manufacturer</td>
<td>Compounder</td>
<td>Coated fillers</td>
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**WACKER’s Contribution**
- Donor Silanes (PP)
- Silanes for Crosslinking and Coupling (PE)
- Silicone Additives
- Silanes, Silicones
Production of polyethylene and polypropylene by polymerization of olefins in the presence of Ziegler-Natta catalysts is carried out on an industrial scale and is of major economic importance. Unlike polyethylene, polypropylene and its copolymers must be stereospecific if the end products are to be of high quality and have good polymer properties. Production is therefore closely controlled to ensure a high yield of isotactic polymer. Stereospecificity can be boosted by adding special alkyl-alkoxysilanes to the catalyst. This not only increases the yield of isotactic polypropylene and promotes catalytic activity but also affords a way of controlling other important polymer properties, such as molecular weight and molecular weight distribution. Silane CHM-Dimethoxy ("Donor C") and Silane CP2-Dimethoxy ("Donor D") are used around the world as "Donor Silanes" for the production of polypropylene. Silane CHM-Dimethoxy is mainly applied for the manufacture of PP homopolymer, Silane CP2-Dimethoxy for PP copolymers.

<table>
<thead>
<tr>
<th>Standard Plastics</th>
<th>Chemical name</th>
<th>Structural formula</th>
</tr>
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<tbody>
<tr>
<td>Silane CHM-Dimethoxy</td>
<td>Cyclohexylmethyl(dimethoxy)silane</td>
<td>SiMe₃OMe</td>
</tr>
<tr>
<td>Silane CP2-Dimethoxy</td>
<td>Dicyclopentyl(dimethoxy)silane</td>
<td>SiOMe₂</td>
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Silane crosslinking technology makes it possible to convert inexpensive thermoplastic polymers into crosslinked polymers. The result is a great improvement in heat and dimensional stability, electrical conductivity and creep characteristics as well as weatherability.
Silane crosslinking is today an established way of producing low and medium voltage cable from crosslinkable polyethylene (PEX). But technological diversity, economics and the new olefins produced by metallocene catalysis are opening up numerous other new applications. These include production of PEX pipes commonly used for hot water and underfloor heating, transfer of polyethylene technology to ethylene copolymers and polypropylene, development of new process technologies for single-parts production and the production of polyolefin foams.

PEX compounds may be produced and processed by either the SIOPLAS or the MONOSIL methods in which vinylalkoxy-silanes are grafted onto the polyethylene. As with the SIOPLAS method, it is also possible to process PE and copolymer compounds produced by direct copolymerization of ethylene, vinylalkoxy silane and, where appropriate, other monomers.

GENIOSIL® XL 10 and GENIOSIL® GF 56 are used for silane crosslinking and the production of crosslinkable polyolefin compounds. Faster crosslinking catalysts and the development of ambient cure systems require better storage stability of SIOPLAS compounds. Silane 25013 VP and Silane M1-Triethoxy are used as water scavenger and precuring retarder. They can increase shelf life as well as safety in handling and processing of silane crosslinkable compounds.

GENIOSIL® GF 51 is applied in compounds for flexible filled rubber cables and, in contrary to other state-of-the-art coupling agents, does not release SVHC when applied.
### WACKER Product

<table>
<thead>
<tr>
<th>GENIOPLAST® Pellet S</th>
<th>Ultrahigh-molecular-weight polydimethylsiloxane in pellet form</th>
<th>White translucent cylindrical pellets, diameter and length each approx. 4 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENIOPLAST® Pellet P Plus</td>
<td>Ultrahigh-molecular-weight polydimethylsiloxane in pellet form for food contact applications</td>
<td>White translucent cylindrical pellets, diameter and length each approx. 4 mm</td>
</tr>
<tr>
<td>GENIOPLAST® Gum</td>
<td>Ultrahigh-molecular-weight polydimethylsiloxane</td>
<td>Clear, colorless silicone gum, typical viscosity 10,000,000 – 20,000,000 mm²/s</td>
</tr>
<tr>
<td>GENIOPLAST® Fluid FR</td>
<td>Formulation comprising high-molecular-weight polydimethylsiloxane and silicone resin</td>
<td>Clear, colorless, high-viscosity fluid, typical viscosity approx. 500,000 mm²/s</td>
</tr>
<tr>
<td>GENIOPLAST® Fluid 110</td>
<td>Food compliant silicone based additive specifically for PVC applications</td>
<td>Clear, colorless, low viscosity fluid</td>
</tr>
<tr>
<td>GENIOPLAST® Fluid 220</td>
<td>Silicone based additive specifically for polyolefin applications</td>
<td>Clear, colorless, medium viscosity fluid</td>
</tr>
<tr>
<td>WACKER® AK Silicone Fluids (AK 100 – AK 1,000,000)</td>
<td>Polydimethylsiloxanes</td>
<td>Clear, colorless fluids; relevant viscosity range: 100 – 1,000,000 mm²/s</td>
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</tbody>
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From smart phones to portable media players: plastics are an essential part of our life. Additives ensure that the plastic has the desired properties and improve the processability.
GENIOPLAST® and WACKER® AK Silicone Fluids are perfect products for processing and modifying thermoplastic resins. They find applications as compounding additives for standard plastics as well as for engineering plastics.

General Benefits for Thermoplastic Polymers
On addition of 0.1 – 1%:
• Improved processing and flow properties
• Less extruder torque
• Significantly faster throughput
• Internal lubrication
• Better mold filling and mold release
• Reduced warpage of moldings

On addition of 1 – 5%:
• Better surface properties for the moldings
• Improved surface smoothness
• Lower coefficient of friction
• Greater scratch and abrasion resistance
• Better mechanical properties

Specific Gains
GENIOPLAST® Pellet S
GENIOPLAST® Pellet S is a unique product concept, providing an outstanding high loading of ultrahigh-molecular weight polydimethylsiloxane and general compatibility with thermoplastic resins. Major applications of GENIOPLAST® Pellet S comprise improved processing of cable compounds and better scratch resist properties of automotive interior surfaces. GENIOPLAST® Pellet S is also applied for better processing and surface properties in engineering plastic compounds and for thermoplastic elastomers.

GENIOPLAST® Pellet P plus
GENIOPLAST® Pellet P plus provides the same benefits as GENIOPLAST® Pellet S but has been specifically developed for applications where food contact regulations must be met.

GENIOPLAST® Gum and GENIOPLAST® Fluid FR
GENIOPLAST® Gum, a high viscosity silicone gum for incorporation by batch processing and GENIOPLAST® Fluid FR, a silicone-based flame-retardant additive, are specifically applied when balanced requirements on processing, surface properties and thermal/mechanical characteristics must be met.

GENIOPLAST® Fluid 110 and Fluid 220
GENIOPLAST® Fluid 110 has been specifically designed for PVC applications. GENIOPLAST® Fluid 110 has an outstanding property profile which sets it apart from conventional internal and external lubricants, improving e.g. processing, thermal stability and mechanical properties. GENIOPLAST® Fluid 220 has been developed as additive specifically for processing of highly mineral filled, crosslinkable polyolefin compounds.

WACKER® AK Silicone Fluids
WACKER® AK Silicone Fluids, available in viscosities ranging from 100 to 1,000,000 mm²/s, provide manifold processing benefits to standard and engineering plastics compounds. As mentioned, the range of benefits varies with the quantity added to thermoplastic resins.

For more information on GENIOPLAST® and WACKER® AK Silicone Fluids, please refer to the respective brochures available.

Target Polymers that Can be Modified
Polymers that stand to benefit from WACKER silicones and silanes:

Standard plastics
Polyethylene (PE-LD, PE-LLD, PE-HD), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS, EPS)

Engineering plastics
Styrene copolymers (ABS, SAN, ASA), polyamide (PA), polycarbonate (PC), polymethyl methacrylate (PMMA), polyester (PET, PBT), polyacetal (POM), polyphenylene ether (PPE) and blends (PC/ABS, PC/ASA, PPE/PS, PPE/PA etc.)

Thermoplastic elastomers
Styrene block copolymers (SBS, SEBS, SEPS), thermoplastic polyurethanes (TPU), polyolefins (TPO) and co-polyester (TPE-E)

See for yourself what performance improvements are achievable when using GENIOPLAST® Pellets in thermoplastic compounds!

www.wacker.com/genioplast
WACKER is one of the world’s leading and most research-intensive chemical companies, with total sales of €4.63 billion. Products range from silicones, binders and polymer additives for diverse industrial sectors to bio-engineered pharmaceutical actives and hyperpure silicon for semiconductor and solar applications. As a technology leader focusing on sustainability, WACKER promotes products and ideas that offer a high value-added potential to ensure that current and future generations enjoy a better quality of life based on energy efficiency and protection of the climate and environment. Spanning the globe with five business divisions, we currently operate 24 production sites worldwide. WACKER is represented by subsidiaries and sales offices in 29 countries in the Americas, Asia, Australia and Europe. With a workforce of 16,300, WACKER sees itself as a reliable innovation partner that develops trailblazing solutions for, and in collaboration with, its customers. WACKER also helps them boost their own success. Our technical
centers employ local specialists who assist customers worldwide in the development of products tailored to regional demands, supporting them during every stage of their complex production processes, if required.

WACKER e-solutions are online services provided via our customer portal and as integrated process solutions. Our customers and business partners thus benefit from comprehensive information and reliable service to enable projects and orders to be handled fast, reliably and highly efficiently.
The data presented in this brochure are in accordance with the present state of our knowledge but do not absolve the user from carefully checking all supplies immediately on receipt. We reserve the right to alter product constants within the scope of technical progress or new developments. The recommendations made in this brochure should be checked by preliminary trials because of conditions during processing over which we have no control, especially where other companies’ raw materials are also being used. The information provided by us does not absolve the user from the obligation of investigating the possibility of infringement of third parties’ rights and, if necessary, clarifying the position. Recommendations for use do not constitute a warranty, either express or implied, of the fitness or suitability of the product for a particular purpose.