

TAILOR-MADE SILICONE COMPOUNDS

and the role of compounders.

Žiga Mandič, Gomline d.o.o., for HCR Excellence, Burghausen, 17. 4. 2024

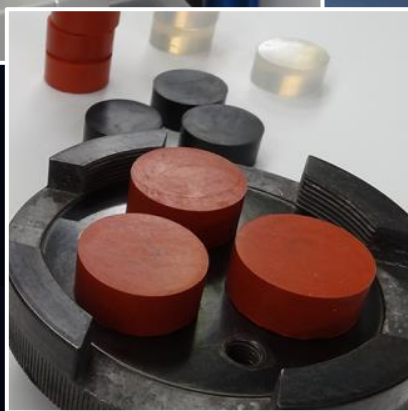
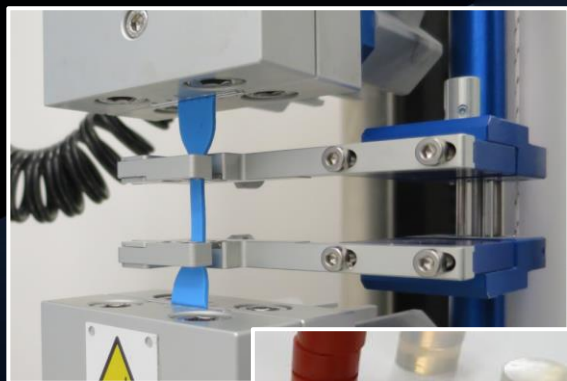
TODAY WE WILL ANSWER THE FOLLOWING QUESTIONS:

- ① **What is the role of a compounder?**
- ② **What are the benefits, or what's the added value to have a compounder?**
- ③ **What kind of silicone compounds exist?**
- ④ **What are the ends of what's possible to achieve with silicones?**
- ⑤ **Why Wacker? And why Gomline?**

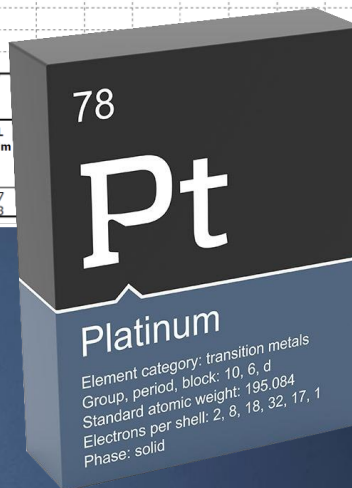
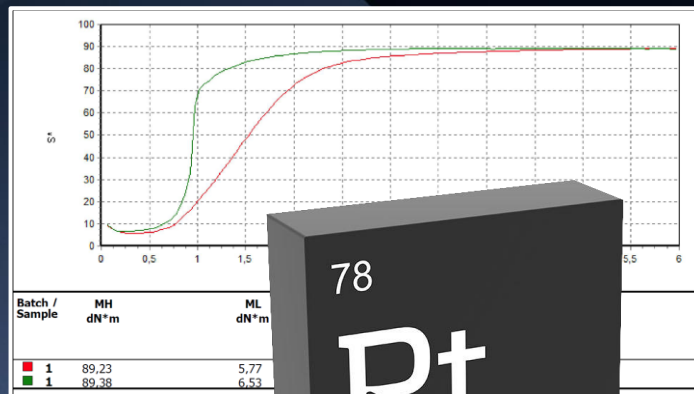
A COMPOUND

is a blend of polymers, fillers and other additives, that a compounder has to fine-tune, considering the following criteria:

PHYSICAL PROPERTIES



PROCESSABILITY



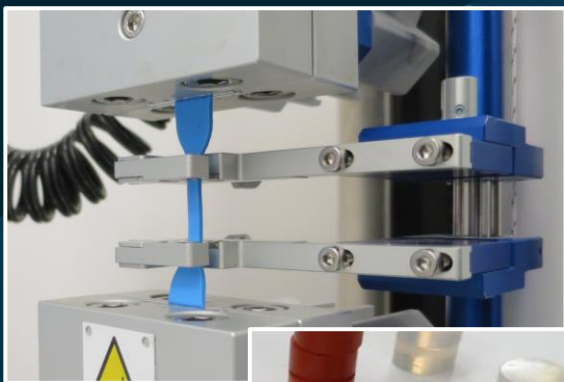
RAW FORM & THE WAY IT IS PRODUCED



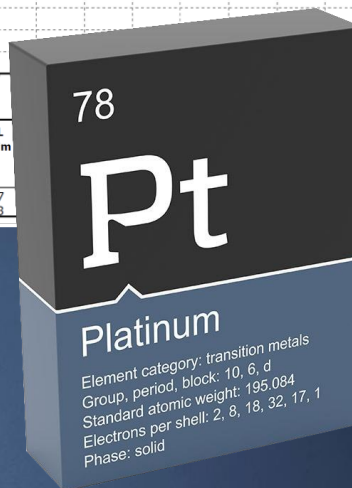
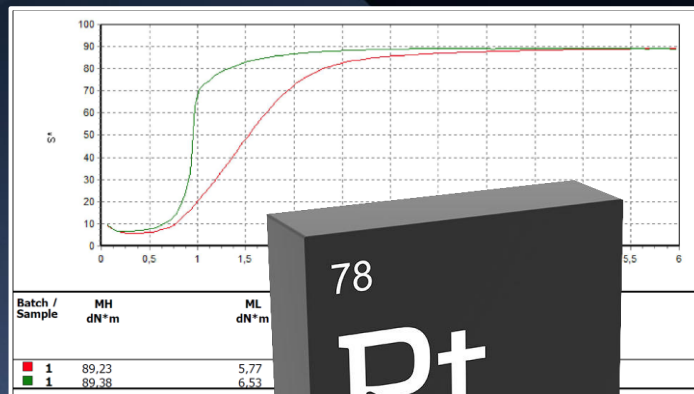
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PHYSICAL PROPERTIES

Wacker has a broad portfolio of polymers (70+) and additives, building blocks, that allow us to fine tune the physical properties of compounds, to meet a desired target.

Tensile properties

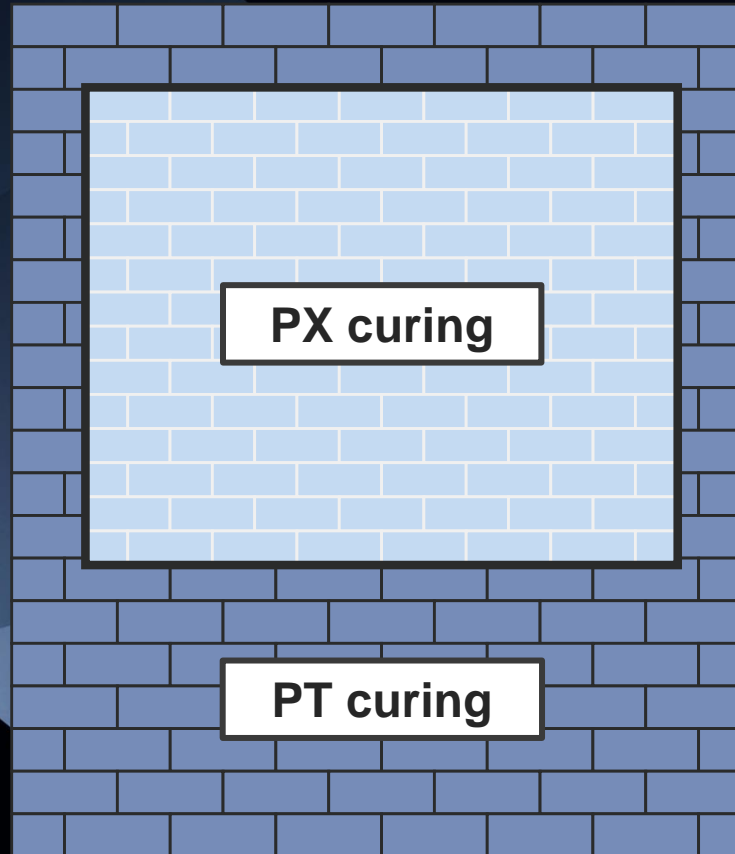
TS up to 13 MPa
Up to 1200 % elongation

Hardness

10-95 ShA

Tear resistance

5-60 N/mm



Heat stability

Up to 300 °C

Media resistance

Oils, greases, cleaning agents, ...

C.set, Tension set, rebound

<3 %, 30-70

Standards ASTM, DBL, ISO, UL, ...

INTERESTING PHYSICAL PROPERTIES

- **Non-black electrically conductive or antistatic (grey, blue, green, red,...)**
- **Black electrically conductive platinum curing for moulding (!) from 40-80 ShA**
- **Black or non-black with metal-like conductivity (best we achieved: 0,1 Ohm = 10^{-4} Ohm*cm)**
- **Self-adhesive industrial (to FKM, FVMQ, metals, glass, polyester, polypropylene, polyethylene, ...)**
- **Self-adhesive FDA (to metals, glass, ...)**
- **Compounds attracted by magnet for moulding or extrusion (PX or PT)**
- **Metal detectable compounds (grey, blue, FDA, platinum curing, ...)**
- **Transparent 95 ShA platinum curing for moulding or extrusion**
- **Peroxide curing, non-yellowing for moulding (remains transparent like with PT-curing)**
- **Extremely high heat stable compounds (zero change after 52 days @ 200°C)**

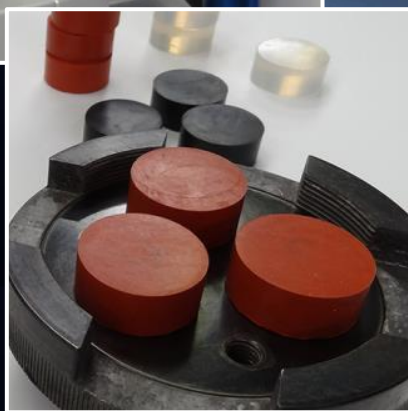
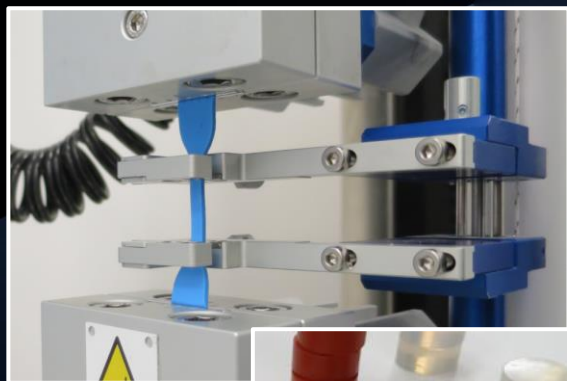
INTERESTING PHYSICAL PROPERTIES

- **Self-extinguishing compounds (UL 94 V0), and compounds for fire safety cables**
- **Sponge (closed cell) compound for extrusion and moulding (!)**
- **Oil bleeding or self-lubricating compounds**
- **Laser markable surface**
- **Antifungal and antimicrobial additives (identified with an Infra-red laser pen)**
- **Low coefficient of friction (various different solutions)**
- **Heat conductive compound (5,9 W/mK)**
- **UV curable compounds**
- **Photochromic and thermochromic colours**
- **Fluorescent and phosphorescent colours (blue, green, red glow in the dark,...)**

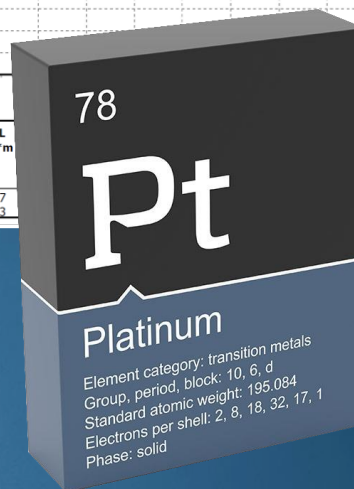
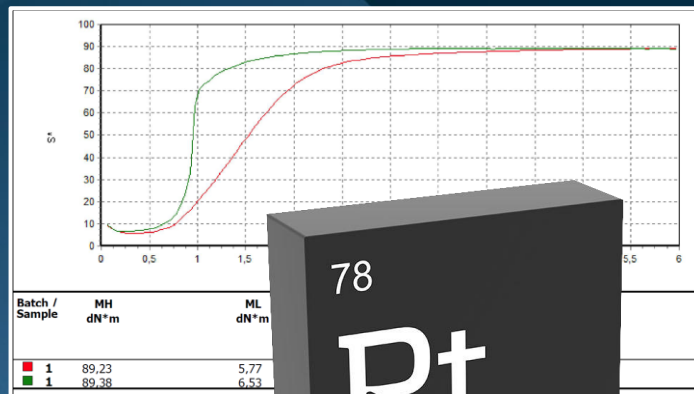
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PROCESSABILITY



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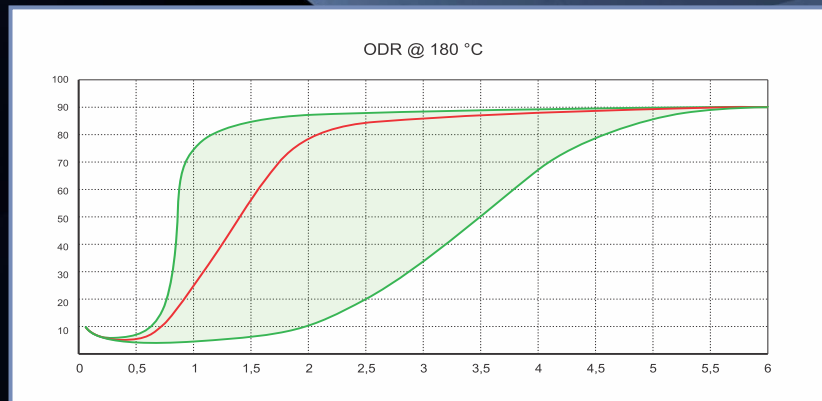


PROCESSABILITY → PX or PT

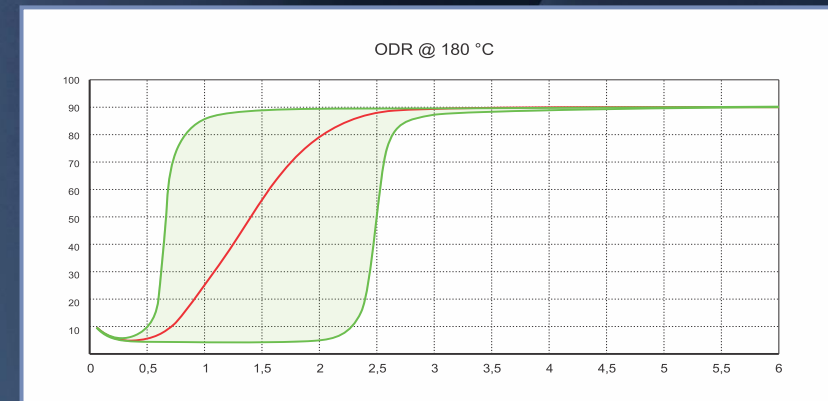
- Price of material to price of work ratio (PX or PT)
- Number of pieces per cavity (or pcs per year)
- Wall thickness(es)
- Overall complexity of the part
- Difficulty to extract out of the mould (high hot tear resistance and sticking to the mould)
- Fine tuning the curing curve (curing speed and transition from T_{s2} to $t'90$), rather than adjusting the curing temperature (!)
- Fine tuning the viscosity (strips, or to low viscosity for the mould), air traps



PX adjustability



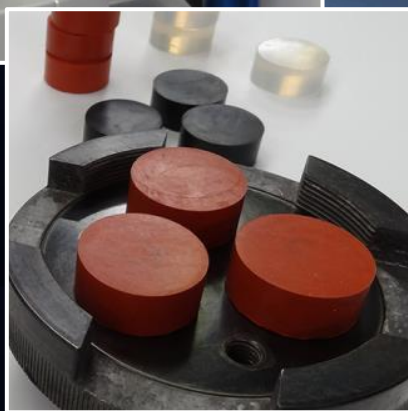
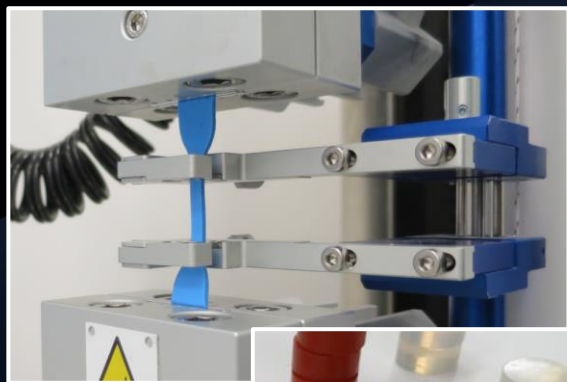
PT adjustability



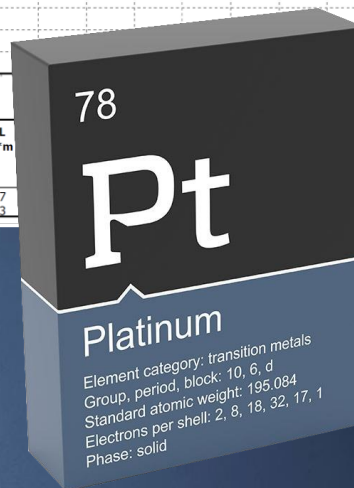
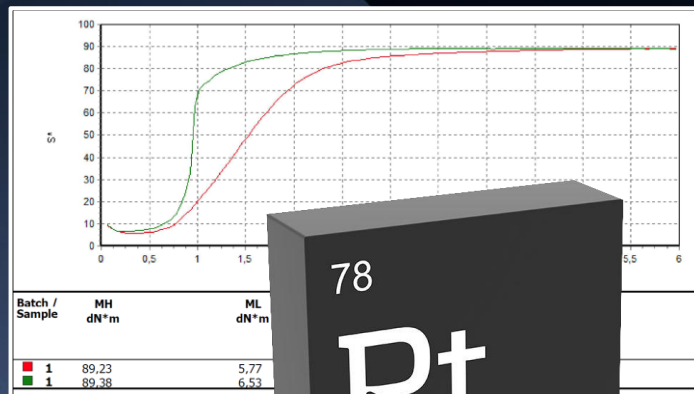
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Depending on complexity of the recipe, and the way the compound will later be processed, we have to ensure repeatability.

Moulded articles:

- Injection? With piston, or with screw? Green strength adjustment?
- Medical products of thin membranes?

Extruded articles:

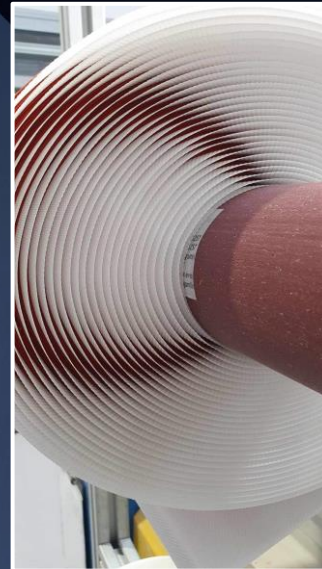
- Extruder opening size and dosing method?
- Talc or no-talc coated strips – medical maybe?
- Thick-walled profiles (>3-4 mm)
- Mixing under vacuum (PMBP for extrusion)?

Calendered articles:

- Adjusting green strength and Mooney stability

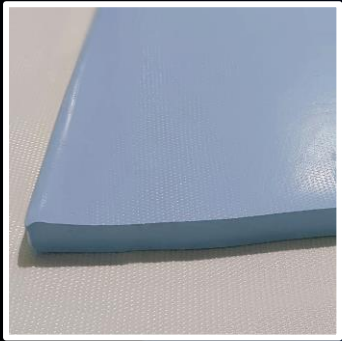
Machines needed to do the job:

- Two roll mills
- Internal mixers (twin screw, sigma blade, masticator blade)
- Strainer



DELIVERY FORMS

Compounds can be supplied in the following forms:



PLATES / SHEETS



BLOCKS



ENDLESS STRIPS



ROLLS



CALENDERED SHEETS



SMALL BOX



BIG BOX



PALLET



PLASTIC PALLET

TODAY WE HAVE LEARNED THAT:

The role of a modern compounder is to fine tune:

- the physical properties,
- the curing curve,
- and the raw form of the compound,

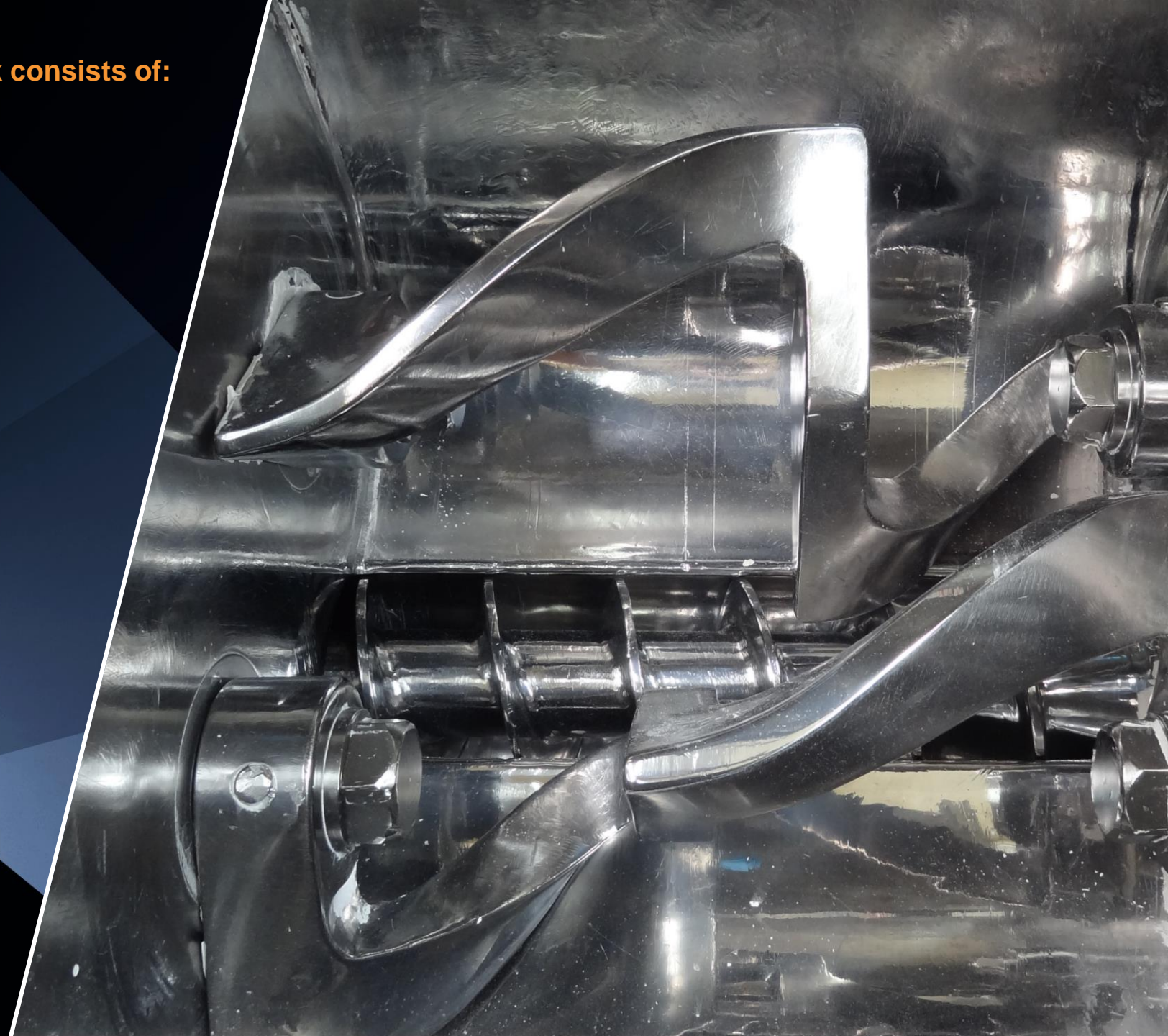
so that the one processing it can sleep tight or stay competitive.

In order for a compounder to do so, he needs a large portfolio of quality ingredients to choose from.

Wacker provides such flexibility.

For silicone production, our machine park consists of:

- CTM 185 twin screw mixer
- CTM 185 twin screw mixer with vacuum chamber
- 1.800 mm two roll mill
- 1.500 mm two roll mill
- 1.000 mm two roll mill
- 450 mm two roll mill
- 4x laboratory two roll mills
- 1.200 liter sigma blade mixer
- 180 liter sigma blade mixer
- 150 liter masticator blade mixer
- 2x 50 liter masticator blade mixer
- 10 liter laboratory masticator blade mixer
- 5 liter laboratory masticator blade mixer
- 1 liter laboratory masticator blade mixer
- 0,5 liter laboratory sigma sigma blade mixer
- Strainer/filter (able to filter down to 20 microns)
- 150 liter planetary mixer
- 5 liter laboratory planetary mixer
- 400 mm wide 5 roll calender
- 500 mm wide 3 roll mill



DELIVERY FORMS

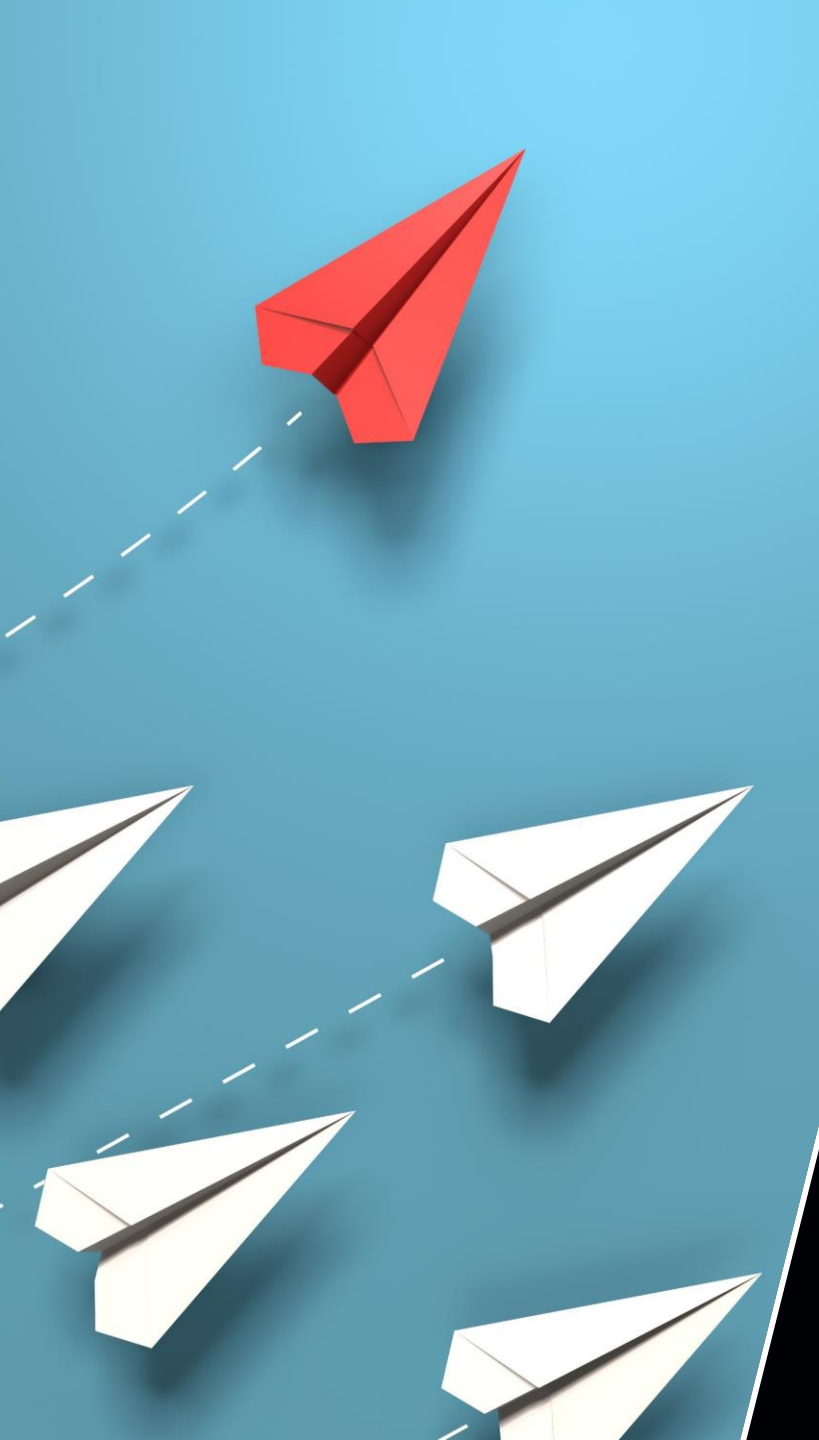
- Plates/sheets of various sizes
- Blocks of various sizes
- Endless strips of various sizes (talc or non-talc coated)
- Rolls
- Calendered sheets

LABORATORY

- Curing: MDR and ODR (also with pressure chamber)
- Tensile properties (also at elevated temperatures)
- Mooney
- Vertical and horizontal burning (UL 94, etc.)
- Electrical conductivity (surface, volume)
- Compression set (air, in media, also under pressure)
- Fatigue life (DeMattia)
- Tension set
- Hardness and density
- Rebound (elasticity)
- Heat aging and media resistance
- Coefficient of friction
- Colour $L^*a^*b^*$ values
- Preparation of standard specimens



Roughly 150 tons of polymers on stock at any given moment



Final word ...

GOMLINE AS A COMPOUNDER

Our vision is to remain a recognizable and trusted partner with minor as well as with larger, more demanding projects, requiring exceptionally fast response, above-standard solutions and adaptability to specific customers' demands.

We work in close partnership with our customers, suppliers and employees and continuously strive for progress and improvements. We are continuously providing technical support, resources and development services regardless of the industrial sector. We strive to provide the market with compounds of the highest quality and consistent repeatability considering physical and chemical properties, as well as superior processability.

Our corporate responsibility, as one of the leading companies in the field of development and production of silicone compounds, is to create new sustainable solutions, which will help ensure a better tomorrow and enable our branch further existence and development and will at the same time increase business success and excellence.