

PTFE/TECAPOWDER PI Compounds

The reinforcement of PTFE (chemically Polytetrafluoroethylene and colloquially referred to as Teflon®) with high performance polymers has many advantages compared to inorganic fillers. The most important properties are the excellent wear behavior without abrasion of the sliding partner. TECAPOWDER PI (based on P84® by Evonik) is an active filler in PTFE. This is shown by a highly increased creep resistance and a good mechanical bonding of the powder into the matrix.

The development of extremely fine powders lead to excellent surfaces of machined parts and skived films of these compounds.

PTFE/TECAPOWDER PI compounds replace other materials

Application	Replacement (type of compounds)	Replaced material
Compressor parts piston and rider rings in bone dry applications	85/15 and 80/20	PEEK composites, PTFE/bronze and PTFE/carbon/graphite compounds
Hydraulic seals, spring reinforced and others	93/7 and 90/10	PTFE/carbon, PTFE/bronze and PTFE/Ekonol
Dynamic seals in air components	80/20 and 85/15 P1	PE/carbon compounds, rubber and PUR seals
Sealing bands for turbo charger	80/20	PTFE/bronze and PTFE/bronze/MoS ₂ compounds
Sealing bans for shock absorbers	75/20/5	Most other PTFE compounds tested
Sliding liner for multilayer bearings in automotive applications	75/25 and 75/20/5, standard and paste types	PTFE/MoS ₂ and PTFE/lead compounds
Inner liner for push-pull cables	Proprietary paste compounds	PTFE/glass types, PTFE/PPS compounds
Guidance films for pistons and gliding components, esp. in weaving equipment	85/15 with 1200 mesh	RULON

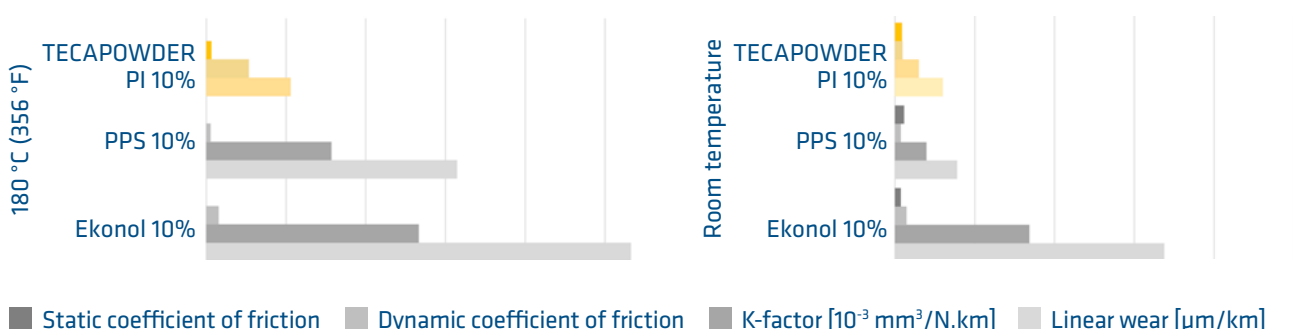
TECAPOWDER PI in PTFE compounds improves the properties

The most important properties of TECAPOWDER PI filled PTFE (Teflon®) are excellent wear resistance at elevated temperatures, high elongation, and no abrasion of the sliding partner – all without the need for lubrication.

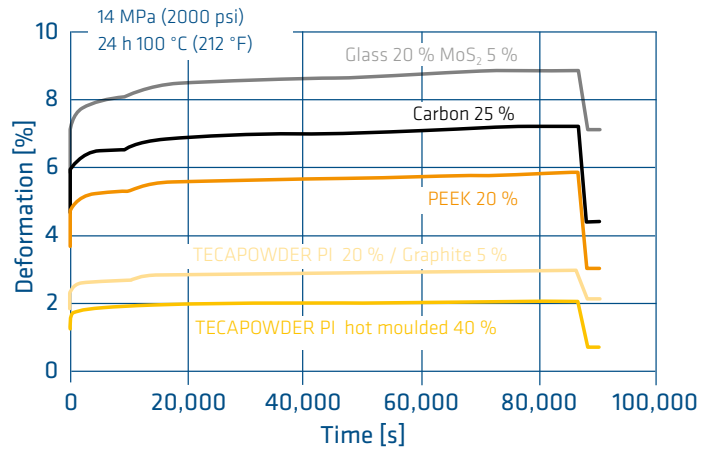
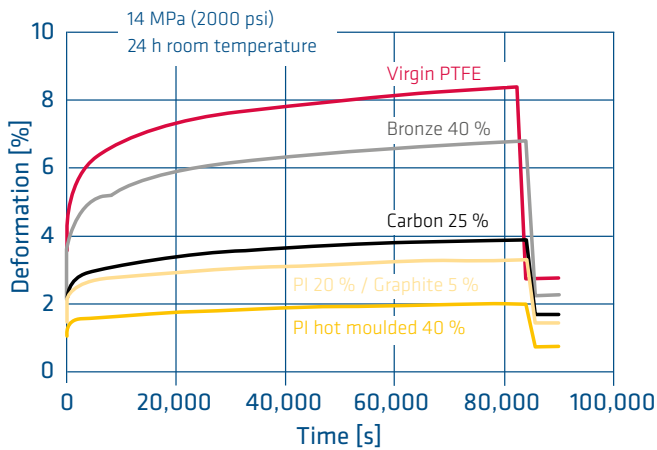
TECAPOWDER PI as an active filler in PTFE improves the mechanical properties of the PTFE. Blending 5-20 % loadings of TECAPOWDER PI VPD in PTFE creates wear resistant PTFE compounds that extend the performance envelope of standard PTFE materials especially at high pressures, velocities and temperatures. TECAPOWDER PI polyimide filled PTFE compounds are especially good running against soft mating surfaces.

- Teflon® is a registered trademark of E.I. du Pont de Nemours and Company
- Good chemical resistance
- Very good slide & wear properties
- High toughness
- Lower friction and wear
- High electrical insulation

Tribological properties of PTFE compounds against steel in comparison to PPS or Ekonol as fillers



Creep under load



Processing Guidelines

To mould these compounds standard PTFE free sintering process conditions can be used.

Different grain sizes for different purposes

To offer extremely low porosity and smooth machined surfaces, TECAPOWDER PI is available in different grain sizes. For technical parts i.e. bearings, gliding elements and piston rings, 325 mesh is used. For skived films and dynamic seals 425 mesh and 1200 mesh is offered. The discolouration of the outside section will be reduced with finer particles. Mechanical properties depend on the base PTFE resin. The mechanical properties are strongly affected by the base PTFE resin. Fine PTFE particles offer a maximum on elongation and strength.

Moulding

PTFE / PI powder compounds require slightly higher moulding pressures than virgin PTFE. With TECAPOWDER PI loadings of more than 20 % the moulding pressure is twice the pressure of standard PTFE. This high compaction is required to obtain a maximum on density and hardness. Also, the porosity is influenced. The compaction speed should be slower than standard compounds because of the micro-porous structure of PI powder. The moulded billets should be stored in air overnight to enable the release of compressed air.

Sintering

The sintering of high loaded compounds requires modified sintering temperatures over virgin PTFE. High temperatures up to 370 °C (700 °F) lead to a maximum in hardness and better tribological results. But this temperature must not be exceeded. More than 20 % TECAPOWDER PI powder needs to be sintered at lower temperatures (see table for conditions). Loadings of more than 30 % by wt. of P84 requires hot moulding conditions at a maximum temperature of 345 °C (650 °F).

Skiving

Skiving should be done with preheated blocks up to 150 °C (300 °F). This guarantees best surface qualities.

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The Ensinger Group is engaged in the development, manufacture and sale of compounds, semi-finished materials, composites, technical parts and profiles made of engineering and high-performance plastics. To process the thermoplastic polymers, Ensinger uses a wide range of production techniques, such as extrusion, machining, injection moulding, casting, sintering and pressing. With a total of almost 3,000 employees at over 30 locations, the family-owned enterprise is represented worldwide in all major industrial regions with manufacturing facilities or sales offices.

6-EN-12|24