

High-Performing PTFE Compounds Open Up New Areas of Application

An Ingenious Blend

New developments in the field of PTFE are making this material more and more attractive to design engineers. New filler combinations and processing techniques continuously open up new areas of application. Four examples illustrate these developments

Standard PTFE has an exceptionally wide thermal application range, possesses nearly universal chemical resistance as well as being insensitive to light, weather and water vapor. It has outstanding sliding properties, anti-adhesive behavior, good electric and dielectric properties and is physiologically neutral.

Despite this variety of positive properties, new technical requirements keep emerging. The first step is to modify PTFE and to thus improve its properties profile. Complementing this approach, or as an alternative, special PTFE blends are created in order to achieve even further improvements of certain characteristics. The high-performance material, PTFE, is used in many applications. On account of its outstanding properties, sealing technology is no longer conceivable without it. Yet in view of the fact that load limits are reached even when using standard fillers such as carbon, glass fibers, bronze or graphite, additional requirements have to be met through new developments in the area of processing and fillers. Based on the example of four materials, this article will show how fields of application have been expanded through special material properties.



With new filler combinations, PTFE causes a sensation

High Reverse Bending Strength

One of the properties of polytetrafluoroethylene valued by engineers is its high resistance to de-formation of the structure. This has made PTFE the preferred material for diaphragms and bellows. While existing types of PTFE already cover a broad range of applications, PTFE HS 22121 surpasses all previous parameters of reverse bending strength. In addition, cold flow has been reduced further. For long "mileage", the parts require increasingly thin-walled designs. Therefore, it is all the more important that the material have a high barrier effect against permeation. Other benefits of the material are:

- Smooth surfaces
- Low porosity
- Weldability

The following case in point is a bellows for a bottling valve. The requirement could only be met using the modified HS 22121 compound. Its characteristics are:

- Pressure resistance to 6 bar of interior pressure

The Author:

Martin Schuster is Sales Manager of ElringKlinger Kunststofftechnik GmbH in Bietigheim-Bissingen, Germany



- Cleaning temperature 140 °C
- Stroke 20 mm
- Reverse bending strength 10 million cycles

Pressure- and Wear-Resistant

The material was developed specifically for oil-free compressor applications. With dry media, low-lubrication conditions and high pressures, the HS 22111 PTFE compound is used. By means of suitable filler combinations it was possible to further increase the pressure level of wobble-piston compressors without reducing the service life of the sealing elements. Benefits of the material are:

- Dimensional stability
- Suitability for use in humid and dry atmospheres
- Wear resistance
- Economy

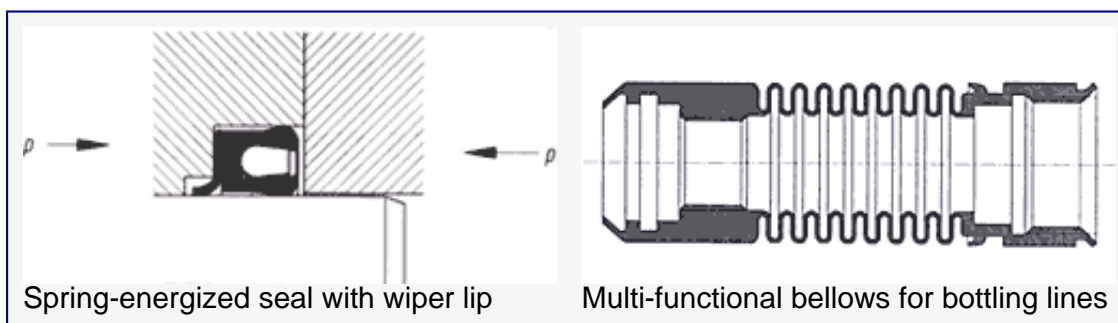
The example of a "Molded Memory Packing in a One-Step Wobble-Piston Compressor" illustrates the requirements to be met by the sealing element:

- Pressure load up to 20 bar
- Temperatures up to 200 °C
- Service life 1000 hours
- Mating surface hard-coated aluminum Rz < 4 μm .

Universal for Many Applications

As a matter of principle, from a technical perspective, the objective is always to achieve the optimum in terms of service life, quality and function of the sealing element. In order to be able to cover a broader application range, it is necessary to develop materials that achieve good results in all areas. This is the angle from which ElringKlinger has developed the HS 21037 PTFE compound. Its main characteristics are:

- Very good wear resistance in no-lube operation
- Non-abrasive to the mating surface
- Good price-performance ratio



This has resulted in a material that even surpasses the requirements. The HS 21037 PTFE compound is now being used in many products such as:

- Shaft seals
- Memory packings
- Spring-energized seals

- Piston and guide rings

Again, the application example – PTFE shaft seal for high-speed centrifuges in the food, chemical and pharmaceutical industries for separating solid substances from liquids – shows that the universal material successfully meets the high requirements of the application. Such applications are characterized by very high circumferential shaft speeds. The associated major requirements are:

- High wear resistance in no-lube operations
- Circumferential shaft speed 35 m/s
- Medium air/nitrogen
- Hardened shaft 58 HRC
- Low development of friction heat

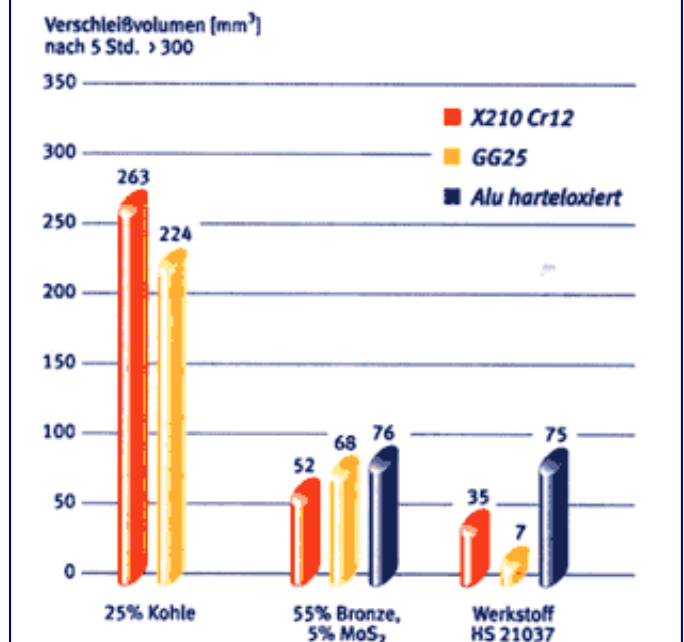
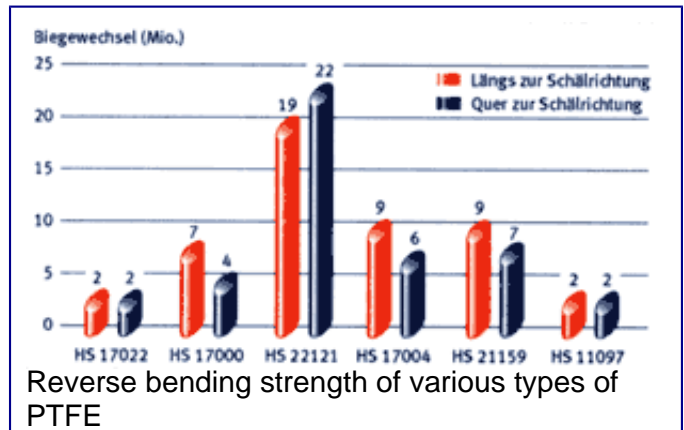
In addition to the material, a special design of the PTFE sealing lip was developed.

Media with Poor Lubricating Effect

With dynamic seals, the medium often confronts engineers with load limits. Numerous lab and field tests are necessary until the causes of the complex wear mechanisms of a sealing lip have been determined as a prerequisite for creating a new material. The combination of several fillers increases and, in case of media with poor lubrication, maximizes pressure resistance. The material is specifically used for spring-energized piston pump seals. The pumps are used in high-pressure gasoline injection systems and in liquid chromatography. The following operating parameters are covered:

- I Stroke movements of up to 200 Hz
- Strokes of up to 15 mm
- Temperatures of up to +150 °C
- Pressure loads of up to 400 bar

In terms of its operating conditions, every application must be tested separately. In a joint development effort even difficult problems can be resolved for successful application in the field. This makes close collaboration between the seal manufacturer and the customer all the more important.



Wear of various PTFE compounds



Wobble-piston for oil-free compressors