Gears

Stanyl®

a DSM Brand

Astonishing Stanyl®

Gears

Why you should consider Stanyl in your next gear project:

- **Potential for gear diameter and face-width reduction**
- **Great cost savings versus sintered metals and other, more traditional plastics**
- **Opportunity to use lower-cost e-motors in your drive train**
- **High temperature resistance**
- **Best retention of mechanical properties between 100-170°C (210-335°F)**
- **Best endurance and fatigue resistance at > 100°C (210°F)**
- **Best creep performance**
- **Best combination of low wear and low coefficient of friction at elevated temperatures**
- **High strength and stiffness**
- **Easy processing**
- **Reduced cycle times**
- **Increased cavitation**
- **Broad portfolio**
- **Professional support in gear design and execution**
- **Highest reliability in advanced gears**
- **Proven market capabilities**

DSM's focus on innovation.

Using Stanyl PA46 resins results in molded gears which feature higher endurance and reduced dimensions, in high-temperature environments, and for high torque transmitting situations.

The gear industry is continuously faced with the challenge of providing thermoplastic gears with extended lifetimes and reliability, reduced size and, of course, the best cost position. These trends are clearly seen in all the end-markets which gear manufacturers supply to: automotive, consumer electronics, office equipment, industrial applications and many more.

DSM Engineering Plastics responds to your needs and offers you significant technical as well as system cost advantages, enabling gear designers and manufacturers to better respond to end-user's advanced requirements and increase your competitive situation.

Many gear manufacturers are currently reaping the benefits of using Stanyl grades to meet their advanced gear needs. Especially when temperature resistance is a concern: Stanyl is the most suitable and cost-effective solution for gears operating between 100-170°C (210°-335°F). Gears currently made in Stanyl resins include electronic throttle control gears, power window lifter gears, paper shredder gears, seat recliner gears, starter motor gears and hundreds of other types of gears, many in production for more than 10 years. Stanyl gears are engineered as replacements for sintered metal (weight/cost savings) or for improvements in endurance and reliability compared to other thermoplastic gears.

DSM offers a broad portfolio of Stanyl grades with proven applicability in gears!

Stanyl offers you the toughness advantages of a polyamide combined with high-temperature resistance. Stanyl is a high-temperature resistant polyamide with a melting point of 295°C (560°F), developed by DSM. Through its molecular structure (figure 1), it improves on conventional polyamide PA6 and PA66 performance, while additionally offering high productivity (short cycle times) and much higher crystallinity (mechanical property retention at elevated temperatures) (figure 2).

Stanyl TW341 in a **power window system** gear enables you to take advantage of the trend towards low-torque, high-speed small package motors.
- **Improved power-to-cost ratio** by using high-speed, low torque, lower cost e-motors. Up to 50% savings on your e-motor.
- **Improved power-to-unit size ratio**: 10-15% smaller size, lower weight (10%), same torque output and durability result in significant space savings in the door panel compartment.

Traditional gear materials fail while Stanyl meets the challenge; e.g. POM melts and PA66 has twice the wear of Stanyl.

Stanyl TW200F8 used in **starter motor gears** for motors with power ratings up to 2.3 kW offers:
- **Significant component cost savings:** up to 40% in **component cost** versus sintered metals; 30% higher **productivity** (shorter cycle time) vs. PA66.
- **Improved starter performance:** higher number of cranking operations compared to PA6, PA66 or PPA (60% more – up to 80 k cycles) due to the intrinsically superior wear and fatigue resistance of Stanyl. Also, Stanyl's cold temperature characteristics – down to -30°C (-22°F) – ensure smooth start-up, even in the coldest areas of the world.

Stanyl is available in unreinforced as well as glass fiber reinforced grades, suitable for replacing current materials that can no longer meet performance requirements.

Whether in dry or in lubricated conditions, Stanyl excels because of its low dynamic coefficient of friction and wear rate especially at high PV (pressure/velocity) values – where more traditional materials such as POM and PPA fail (figures 3 and 4). Stanyl is also the best solution to replace POM when the latter's failure mode is due to high temperatures (either ambient or interface).

There are indeed other high-temperature resistant materials, but either at significantly higher (system) costs or with lower performance.

One of the key differentiators of Stanyl as a gear material is its outstanding fatigue resistance (figure 5), which ensures excellent gear durability, even at challenging temperatures.

Figure 1 Stanyl has a unique molecular structure within the polyamide family.

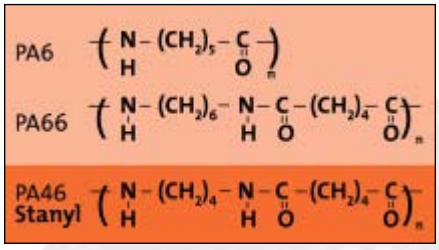


Figure 2 Stanyl's high crystallinity ensures excellent retention of mechanicals at elevated temperatures.

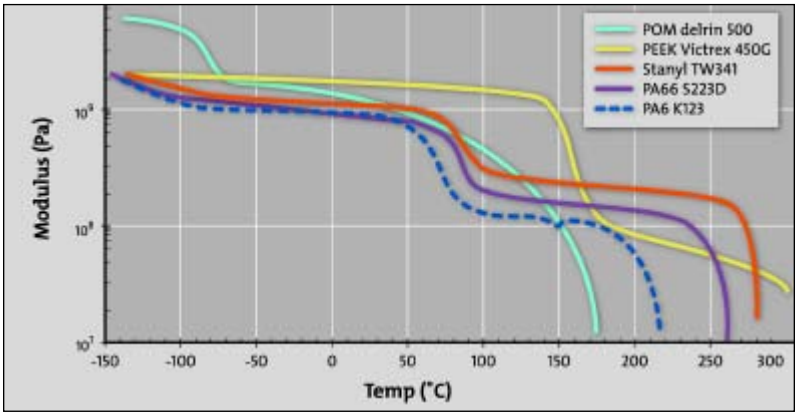


Figure 3 Stanyl (unfilled) low wear rate compared to POM.

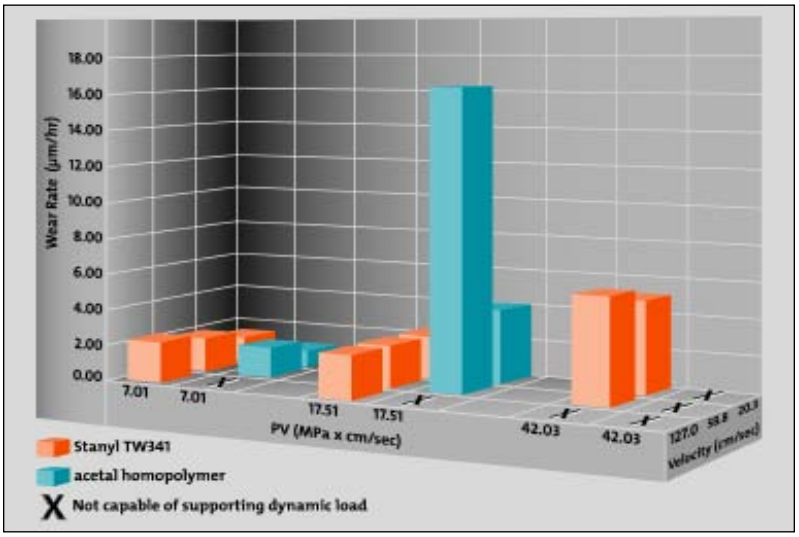
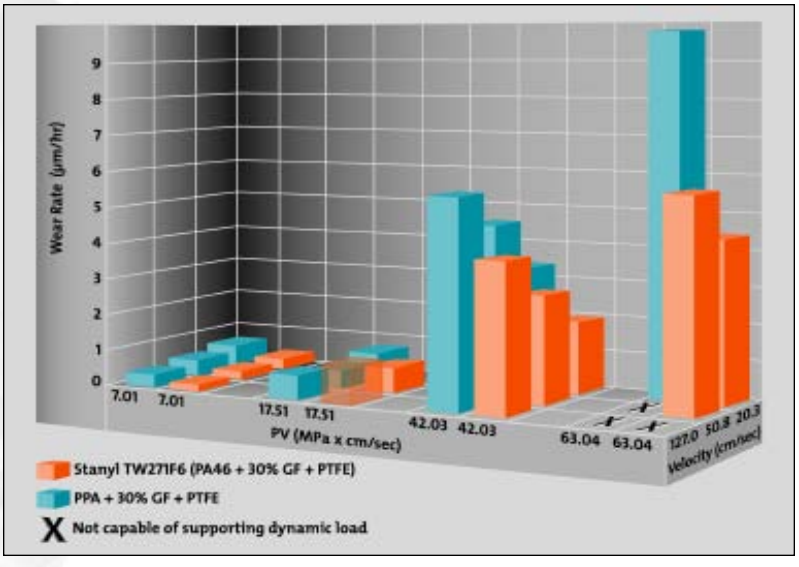


Figure 4 Stanyl (unfilled) low dynamic coefficient of friction compared to POM.



Concerned about the dimensional stability of your gears when they are subjected to high relative humidity/temperature environments? No need to be.

Many gear manufacturers with proven applications have already found that Stanyl solutions exceed their expectations. One solution is annealing, i.e. a thermal treatment of the gears, either in the system under conditions of use or as a separate step. This raises Stanyl's properties to even higher levels while significantly reducing moisture uptake, to levels lower than PA66 or, when done properly, even down to cast PA levels (please consult your local DSM representative).

An additional benefit of annealing comes from the improved performance of Stanyl, typically:

- Up to 50% higher stiffness and strength above T_g
- 25-50% higher fatigue resistance at high temperatures (see figure 5)
- 50% lower wear rate
- 25% lower friction
- 30% higher stress at 2% strain at high temperatures (see figure 7)

A higher stress-strain capability at high temperatures enables smaller gears to be designed which still transmit the same torque as a much larger gear. And this at high temperatures.

Space savings of 20-40% are typically possible through using Stanyl in addition to valuable cost savings. DSM can help you design the most effective gear and save space in your innovative designs. Please consult your local representative for a list of specific grades.

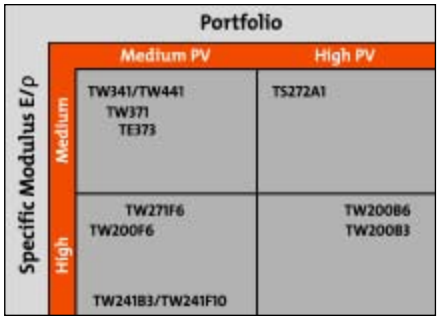


Figure 5 Outstanding fatigue resistance of Stanyl at 8Hz/140°C. Note: TW200F6 = PA46, 30%GF; TW200B6 = PA46, 30%CF

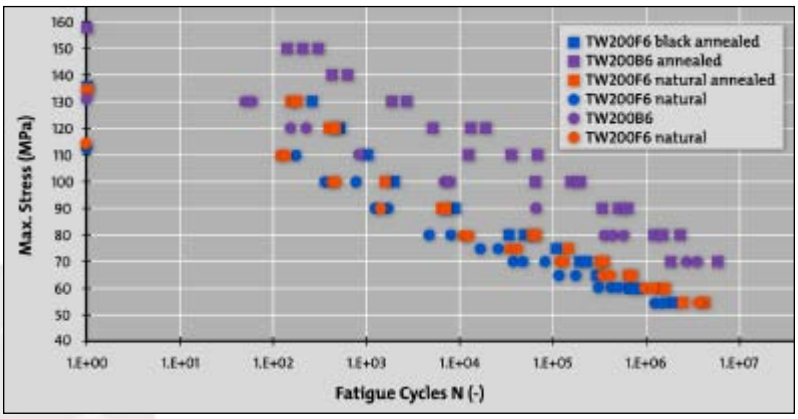


Figure 6 Decrease in moisture uptake of Stanyl after 18 days annealing compared to competitive gear materials.

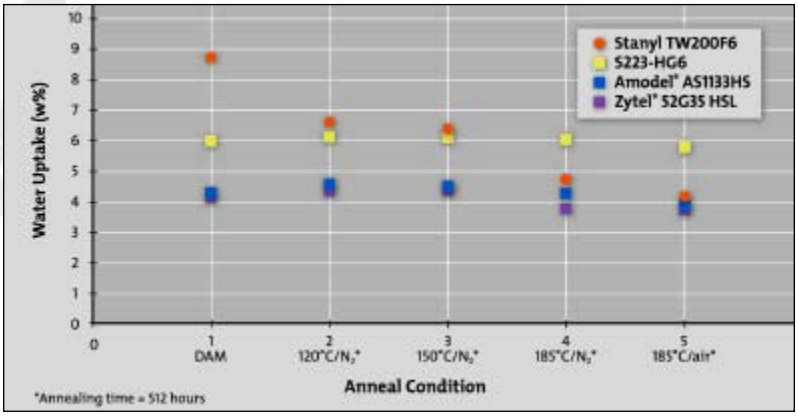
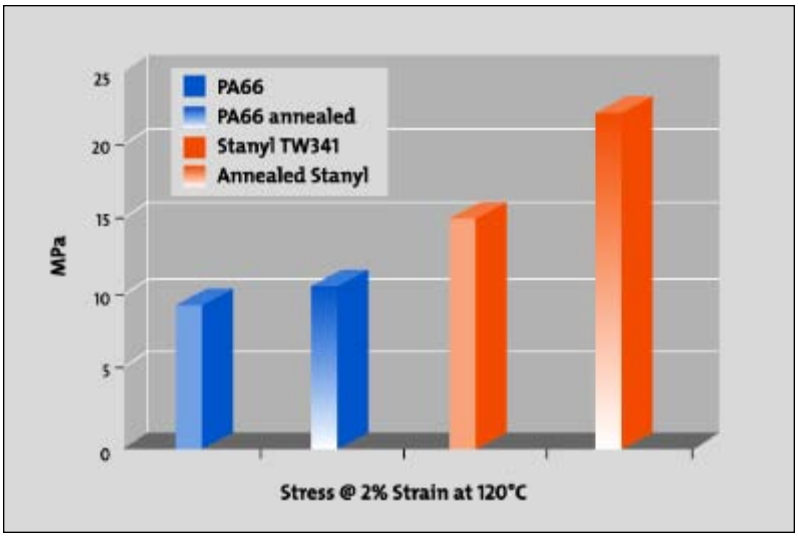


Figure 7 Annealed Stanyl's higher stress at 2% strain at 120°C (245°F).



Stanyl® for high-temperature, high torque transmitting gear solutions

Are you facing situations where:

- You don't know which thermoplastic to choose when needing to change from a sintered metal gear?
- High contact temperatures and loads are leading to teeth root cracking failure in thermoplastic gears?
- Endurance expectations on a plastic gear are not being met?
- The gear train size needs to be reduced to meet the customer's system spatial requirements?
- Excessive wear or high friction is being encountered under dry running conditions?
- More choice in e-motor types is wanted, but the current gear train can't perform?

The Stanyl® product line offers the best choice for advanced gear solutions.

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