



Stanyl®

Gears

For high temperature, high torque transmitting applications

Automobile manufacturers are increasingly turning to plastics to help reduce weight, noise and costs. Today, plastics are being used to manufacture interior gears (comfort actuators), motor management gears (air and fuel management actuators), electric power steering gears, and to replace metal gears in general. The Stanyl® product line offers the best choice for advanced gear solutions providing the following:

Benefits

- Easy processing
- Professional support in gear design and execution
- Excellent tribological properties at elevated temperatures
- Best endurance & fatigue resistance at >100°C (210°F)
- Best retention of mechanical properties between 100-170°C (210-335°F)
- Great cost savings versus sintered metals and other, more traditional plastics

Features

- High temperature resistance
- Highest reliability in gears
- High strength and stiffness
- Broad portfolio
- Proven market capabilities
- Best creep performance

Proven applicability in gears

Stanyl is a high performance polyamide that delivers toughness combined with high-temperature resistance melt point of 295°C (560°F). Through its molecular structure 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).

Whether in dry or in lubricated conditions, Stanyl excels because of its excellent tribological properties, especially at high PV (pressure/velocity) values where materials such as acetal (POM) and PPA fail (figures 2 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) and/or creep.

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 6), which ensures excellent gear durability, even at challenging temperatures and/or loads.

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

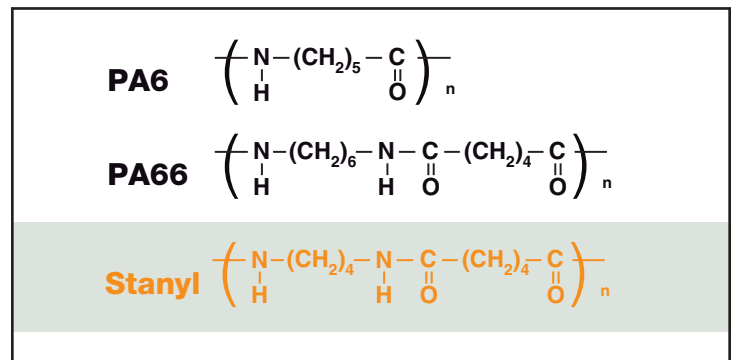
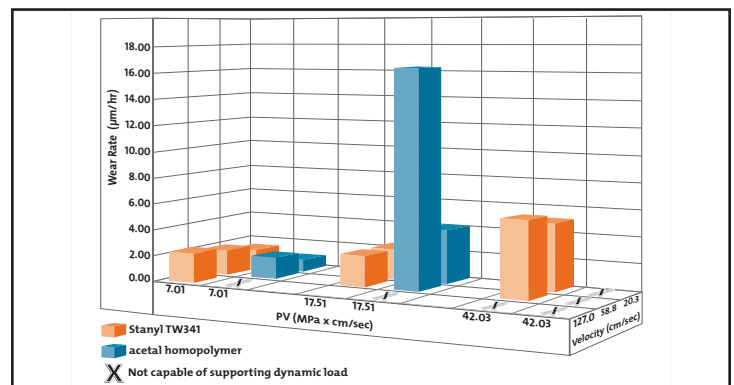


Figure 2 Stanyl (unfilled) low wear rate compared to POM.



Revolution under the hood

The gear industry is continuously faced with the challenge of providing thermoplastic gears with extended life times 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. Are you facing situations where:

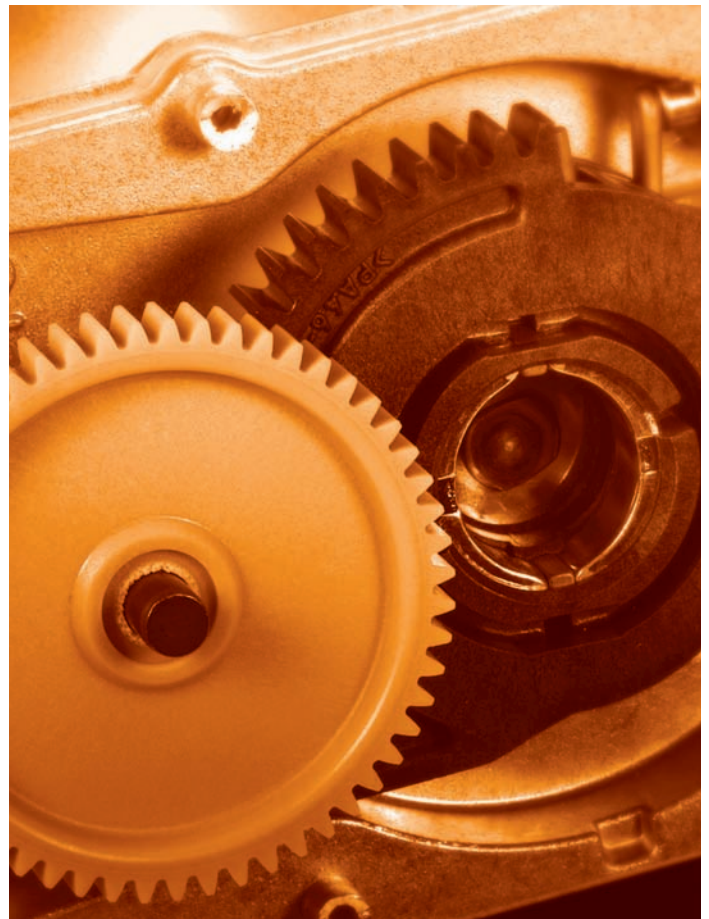
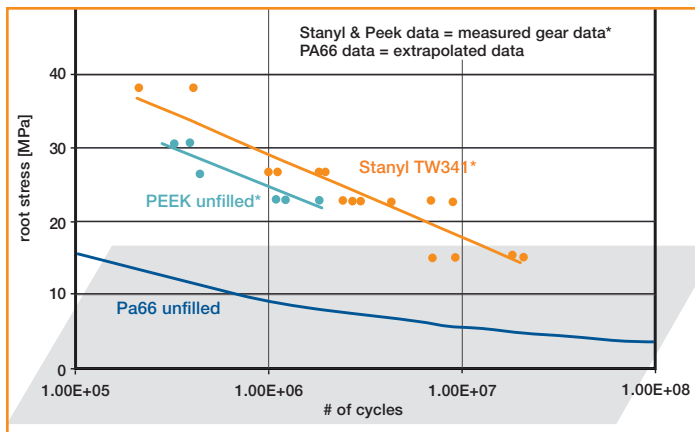
- You don't know which thermoplastic to choose when needing to change from a sintered metal gear?
- High contact temperatures and loads are leading to teeth root failures in thermoplastic gears?
- Endurance expectations on a plastic gear are not being met?
- Excessive wear or high friction is being encountered under dry running conditions?

Using Stanyl resins results in molded gears with boosted performance, durability and safety in high temperature environments and for high torque transmitting situations. DSM Engineering Plastics responds to your needs and offers 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.

Figure 3 Stanyl portfolio.

Portfolio			
Specific Modulus E/ρ	Medium PV		High PV
	Medium	High	
High	TW341 TW441		TW371 TS272A1
	TW200F6 TW200F8 TW241F10 TW275F6		TW271F6 TW241B3 TW200B6 TW271B3 TW272B6

Figure 4 Fatigue resistance at 140°C with oil lubrication.



Performance that exceeds expectations for gears

If you need to **BOOST PERFORMANCE, SAFETY AND DURABILITY** then Stanyl is the high performance polyamide that provides unmatched performance and value across an amazingly broad range of applications. It's a cost effective material solution that offers a unique combination of properties which enable you to design gear trains with:

High & constant accuracy/efficiency of gear train

- excellent tribological behavior (50% less wear as PPA)
- low creep (30% less as PPA)

Higher torque loads & high durability

- high stiffness & strength and retention of stiffness & strength at elevated temperatures (30% higher at 150°C as PPA /PA66)

Increased reliability & safety

- high fatigue resistance (allows 25% higher stresses at same number of cycles than PPA or PA66 at 140°C)
- high impact strength (25% higher as PPA)

DSM can help you design the most effective gear and save space in your innovative designs. Please use the information on the back of this brochure to consult your local representative for a list of specific grades.

Figure 6 Outstanding fatigue resistance of Stanyl at 140°C.

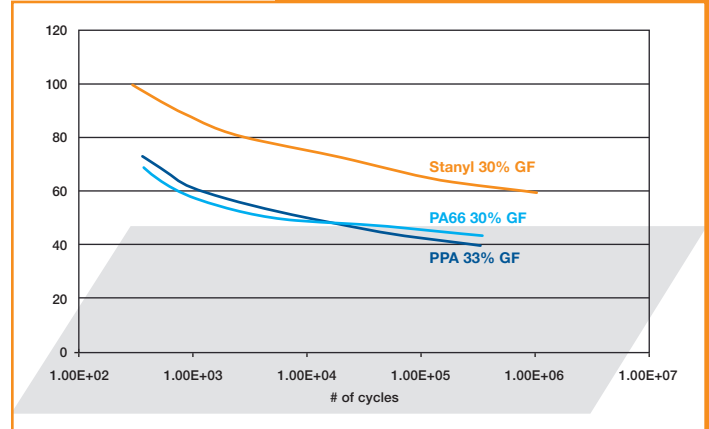


Figure 7 Stanyl creep at 140°C, 50 MPa.

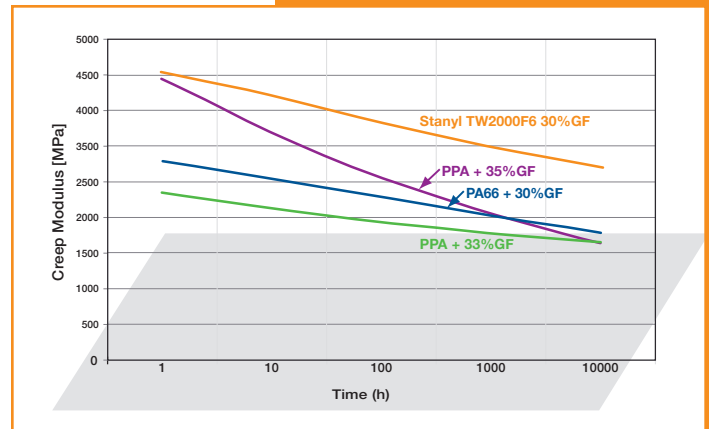


Figure 5 Stanyl (filled) low wear rate compared to PPA.

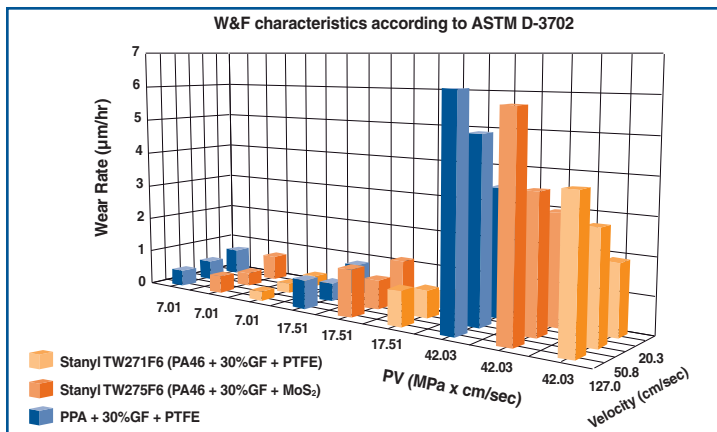
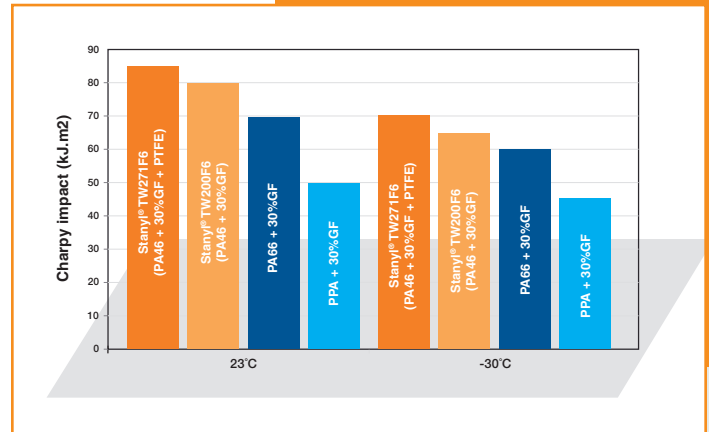


Figure 8 Stanyl impact at 23°C and -30°C.



Gear applications at a glance



Starter Motor Gears

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
- 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, the cold temperature characteristics of Stanyl [down to -30°C (-22°F)] ensure smooth start-up, even in the coldest areas of the world.



Motor Management Gears

Stanyl TW271F6, TW275F6, TW200F6, and TW200F8 deliver performance for ETC, EGR, Turbo & Variable Induction System (VIS) gears. In the case of ETC gears the control of the throttle has to be very accurate and the dimensional stability has to be extremely high. Stanyl TW271F6 suits this application extremely well due to its excellent heat resistance and wear and friction resistance. For similar gear applications with extreme requirements Stanyl TW271F6, TW271B6, TW241B3, and TW200B6 meet the demands.



Small Petrol Engine Gears

The excellent wear & friction behavior, high stiffness at elevated temperature, long term creep properties, and excellent oil resistance of Stanyl TW341, TW241B3, TW241F10, and TW200F3 make it a perfect candidate for metal replacement options like oil pump gears, cam gears, lawn mower, and chain saw applications. The high fatigue resistance of unfilled Stanyl TW341 compared to unfilled PEEK or PA66 at elevated temperatures meets the customer's high requirements on safety and lifetime. Lower noise and system cost reduction are further drivers to use Stanyl for metal replacement in engine gears.



Interior Gears

With the higher requirements of automotive interior gears we see traditional materials facing their limits. For example, in window lifts creep causes acetal (POM) gears to become distorted and running loads can lead to a PV failure causing the material to appear melted. Stanyl is a low outgassing material, does not contain formaldehyde, and in applications like EPS, seat actuators, and wiper systems, it outperforms PA66 and POM. Stanyl has mechanical properties that are over two times better than PA66 at the gear interface temperatures of 130°C which occurs in many worm wheels. Common worm wheel grades include TW341, TW371, and TW200F3.

Living solutions that deliver key benefits to customers: performance, design freedom and system costs.

At DSM Engineering Plastics, we develop materials to help our customers make substantial productivity gains, while meeting or exceeding today's stringent environmental requirements. Examples include Stanyl®, offering greater design freedom for thin wall applications as well as low system costs and lead-free soldering; Arnitel® for wire & cable applications requiring high heat solutions, meeting environmental requirements at significantly lower costs; and Akulon® Ultraflow, a halogen-free flame retardant material offering greater design freedom and lower systems costs.

Contact

At DSM Engineering Plastics, our customers are key. Focusing on the advantages for the end user is essential. If the end user is satisfied, so are our customers. And so are we. We do not settle for ordinary solutions. Instead, we strive to find Living Solutions™, working together with customers in a dedicated, resourceful and reliable way.

If you share our values and are looking for your own Living Solutions™, please get in touch.

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Printed in the USA 11/08 1,000