

# Manufacturing durable, lightweight and cost-effective actuator gears

Achieving vehicle emission reduction continues to be a major focus area for the mobility industry for conventional internal combustion engines, hybrid vehicles and fully electric vehicles.

Having a highly efficient engine plays an integral role in realizing this goal. By deploying various automotive engine control units and actuators, engines can run at their most optimal range, helping to significantly reduce CO<sub>2</sub> and NO<sub>x</sub> emissions.

Engine management actuators – including exhaust gas recirculation valves (EGR), turbo actuators used in downsized and charged engines such as electric waste gate valves – electronic throttle control valves (ETC), and coolant actuator valves, are all effective methods for lowering emissions. Yet, to maximize efficiency gains, OEMs need to design

lightweight vehicles. This requires smaller components, including compact actuator housings, covers, and thinner, more reliable gears.

Engineering materials such as polyphthalamides (PPA) and polyamide 66 (PA66) are commonly used to manufacture actuator gears. However, these plastics quickly lose their durability performance when molded into thin-walled parts. For applications that rely on high-performance gears designed to remain strong and durable across a wide range of operating temperatures, DSM Engineering Materials offers Stanyl® PA46.

## Stanlyl® PA46

### The leading material solution for automotive gears

For more than 20 years, auto-parts manufacturers worldwide have relied on our best-in-class high-temperature aliphatic polyamide for their most demanding actuator requirements. Stanlyl PA46 is used to produce over 100 million actuator gears each year and offers:



Best-in-class thermal, creep and fatigue resistance



Outstanding durability in high torque applications



Excellent mechanical performance that prevents gear failure



Inherent wear and friction properties to minimize the need for expensive material additives



Superior flow properties that enhance design flexibility



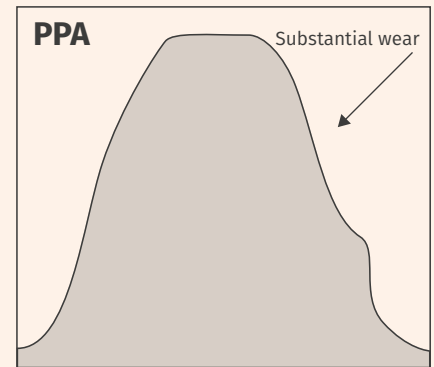
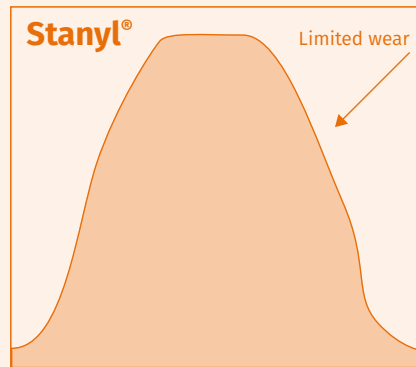
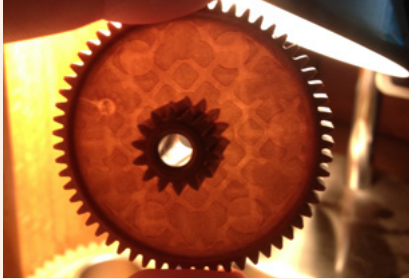
Up to 40% less material required to mold high-performance gears

# Superior wear and friction properties

One of the most common gear failure modes is tooth wear that reduces actuator performance. Stanyl PA46's inherently high stiffness and crystallinity provide outstanding wear and

friction properties that can extend gear lifetimes by 5 to 10 times – even when applied to high-stress environments with limited design space.

## Thin gears for reduced mass and increased performance



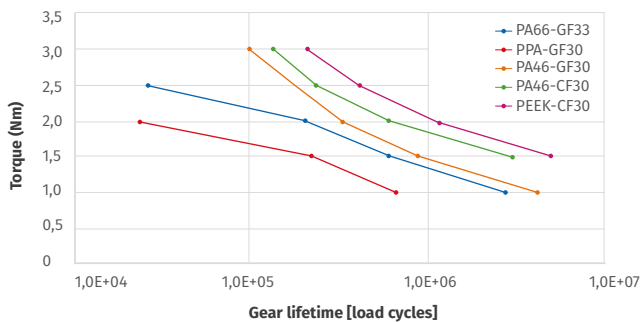
## Balancing performance and weight requirements

Gear durability testing verifies that gears made from Stanyl PA46 offer up to 40% higher torque resistance compared to PA66 and PPA alternatives of the same size. The material enables manufacturers to miniaturize designs in fewer steps and deliver products faster to strengthen customer relationships.

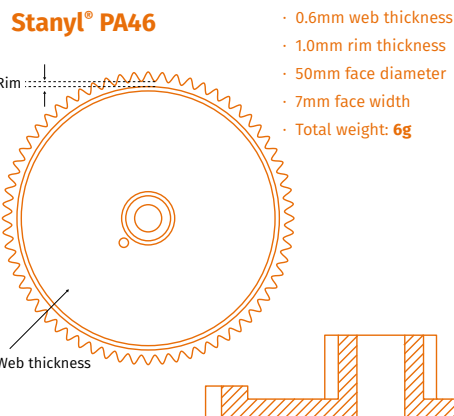
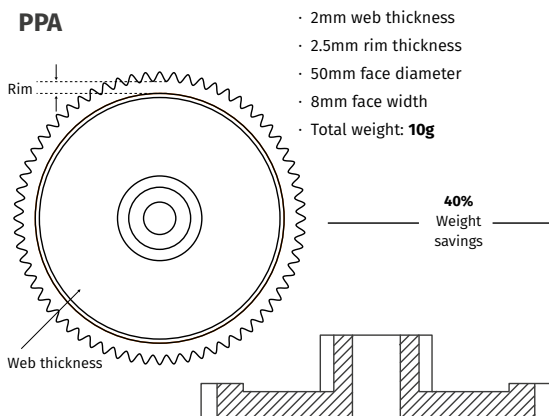
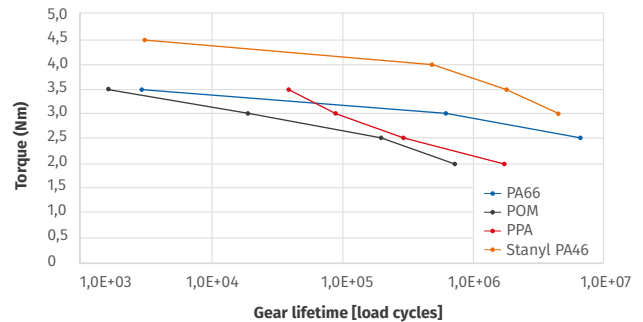
Compared to PPA, Stanyl PA46 enables gear rim thickness to be reduced by up to 60% without compromising part durability. The material also supports gear designs with thinner walls and decreased width to provide a total weight savings of 40%.

## Gear durability testing

Gear durability tests at 130°C



Gear durability tests at 80°C, 500 RPM, grease lubricated



40%  
Weight  
savings

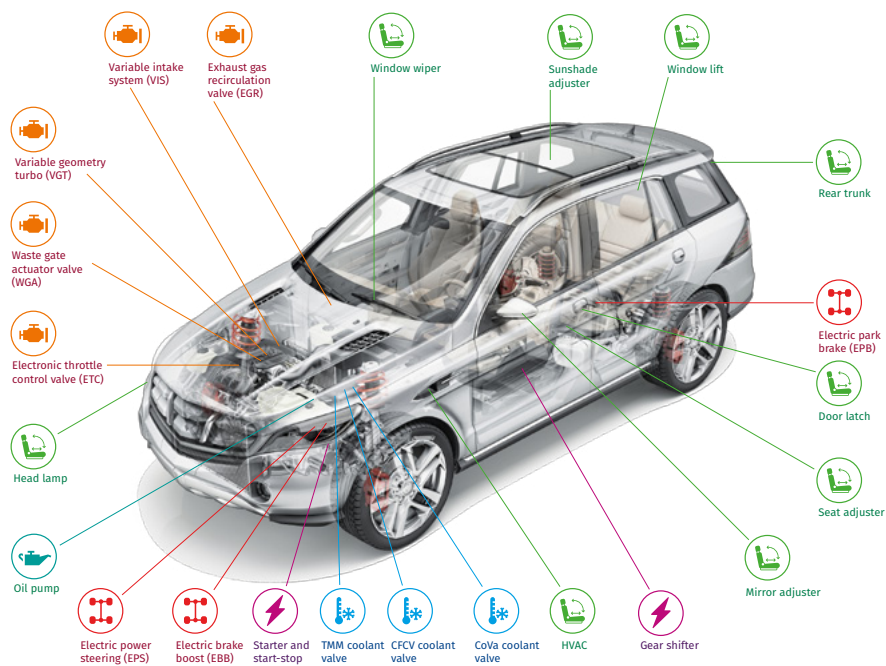
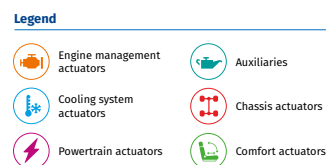
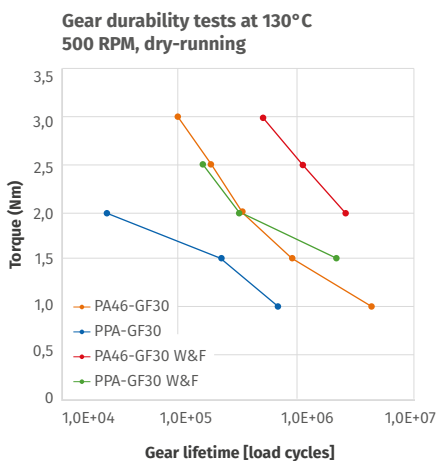
Stanyl enables web  
thickness reduction  
of up to 70%

# Driving additional cost-savings

For many applications, Stanyl PA46 is an ideal replacement for expensive metal and polyetheretherketone (PEEK) materials for gears due to its inherent fatigue, wear & friction perfor-

mance, and high temperature thermal properties. Unlike PPA and PA66, Stanyl PA46 generally doesn't require costly PTFE or carbon fiber reinforcement additions to deliver demanding performance, which can be a big cost driver.

| Operating costs                              | Stanyl PA46 cost-savings vs. PPA |
|--|----------------------------------|
| Gear materials                               | 15%                              |
| Manufacturing costs (tooling, molding, etc.) | 15%                              |
| Realized costs                               | 10-15%                           |



## Our focus on customer success and sustainability

With our global footprint, DSM quickly responds to customers' shifting material quantity demands to lower the risk of supply chain issues. Our North American material production plants run on 100% renewable electricity, as part of our commitment to

source 75% of our total power usage from renewable resources by 2030. In addition to our 100% bio-based **Stanyl B-MB** solution, we're developing a full range of circular material solutions to help you meet your sustainability goals.

Our teams of experts provide hands-on support throughout your gear design, testing, and manufacturing processes.

To learn more, contact us at [dsm.com/contactdem](https://dsm.com/contactdem) or visit [dsm.com/engineeringmaterials](https://dsm.com/engineeringmaterials).



Royal DSM is a global science-based company active in health, nutrition and materials. By connecting its unique competences in life sciences and materials sciences DSM is driving economic prosperity, environmental progress and social advances to create sustainable value for all stakeholders simultaneously. DSM delivers innovative solutions that nourish, protect and improve performance in global markets such as food and dietary supplements, personal care, feed, medical devices, automotive, paints, electrical and electronics, life protection, alternative energy and bio-based materials. DSM and its associated companies deliver annual net sales of about €10 billion with approximately 25,000 employees. The company is listed on Euronext Amsterdam. More information can be found at [www.dsm.com](https://www.dsm.com). © DSM 2022