

Moving without metals?

Engineering polymers for cars of the future



Saving weight and costs with strong lightweight construction materials

There was a time when cars only had to be fast and stylish. Now there is another important requirement: economy. While car drivers are concerned with rising fuel costs, automotive manufacturers must meet European Union requirements and reduce the average emission from a new car to 120 grams of carbon dioxide per kilometer by 2012. This represents a fuel consumption of 5 l/100 km. A possible solution is to cut weight and so reduce both fuel consumption and CO₂ emissions.

The future for cars lies in the increased use of engineering polymers. These lightweight, highly specialized materials can reduce the weight of car components by an average of 30 percent, while at the same time increasing performance and safety. In Europe around 15 percent of a new car is already produced from polymers and the share is rising.

In the medium term, lightweight construction could trim up to 300 kg off the weight of a car. The potential for this slimming lies in the 900 kg or so of steel and metal parts which are contained in medium-sized cars and can be replaced in many areas by polymer-based components.

Achieve the ideal weight with Ticona high performance polymers

As an engineering polymer producer with over 40 years of experience, Ticona has helped develop many successful applications in the automotive industry. In particular, Fortron® PPS, Celstran® LFT and Hostaform® POM have for many years provided the key to fuel saving, future proof solutions. The linear polyphenylene sulfide Fortron® PPS, acetalcopolymer Hostaform® POM and Celstran® LFT long fiber reinforced thermoplastic composites are used in both structural/functional and esthetic components

– from front ends to climate sensors and door handles. These high quality Ticona materials are not only lighter than metals but also help reduce production and processing costs, since they enable the elimination of some production steps and post-finishing operations.

Fortron® PPS, Hostaform® POM and Celstran® LFT have excellent mechanical and chemical properties and are resistant to corrosion and high temperatures. The wide selection of grades available in each of these three Ticona polymer ranges ensures that the different areas of vehicle manufacturing are covered in a targeted, cost-effective way.

A weight reduction of 100 kg means a 0.5 liter fuel saving per 100 km.



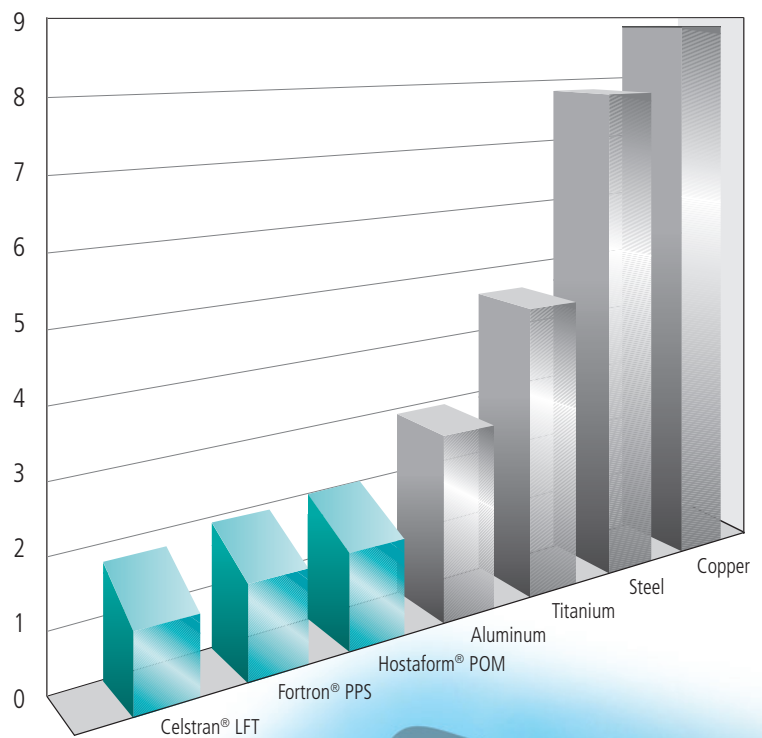
-4%
fuel

Engineering polymers versus metals

Engineering polymer property and cost advantages

- + Significant weight saving for comparable stiffness
- + Lower system costs
- + Good corrosion and chemical resistance
- + Vibration damping and noise deadening
- + Good thermal and electrical insulation properties
- + High precision manufacture of complex moldings
- + Longer tool life
- + Elimination of production steps and post-finishing
- + Design freedom
- + Ease of coloring

Density (g/cm³) of various polymers and metals



In the fast lane: Fortron® PPS

Photo: Volkswagen AG



Fortron® PPS, the linear polyphenylene sulfide in Ticona's portfolio, offers advantages that come into their own under extreme conditions – for example in the engine compartment. In this environment, temperatures of over 200 °C, aggressive fluids and pressure variations between 0 and 3 bar make extreme demands on materials, but Fortron® PPS copes with all these challenges.

In turbocharger systems, Fortron® PPS has already proven to be the

material of choice for charge air pipes. Tipping the scales at only 500 g, this lightweight replacement for an aluminum version weighs an impressive 43 percent less.

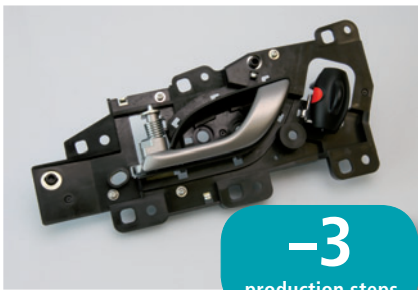
Another advantage is that the Fortron® PPS component is more economical to produce than a comparable metal part. The integration of fixing elements and elimination of manual post-finishing cut costs by approximately 25 percent.

- + High hardness and stiffness
- + Excellent media and chemical resistance
- + Low coefficient of thermal expansion
- + Very low water absorption



25%
savings potential

Built-in design: Hostaform® POM



-3
production steps

- + High chemical resistance and thermal stability
- + Good scratch resistance and impact strength
- + Excellent colorfastness

With its engineering polymers and know-how, Ticona is helping car manufacturers to achieve cost-effective innovations on the road and working closely with customers, is developing specially tailored grades. Grades such as Hostaform® POM Metallic, which Honda uses for the interior door handles on the Civic, combines design with functionality, a long service life and cost efficiency. This special grade comes with a built-in, high quality metallic look as the desired finish.

Cost and time optimization

Door handles and other vehicle interior components traditionally

received their metallic look through time consuming pretreatment and post-finishing operations. The metallic Hostaform® POM grade now possesses this property immediately on ejection from the injection mold. This means that production steps such as painting, coating and vacuum metalizing can now be eliminated, as are the associated handling, transport and quality control costs.

The components are colorfast and scratch resistant and have no problem withstanding chemicals, like those used in cockpit cleaners, or temperature variations in the vehicle interior.

Plus for safety: Celstran®+

In modern cars the demands made on materials are high. Lightweight construction must not be at the expense of function, comfort or safety and in the end vehicles must also remain affordable for customers. One material that meets all these criteria is Celstran®+ PP.

Impact protection

Ticona's long fiber reinforced thermoplastic is used in applications such as front ends. This is because Celstran®+PP has excellent energy absorption capacity, which comes into its own in the event of a crash. The front end deforms on impact, absorbing the energy generated and reducing the forces acting on the passengers. Celstran®+PP gives the large front end high stiffness and strength, which are further enhanced by the hybrid construction. The secure attachment

of the thermoplastic to metal elements increases load-bearing capacity.

Functional integration

The front end made from Celstran®+PP is a successful example of functional integration in lightweight construction, allowing elements such as headlights, the radiator and bumpers to be easily mounted.

This saves time in sub-sequent assembly, cuts costs and also reduces weight. The module is 50 percent lighter than conventional front ends.

Production process

Celstran®+PP is manufactured by pultrusion. Unlike conventional methods of producing LFTs, pultrusion ensures both uniform fiber coating and homo-

geneous distribution in the polymer. This gives the thermoplastic higher stability and at the same time improves the quality of the components.



50 %
weight saving

- + Excellent mechanical properties
- + High impact and notched impact strength
- + Very low creep and warpage tendency
- + Excellent dimensional stability

Light but strong: Celstran® LFT

Photo: MAN Nutzfahrzeuge AG



Approx. **20 %**
weight saving

Structural elements in automobile engineering have traditionally been the domain of metals. But high performance polymers from Ticona are also penetrating this area as a result of their toughness, stiffness and energy absorption.

Luggage rack strut

A luggage rack strut made from Celstran® PA66-GF50 plays a key role in holding cases and bags securely on coaches. This component weighs about 20 percent less than its aluminum predecessor but fulfills the same function.

Additional advantages of Celstran® PA66-GF50 include very low creep and warpage and excellent dimensional stability. The luggage rack strut also displays impressive crash behavior, since it does not splinter on fracture. In view of its exposure to long-term service stress, the strut is required to exhibit high creep resistance. It also stands up well to short term stress peaks. There are other arguments in favor of metal replacement. Celstran® PA66-GF50 does not corrode and has very good slip and abrasion properties.

Our skills and experience for your application

Ticona, a business of Celanese Corporation, is a leading global manufacturer of engineering polymers. For many years, the company has been a polymer supplier for injection molding applications in key markets such as auto manufacture, the electronics and telecommunications industry and medical technology. Thanks to their excellent property profiles, the Ticona polymers successfully used in these sectors offer promising potential for other technologies and applications as well – particularly for extrusion.

Ticona is more than just a material supplier. As a polymer producer, the company provides comprehensive technical service and support for its customers. This includes not only in-depth project consulting but also assistance with material selection, component and mold design, CAE calculations and recommendations on optimizing production processes.

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