



Bright Science means reducing weight while remaining extremely precise

DSM's high-performance Arnite® XT offers high dimensional stability and excellent batch-to-batch consistency for precision components.

Driven by the need to reduce emissions, today's automotive industry is strongly focused on improving vehicle efficiency by reducing weight through metal-to-plastic conversion. Around the globe, new and upcoming legislation is placing ever-tighter limits on vehicle emissions and carbon footprints during the manufacturing process to secure a brighter future. With close to 30,000 parts in a single vehicle, every element that can be successfully converted from metal-to-plastic contributes to the overall goal of reducing vehicle weight.

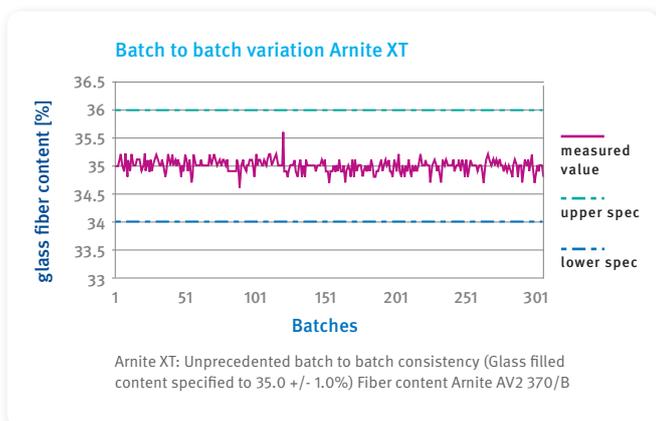
For precision parts such as brake booster valve bodies, gear housing and throttle valve bodies, parts have traditionally been designed in die-cast aluminum or steel because these materials have excellent strength and dimensional stability. At the same time, these components have very stringent precision requirements, often 50 microns or less. These requirements have proven difficult to

meet with plastics, and even more difficult to achieve during mass production, which requires almost no variance in quality between material batches.

DSM's Arnite® XT is a high performance polyethylene terephthalate (PET) thermoplastic that offers extremely good dimensional stability due to its low moisture absorption and a very low and constant coefficient of linear thermal expansion (CLTE) that is comparable to aluminum. This best-in-class material tolerates a wide range of temperatures and environmental conditions, including chemical exposure. DSM's unique technology enables it to produce Arnite XT to very narrow specifications, for example glass fiber content specified to 35.0 +/- 1.0% versus a minimum 2.0% margin in competitive products.

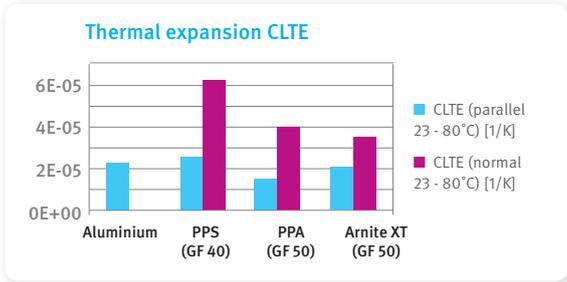
Arnite® XT delivers substantial benefits over aluminum:

- A lower density (1.78 grams per cubic centimeter for Arnite® XT versus 2.7 grams per cubic centimeter for aluminum) and the possibility to design thinner-walled parts lead to weight reductions up to 40%.
- Improved cycle time and cost reduction since Arnite XT is injection moldable, and therefore requires fewer processing steps compared to metal.
- A 50% lower carbon footprint cradle to use over die-cast aluminum.
- Reduced fuel consumption and lower emissions: Replacing aluminum with Arnite XT in a metal gear box housing results in a 35% weight reduction. This reduced fuel consumption and lowers emissions.

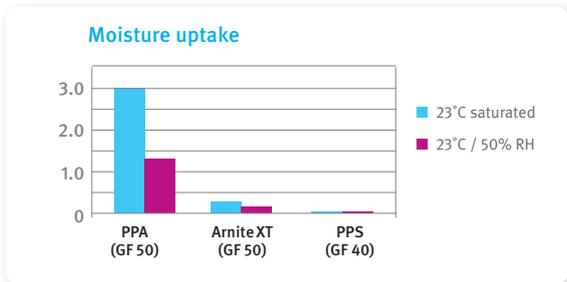


Arnite® XT also delivers clear benefits over alternative plastics:

- Thermal expansion rate comparable to aluminum



- Lower moisture uptake (maximum 0.12-0.18% humidity absorption) compared to high-performance PPA, ensuring improved dimensional stability.



- Outperforms polybutylene terephthalate (PBT) in strength, stiffness and heat resistance.
- More cost-effective than polyphthalamide (PPA) and polyphenylene sulfide (PPS) with equivalent mechanical performance.

25 years of precision components without a single failure



With more than 25 years of experience supplying a special grade of Arnite material for precision safety components, DSM leads the market for brake booster valve bodies. The brake booster valve body amplifies the braking force, making it the heart of the braking system. It is crucial that it operates reliably and faultlessly for the lifetime of the vehicle. For this application, Arnite is the industry

standard across every major car brand in the world, and has been integrated into more than 300 million vehicles without a single fault report.

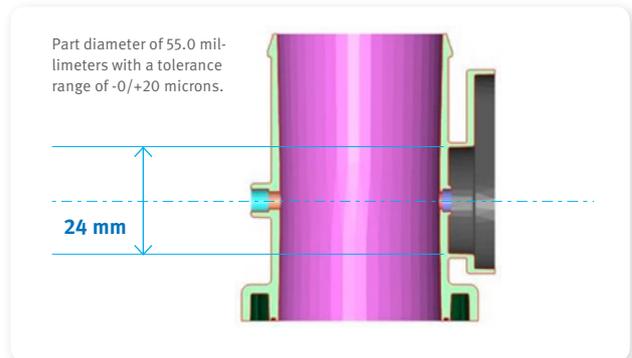
300 million brake boosters with no failure

Roundness tolerances for brake boosters are less than 30 microns

Proven to deliver tight tolerances

Arnite® XT achieved the very narrow target tolerances with extremely low part-to-part and batch-to-batch variation

To further demonstrate the capabilities of Arnite XT, DSM developed its own tool to prove the product’s ability to achieve low, specific tolerances for precision parts. The target application was a throttle valve body, which regulates the airflow to the engine at very precise rates by movement of a butterfly valve. The butterfly valve must fit perfectly into the housing. This places extreme requirements on dimensional stability and accuracy, with a tolerance of less than 20 microns for the bore diameter.



Working together with a toolmaker, our application development engineers designed a prototype part with a diameter of 55.0 millimeters and a tolerance range of -0/+20 microns over a range of 24 millimeters. After several tool modifications, Arnite XT achieved the very narrow target tolerances with extremely low part-to-part and batch-to-batch variation.

Case: Improving durability in Magna Auteca's mirror adjustment housings



Magna Auteca is a leading global supplier of micro-actuator systems for a variety of adjustments including side view mirror glasses, powerfold mirrors, cornering lights and air conditioning. For its MR5 range of mirror adjustment housings, Magna Auteca required a replacement for PBT that improved the durability performance of this new application. DSM's Arnite® XT was selected for the new mirror adjustment housing, which had its commercial debut on the Porsche 911.

"We conducted intensive testing during the one-year validation period," says Michael Kleinhapfl, Design Engineer at Magna Auteca. "Arnite® XT outperformed PBT, PA66, PPA and competitive PET products on every single test, due mainly to its high dimensional stability, high stiffness and strength, and excellent wear and friction properties. In addition to providing top-quality material, DSM provided best-in-class support throughout the entire application development phase."

DSM Engineering Plastics

For further information, please see:
www.dsm.com, www.arnite.com or contact:

Europe

Tel +31 46 47 73796
Info-Europe.DEP@dsm.com

Americas

Tel +1 800 333 4237
Info-Americas.DEP@dsm.com

Asia Pacific

Tel +86 21 6141 8188
Info-Asia.DEP@dsm.com

©DSM 2012

All information, advice and/or samples ("information") are provided by or on behalf of DSM Engineering Plastic on an "as is" basis, without any further warranties as to the accuracy, usefulness, correctness or completeness thereof. Use or disclosure of or reliance on such information shall be for your own sole risk, account and responsibility and you will indemnify and hold DSM Engineering Plastics and its affiliates harmless from and against any and all damages or claims from third parties in respect of your receipt, use or disclosure of or reliance on the information.

The disclosure of information shall not be construed as granting you a license or any other intellectual property rights relating to such information. The obtaining of such license or rights shall be subject to separate negotiations.

Partnering for a brighter future

At DSM, we actively seek to partner with customers across the automotive value chain to replace their precision components with durable, stable and reliable plastic designs. Our portfolio includes a wide offer of grades that maintain their dimensional stability, strength and wear rates at a wide variety of operating temperatures, and ensure low variability from batch to batch. This enables metal to plastic replacement in demanding precision components as the automotive industry continues to work at reducing weight to improve fuel consumption and reduce emissions. DSM backs all of our material sales with extensive research and development, as well as a collaborative partnership where we support customers through grade selection, component design and testing.

Contact us today to discuss how DSM can help you redesign your precision components to create lighter and more efficient vehicles that don't compromise on safety.