Ultramid® Endure

Polyamide speciality for injection molding and blow molding

Ultramid® in the web: www.ultramid.de

BASF
We create chemistry

Ultramid® Endure – stays cool even when it's hot

Ultramid® Endure is a **glass-fiber reinforced polyamide** that combines **excellent heat aging resistance** with the good processing properties of PA 66. **Ultramid® Endure** can withstand **continuous use over 3,000 hours at up to 220°C** and temperature peaks of **up to 240°C**, extending the range of applications of **polyamide** into the **high temperature range.**

This big improvement in the heat aging resistance is achieved by an innovative stabilization technology developed by BASF. The protection is not just confined to the surface, but pervades the whole material. For example, this also allows cutting, which might be necessary in the area of blow-molded pipes. The material **is constantly protected** against attacks by oxygen even at temperatures of **up to 220°C** (Fig. 1).

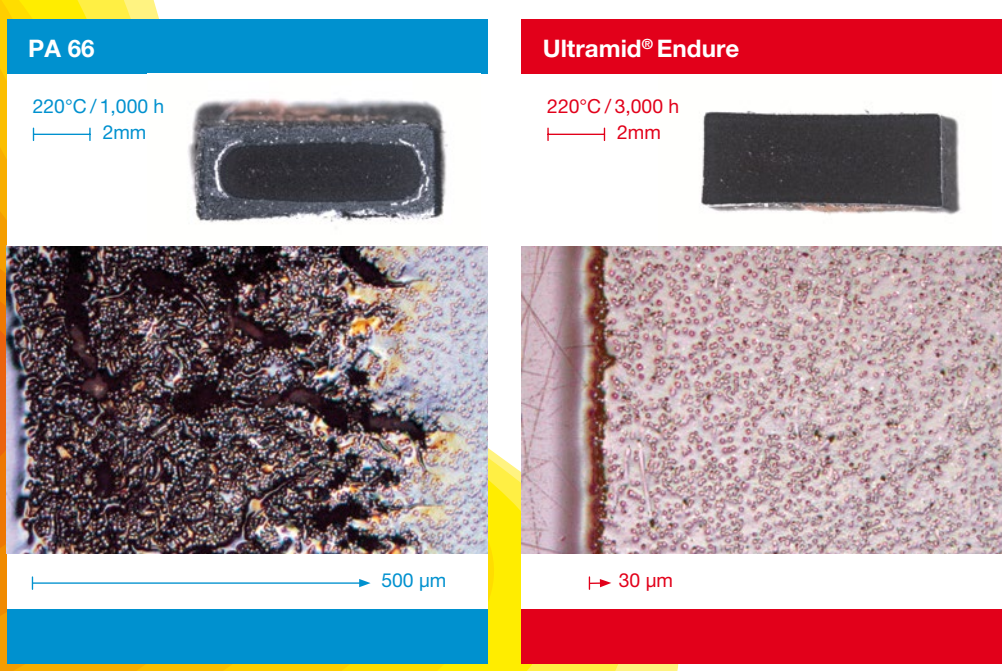

Fig. 1: Resistant surface layer of **Ultramid® Endure** compared to PA 66 (cross section through a tensile specimen)

One of the first serial applications for the injection-molding grade **Ultramid® Endure D3G7** was the substitution of a heat shield in a charge-air duct which had previously been metallic. With its temperature resistance of 220°C in continuous use and peak temperature loads of 240°C, the material can be used directly at the exhaust gas recirculation (Fig. 2).

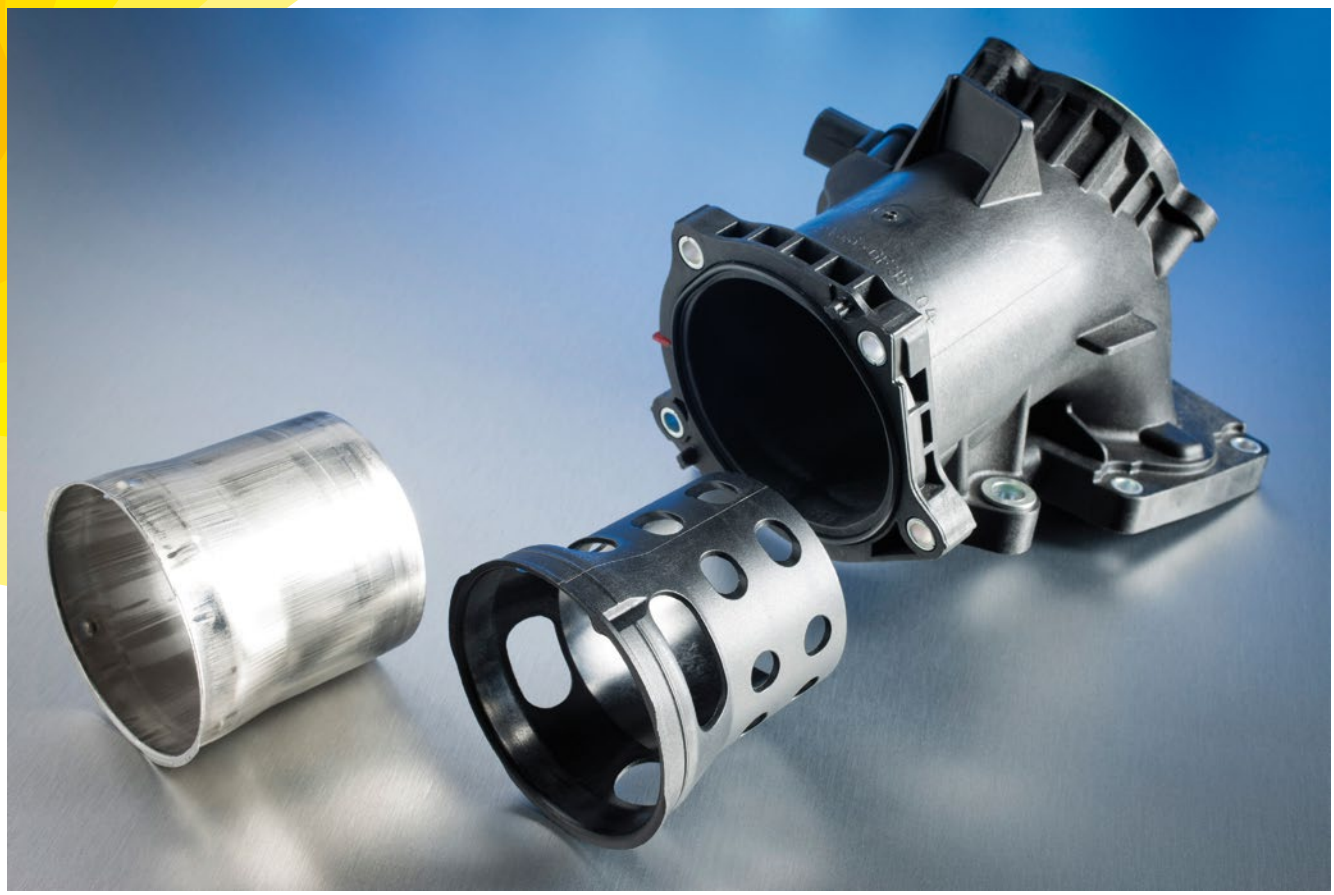

Fig. 2: Heat shield made of **Ultramid® Endure D3G7** in the air intake of the 4-cylinder diesel-powered automobile engine from Daimler

Benchmarking passed with “very good”

In the heat aging test from 150°C to 220°C, **Ultramid® Endure** keeps its high strength even after 3,000 hours, whereas PA 66/6 or PPS significantly decline after a relatively short period (Fig. 3).

In addition to the aging resistance, the material properties play a major role in the design of a part at continuous operating temperature. Toughness and strength are of particular importance.

If they are high enough, wall thicknesses can be reduced without compromising the integrity of the part. Here again, **Ultramid® Endure** performs extremely well (Fig. 4).

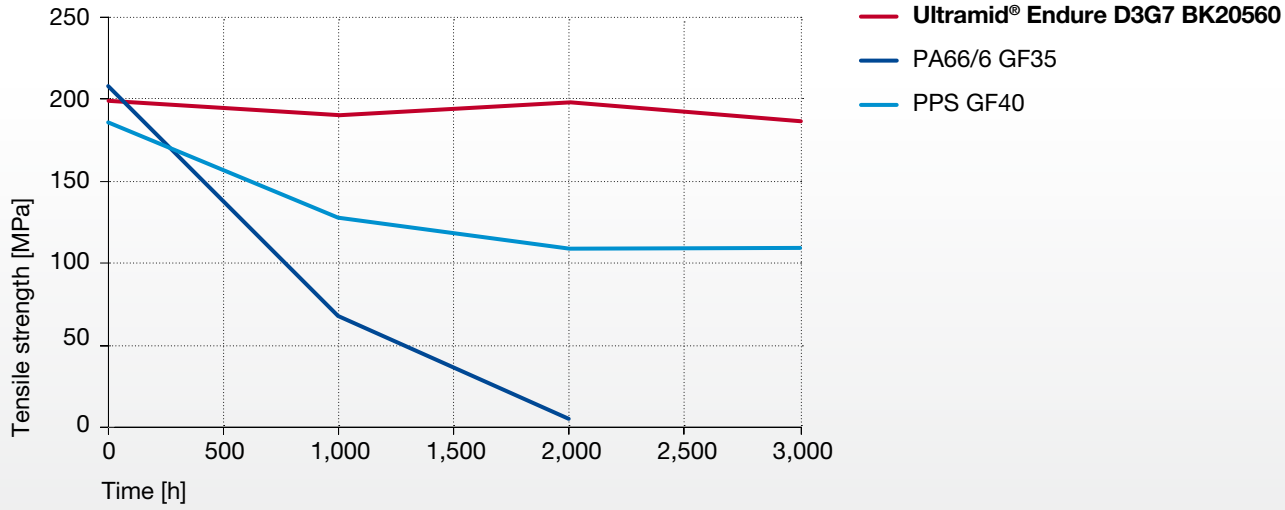

Fig. 3: Tensile strength (23°C) of **Ultramid® Endure D3G7** and other materials after aging at 220°C

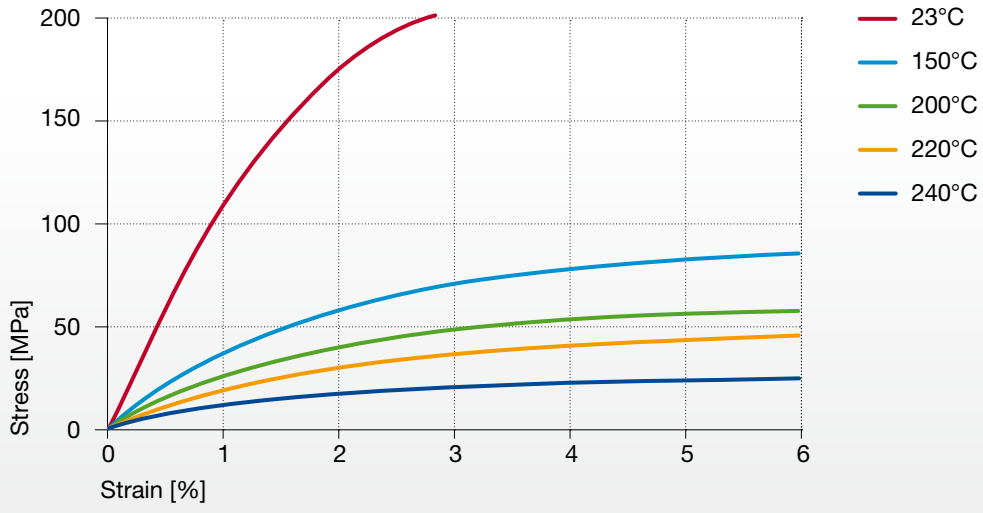

Fig. 4: Stress-strain curves of **Ultramid® Endure D3G7**

In the area of the charge air duct, resistance against acid condensate in the exhaust gas recirculation is required. Close to the condensate test acc. to VDA 230-214, the test shows that the tensile strength of **Ultramid® Endure** does not decline even after 30 cycles (Fig. 5).

Weld lines of parts made of **Ultramid® Endure** also withstand high temperatures in continuous use, with no crack formation apparent at the joins even after 1,000 hours at 220°C. The strength of the weld is equally high (Fig. 6).

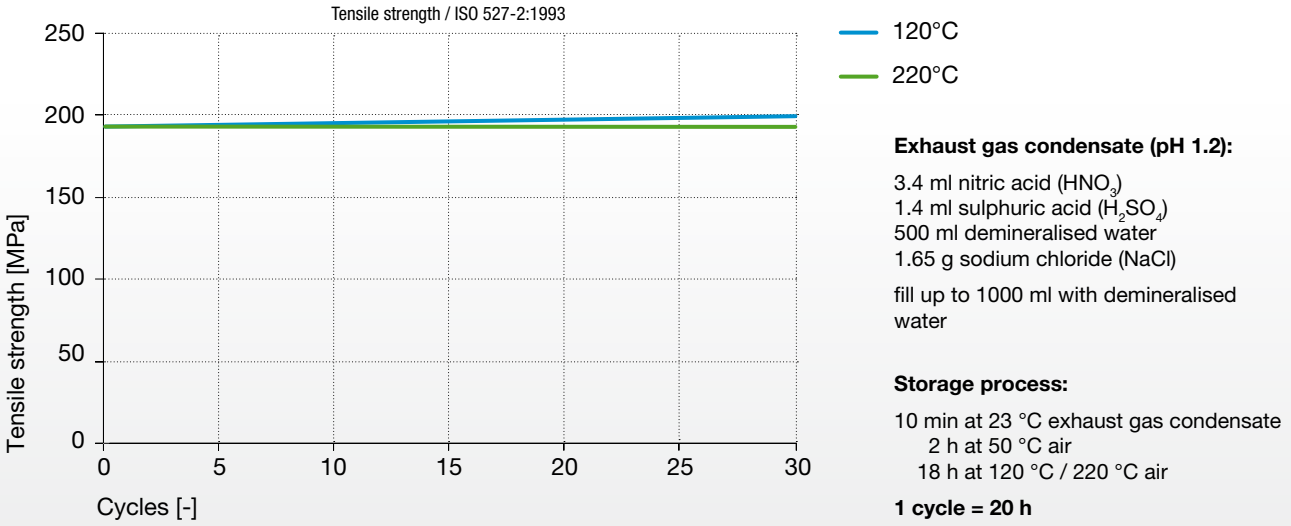

Fig. 5: Tensile strength of **Ultramid® Endure** after storage in exhaust gas condensate

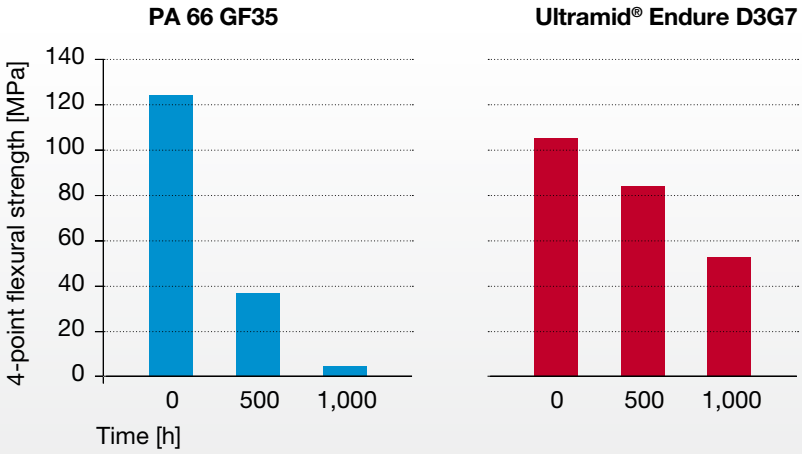

Fig. 6: Weldline strength (23°C) of **Ultramid® Endure** compared to PA 66 after aging in air at 220°C

Easy metal replacement with Ultramid® Endure

Apart from the performance of a material or part, system costs are also an important criterion. They are determined to a large extent by the processing properties of the material used. Either as an injection-molding grade or a blow-molding one, **Ultramid® Endure** offers straightforward processing with a much wider processing window and lower energy consumption than other high-performance plastics or metals. Compared with standard PA, the flow properties of the injection-molding grade are in fact significantly improved once more (Fig. 7).

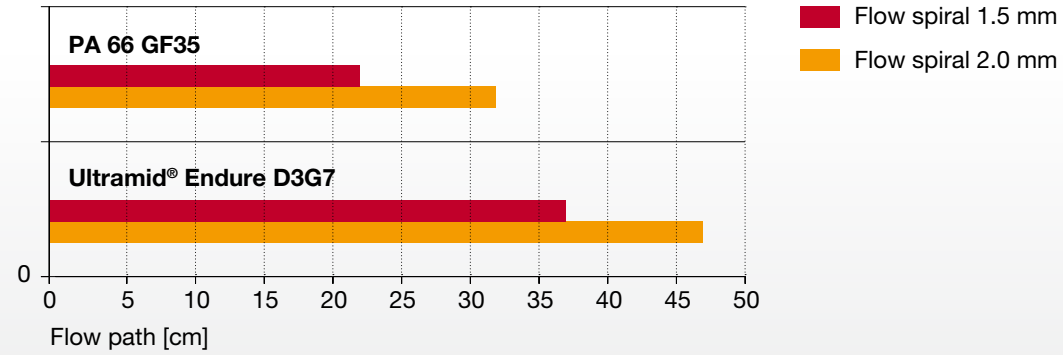

Fig. 7: Flow properties of **Ultramid® Endure** compared to PA 66 GF35: The flow path of Ultramid® Endure is considerably longer than that of a standard PA 66 GF 35.

New blow-molding grade developed

In order to close the gap between turbo charger and intercooler BASF now offers **Ultramid® Endure** also as blow-molding grade. The new **Ultramid® Endure D5G3 BM** with 15 percent glass-fiber reinforcement shows the same high heat aging resistance, can be processed well in the suction blow molding process and has excellent acoustic porperties. The relatively low mass temperature during processing with blow molding generally results in favorable system costs. As with the injection-molding grade, the temperature resistance is 220°C during continuous use and the possible peak temperature is 240°C.

Ultramid® Endure shows excellent damping performance and is therefore suitable for meeting acoustically demanding challenges. **Ultramid® Endure** can be used to reduce the production of disruptive airborne noise, which is radiated from the vibrating component surface, directly at the source. Depending on the temperature and level of humidity, **Ultramid® Endure D5G3 BM** has damping values which are up to ten times better compared with PPS GF 15 (Fig. 8).

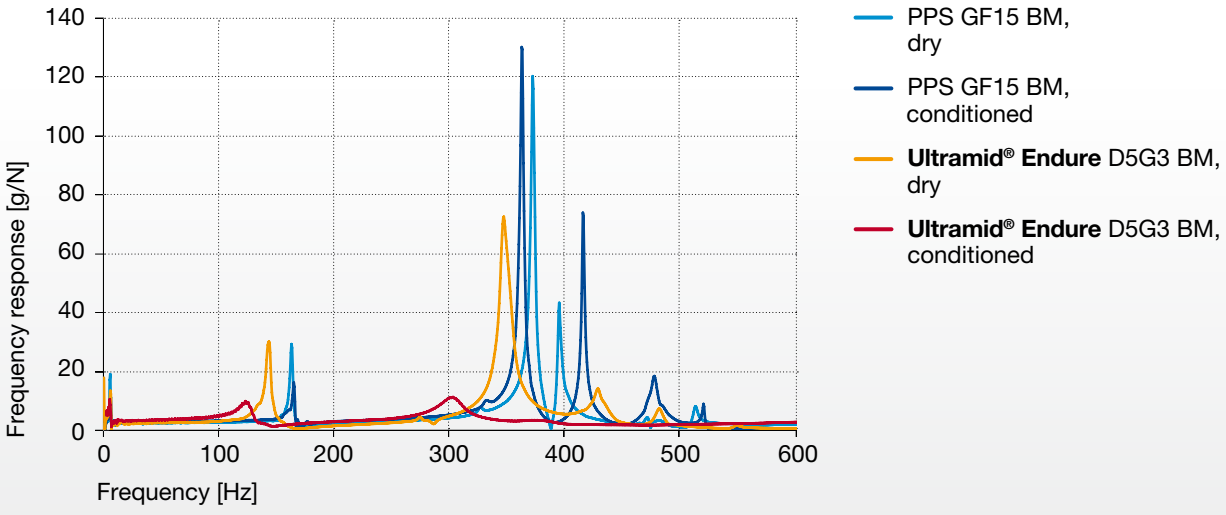

Fig. 8: Frequency response of **Ultramid® Endure D5G3 BM** compared to PPS GF 15 BM

Ultramid® Endure – a material for modern engine concepts

The trend towards increased efficiency in automotive construction means that temperatures in the engine compartment continue to rise. As a result, automotive manufacturers today are attempting to improve the energy efficiency of vehicles by means of charged engines as one approach: Turbochargers are used that lead to higher pressures and temperatures in the engine compartment, particularly in the charge air duct. In charged diesel engines, for example, temperatures of up to 240°C are common in the area between the turbocharger and the intercooler.

Ultramid® Endure is suitable for all parts exposed to high temperatures over a prolonged period. Potential applications for **Ultramid® Endure** consequently include all parts in the charge air duct such as intercooler end caps, resonators, charge-air lines, sensors and actuators (Fig. 9), together with components on the slightly cooler side of the turbocharger.

Another possible future field of application for the material is intake manifolds with integrated water-cooled intercoolers. The high temperatures in these special manifolds push conventional thermoplastic materials for intake manifolds to their limits.

As all relevant material data is available for **Ultramid® Endure**, the parts of the charge-air duct can be designed with BASF's simulation tool Ultrasim®.

1. **Resonator**
2. **Sensors and actuators**
3. **Intake side of the intercooler**
4. **Charge-air manifold**
5. **Charge-air pipe**

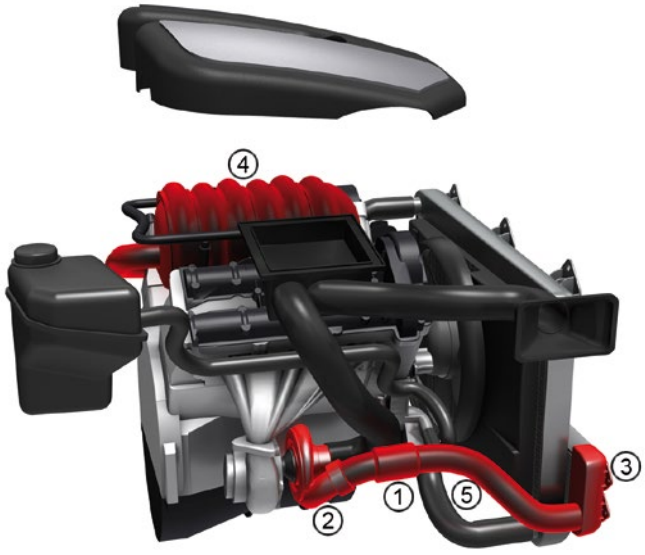

Fig. 9: Charge air duct of an engine

Product range

Ultramid® Endure is offered as injection-molding and as blow-molding grade.

Injection-molding grade with 35% and 50% glass-fiber reinforcement:

Ultramid® Endure D3G7 BK20560

Ultramid® Endure D3G10 BK20560

Blow-molding grade with 15% glass-fiber reinforcement:

Ultramid® Endure D5G3 BM BK20560

Selected Product Literature for Ultramid®:
Ultramid® – Product Brochure
Ultramid® – Product Range
Ultramid®, Ultradur® and Ultraform® – Resistance to Chemicals

Note
The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (Mai 2016)

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