The new direct-injection gasoline engines of the Audi A4 have an active intake system made of Ultramid®

Case Study

MANN+HUMMEL in Ludwigsburg, international development partner of the automotive industry, have developed the first active manifold system in plastic for direct-injection gasoline engines, in co-operation with BASF. The component has gone into series production with the new Audi A4 2.0 FSI 4V. The lower and inner parts of the newly developed manifold are made of Ultramid® B3WG6. The upper shell featuring the metallic-effect is visible in the motor compartment and is made of Ultramid® B3EG6 Titanium Grey. Both these grades are highly heat-stabilised polyamide-6 types with 30 percent glass fibre. Unlike the conventional gasoline engines, with the FSI® engines the fuel is injected directly into the combustion chamber (FSI: Fuel Stratified Injection). This increases the torque and the power, the engine has lower fuel consumption, and the exhaust gas emission data are significantly improved.

Regarding exhaust gas recirculation (EGR) direct-injection gasoline engines make for increased demands on the manifold system. The part is exposed to high temperatures and corrosive agents from the exhaust gas. Thanks to the specific formulation Ultramid® can fully withstand these loadings. Its dimensional, thermal and chemical stability make Ultramid® the material of choice for this intake manifold system. The two types of Ultramid® are perfectly matched. Both grades can be easily processed by injection moulding and vibration welding. This leads to high process reliability, and ensures that the component achieves the required resistance to bursting pressure.

Ultramid® Titanium Grey gives an attractive, granular metallic appearance. The material also displays high colour stability under the corrosive conditions in the engine compartment. This means that the component fulfils the Audi designers' special requirements on engine styling without additional painting. A further advantage over painted components is that the surface of the manifold is not susceptible to scratches or small flashes.

The switching active system patented by MANN+HUMMEL consists of two parts: the rotary valve drum with the sealing cage controls the length of the intake pipes, and makes for a significant improvement in engine characteristics (torque and power). The new, so-called CVTS flange controls the air flow, thus creating a finely distributed, homogeneous gazoline-air mixture in the combustion chamber (CVTS is short for Continuous Variable Tumble System). Rotary valve drum, sealing cage and parts of the CVTS flange are also made of glass-fibre reinforced Ultramid® from BASF. The application development engineers of BASF supported MANN+HUMMEL in the development of the component by computer simulations for analysing bursting pressure, dynamics and acoustics, thus contributing to the optimisation of the intake manifold system.