Heated Catalytic Converters – the Solution to Complex Challenges in the Exhaust System

One of the key features of modern emission control components is the rate at which they convert harmful exhaust gases. Engine raw emissions have to be converted within a few seconds to prevent them from escaping into the environment untreated.

Diesel engines present a particular challenge in this area because they operate at relatively low temperatures due to the fuel-efficient combustion. Current turbodiesel engines rarely generate temperatures over 200°C at the exhaust outlet in inner-city driving. As modern catalytic converters generally have a minimum light-off temperature of around 200°C, the exhaust gas temperature often drops below this level. This represents a major problem both for low-temperature diesel engines and for direct injection petrol engines. The start/stop systems fitted to conventional petrol engines are another factor that can cause exhaust gas temperatures to fall below the light-off point of the catalytic converter and this is further exacerbated by overrun cut-off. Alternative drive concepts, such as hybrids or electric vehicles with range extenders, share the same problems.

The EMICAT® heated catalytic converter was developed on the basis of the existing metal substrate and brought into series production over 20 years ago as a joint venture between EMITEC Gesellschaft für Emissionstechnologie mbH from Lohmar near Cologne and the German automotive industry. EMITEC was the first company to build heated catalytic converters, which were used for high performance petrol engines at that time, and is still the only manufacturer of these components today. This innovative technology was first used by Alpina (Bovensiepen) for the B12 5.7. BMW AG soon followed suit and fitted heated catalytic converters as standard to its 12-cylinder engines. The two manufacturers were able to reduce emissions to well below the limits that applied in Europe, Japan and the US in 1986. The EMICAT® has undergone continuous development ever since and is ready for immediate use in future applications.

Heated catalytic converters can be activated at any time and dramatically reduce emissions during the start phase and during (intermittent) operation and the EMICAT® is often a key component, and not just for modern drive concepts. The EMICAT® will shortly be used for the...
first time as a diesel oxidation catalyst (DOC) for the new V6 and V8 turbodiesels of a major German car manufacturer. When fitted to this type of diesel engine, the electrically heated catalytic converter (EHC) is activated only when the temperature drops below the light-off level. Tests have shown that the EMICAT® is much more cost-effective than engine-based measures, such as fuel mixture enrichment or post-injection, because it saves fuel that would otherwise be spent (wasted) on engine-based catalytic converter heating. The EMICAT® also helps reduce other emissions by a significant extent. When used as a DOC, the heated catalytic converter is installed immediately in front of the main catalytic converter, which means shorter paths and less heat loss.

The greater efficiency of the EMICAT® partly offsets the higher costs associated with heated catalytic converters because it allows automotive engineers to significantly reduce the size and the precious metal loading of the main catalytic converter. The EMICAT® has little impact on the electrical systems of modern vehicles and their innovative electronics or brake energy recovery systems. EHCs also offer the opportunity to convert CO₂-neutral energy generated by the alternator during deceleration into usable heat. Heated catalytic converters are particularly beneficial when installed in cars with a start/stop system because the EHC will prevent the catalytic converter from cooling and saves fuel that would otherwise have to be used for engine-based catalytic converter heating during idling. If electric power were generated through brake energy recovery the heated catalytic converter would have no effect on fuel consumption at all. These factors keep the operating costs of this type of “active” catalytic converter system within limits.

Heated catalytic converters can also reduce soot particles considerably that are emitted by direct injection petrol engines. In SCR systems the EMICAT® guarantees the optimum evaporation of the injected urea solution and so increases the effectiveness of the SCR catalytic converter. These heated metal catalytic converters, which require between 1 and 3 kW of power, not only raise the operating temperature in cars by up to 100°C (or by a critical 20 to 30°C in commercial vehicles) but also further improve the evaporation of the AdBlue urea solution that is injected onto the hot EHC. EMITEC’s heated catalytic converter should be indispensable in commercial vehicles, which will have to meet even stricter emission limits in future. A large
number of car manufacturers also plan to use the EMICAT® for their future models, and especially for their diesel engines.

EMICAT® electrically heated catalytic converter

Compact catalytic converter with EHC

E-SCR-system