Press Release **64th IAA September 2011**

Lightweight catalysts with a bionic structure

Compact catalysts: lighter, more flexible and even more durable

Conventional metal catalysts have a smooth jacket with reinforcing seams, where necessary. The jacket is between 1 and 2 mm thick depending on size and application. As part of the development of lightweight applications at EMITEC Gesellschaft für Emissionstechnologie mbH in Lohmar near Cologne, engineers carried out extensive tests and reduced the thickness of the catalyst jackets first to 0.8 mm and then to 0.5 mm.

A jacket with a thickness of 0.5 mm has a lower degree of mechanical strength, however, it is also much more stress-resistant to rapid temperature changes and thermal shock because the heat capacity of the very thin steel foil matrix and that of the jacket differ to a much smaller extent. Put simply, as it is heated by the inlet temperature the honeycomb wants to expand more quickly than the more slowly heating jacket surrounding it permits. Lightweight catalysts are almost twice as durable under high thermal shock loads and accordingly a much smaller number of catalyst cells exhibit plastic deformations. This has also been shown in hot shake tests, which combine thermal cycles and vibrations with a magnitude of 10 g.

Porsche is the first car manufacturer to exploit these major advantages and uses lightweight catalysts in a number of its production models. Lightweight catalysts have been installed in the exhaust systems of the Porsche Panamera and some Cayenne models.

In the mid-seventies Professor Frank Mirtsch discovered the principle of the self-rigidising effect of vault structures in a thin-walled cylinder. His idea was inspired by nature where bionic structures in the shape of vaults abound. Many companies have since been using the technology, which was patented by Professor Mirtsch. During the development of lightweight catalysts Emitec's engineers also tested catalysts with vaulted structures and were able to demonstrate their superior performance.

Depending on its size a lightweight catalyst with three-dimensional vaulted structures inside a 0.5 mm thick jacket is 10 to 30 per cent lighter than a Metalit catalyst with a thickness of only 1 mm. Its flexural rigidity and inherent stability are up to 65 per cent greater than those of an identical catalyst with a smooth jacket. In addition, lightweight catalysts with vaulted structures are much more durable.

The new lightweight catalyst can be combined with all other Emitec innovations, such as compact catalysts and turbulence-generating Metalit structures.

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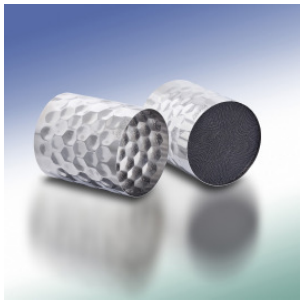
The compact catalyst is a standard or cascade metal substrate catalyst. The cleaned exhaust gases flow around its outside, which has the advantage that the inlet and outlet can be positioned on the same side and virtually in one plane. Unlike conventional systems the exhaust gases no longer have to flow via the catalyst and the pipes to the underbody and then into the rear silencer at the back of the vehicle. Since the inlet and outlet are on the same side the additional length of the catalyst has no effect on the design of the exhaust system. The catalyst can be installed in any position. In a well-designed system compact catalysts cause even less pressure loss than conventional solutions.

The system's great installation advantages are surpassed by its flow and thermal properties. The hot exhaust gases flow around the catalyst jacket heating the rim more quickly and keeping the areas near the rim at a constant temperature regardless of conditions. Modern diesel engines produce very low exhaust gas temperatures. Compact catalysts are ideal for these applications because they are able to substantially reduce the big temperature difference between the centre and the rim of the catalyst, which can be 30 °C or more in conventional systems. It also prevents the catalyst from cooling too much during deceleration and so guarantees particularly effective emission reduction at all times.

Compact catalysts include turbulence-generating METALIT® catalysts, which are up to 30 per cent more efficient than conventional smooth metal or ceramic catalysts allowing their volume to be significantly reduced. Compact catalysts are the perfect solution especially for diesel engines, where the catalyst should or must be flanged directly onto the turbocharger. This innovation is likely to be very useful for other close-coupled applications because installation space is always very limited.



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