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The solution for next generation - competitive deNOx performance on corrugated substrate in heavy duty diesel

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These days, the market requires high fuel efficiency and stricter emission level such as EU VII. These requirements can only be met with state-of-the-art engine technology and high performance aftertreatment system. The main technologies for NOx reduction in modern exhaust aftertreatment systems are Vanadium SCR based or Cu-Zeolite based SCR catalysts. Both types of technologies have been successfully implemented in Euro VI aftertreatment systems.

The current proposal for Euro VII systems points to a tightening of the N2O emissions, an increased demand for NOx reduction in low load operation and increased durability requirements. While historically Cu-Zeolite catalysts have had an advantage in terms of NOx reduction performance, it performs only after certain amount of NH3 is loaded. It delays the reaction time in the low temperature range. In contrast to Cu-Zeolite SCR, the Vanadium technologies don't need to be loaded with as much NH3 to perform and offer a lower N2O formation and better durability, especially the impact of sulfur leads to a lowered effective NOx performance potential of Cu-SCR based catalysts.

Umicore studies innovative twin SCR systems to meet future stringent legislation for heavy duty diesel vehicle. Heavy duty diesel engines emit large amount of NOx which is reduced via the catalytic emission control system where an upstream SCR catalyst with independent urea dosing works in synergy with a classical downstream SCR system. This twin SCR configuration delivers increased emission performance to cover a large span of real driving emissions. It includes excellent performance over the vehicle's lifespan as well as consistent and predictable catalytic activity.

In this paper, the promising next generation system would be introduced. The Vanadium SCR catalysts for close-coupled position, this state-of-the-art catalysts are able to meet the performance and durability targets required by current and expected future emissions legislations as well as complying with relevant regulations globally.

Umicore has an unique technology regarding Vanadium SCR on corrugated substrates. As mentioned both high fuel efficiency and low CO2 emissions are primary. The key parameter to support these targets is low pressure drop over the aftertreatment system. Umicore's corrugated substrate concept allows the catalytic material to be coated within the wall and still maintaining a high porosity on the final product. With this coating approach the pressure drop can be reduced by up to 24 % compared to a coated cordierite substrate keeping equivalent catalytic activity thus contributing positively to the fuel efficiency target. A large part of the total accumulated NOx is emitted during the first part of an engine test cycle. At temperatures below 200 °C the reaction is kinetically limited. The mass of active material is contributing greatly to the level of NOx conversion achieved. The corrugated V-SCR's whole monolithic structure is made of active material in contrary to a catalyst coated on an inert cordierite substrate. This also results in lighter catalyst weight and enables a faster heat-up behavior to reduce NOx emissions in the critical cold start period more efficiently.