

# **Advancement of Environmental Catalysts to Improve “Real-World” Automotive Aftertreatment**

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Integration of catalysts into internal combustion engines (ICEs) has been often referred as one of the greatest successes in automotive history over the last 40 plus years. Since the first emission control device was implemented in mid 70s (in US) and 80s (in Europe), the aftertreatment technology has advanced robust enough to meet 100 times or more stringent current emission regulations compared to the level when legislation began worldwide. It is a fact that such advancement in air quality control has provided a tangible benefit for the quality of life in heavily populated cities. Recently, a variety of new propulsion systems such as battery electric (BEV), plug-in hybrid (PHEV), and even fuel cell electric (FCEV) is being suggested as ultimate mobile solutions not just because they offer zero greenhouse gas but also they don't emit harmful gases such as nitrogen oxides (NO<sub>x</sub>) and hydrocarbons (HC). Further, the health risk associated with those emissions has motivated some countries proposing to ban the future sales of ICE powered vehicles.

The modern gasoline aftertreatment system, however, is capable of reducing 99.9% of NO<sub>x</sub> and HC emissions when catalysts are fully warmed up under stoichiometric operations. Most HC and NO<sub>x</sub> breakthroughs occur during cold-start and/or transient deceleration fuel-cut operations. For the case of diesel, the state-of-the-art SCR technology is capable of almost 100% NO<sub>x</sub> conversion under a wide temperature window. Having mentioned this, one can anticipate that a near zero tailpipe emission is viable if there is an aftertreatment system that manages to mitigate those breakthroughs during the transients. In this presentation, we demonstrate new environmental catalyst technologies for both cold-start HC and NO<sub>x</sub> controls under the real-world vehicle environment. The proposed system will suggest that ICE engines still have potentials for making a zero negative impact on the air quality as one of primary propulsion options in the future automotive world.