Special Feature: Analytic Technologies of Powertrain

Overview

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To prevent global warming, CO_2 regulations in major automobile markets, including those of the EU, China, India, the US, and Japan, have become increasingly strict. In addition, a rigorous test procedure for reducing pollutant emissions in real-world conditions, called Real Driving Emissions (RDE), is being prepared in the EU for 2017 phase-in. Considering the current circumstances, for internal combustion engines to continue to be accepted by society as a sustainable power source even in the distant future, it is absolutely necessary to maximally enhance fuel efficiency while ensuring very low emissions under all possible engine operating conditions. Analytic technologies are essential for understanding the complicated physical processes, such as in-cylinder, catalytic, and tribological phenomena, that play a role in ensuring compliance with such requirements.

This special feature discusses five recent analytical studies in the areas of engine combustion, energy recovery, catalysts, and tribology. The first article introduces a novel diagnostic technique called the tracer-producing LIF technique, which enables 2-dimensional measurement of internal EGR in an engine cylinder. The second article proposes a new concept, low-noise combustion, the mechanism of which can be revealed from in-cylinder pressure analyses. The third article clarifies the mechanism of a type of abnormal combustion called low-speed pre-ignition using a high-speed imaging technique with an optically accessible rapid compression machine. The fourth article demonstrates the fuel efficiency potential of an energy recovery system through systematic analyses of the degradation and recovery of reforming catalysts. The final article describes combinations of unique measurement techniques, such as micro data logging and fluorescence techniques, to understand oil transport mechanisms with the aim of reducing piston friction. Moreover, a paper titled “Experimental and Numerical Analysis for a Urea-SCR Catalytic Converter (SAE Tech. Paper Ser., No. 2016-01-0973)” is noted here as our newest publication, which clarifies the decomposition behavior of injected urea in a SCR aftertreatment system and presents the detailed reaction chemistry of the reactants in the system. The technologies discussed and noted here will contribute to the development of innovative ideas that will assist in the future advancement of powertrains.

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