



Special Feature: Challenges of Internal Combustion Engines for Achieving Low-carbon Society

Overview

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Global warming is a critical issue that must be solved to ensure continuous progress of modern society. Minimizing CO₂ emissions is considered as the one and only solution to prevent this environmental disaster while maintaining a high quality of human life. This is the fundamental motivation for the current drive toward a low-carbon society. There are two primary demands regarding the acceptance of internal combustion engines as the primary power source for future automobiles. The first is maximization of the energy conversion efficiency, and the second is utilization of mass-produced affordable carbon-neutral alternate fuels.

This special feature focuses on our latest research in these two technical areas.

The first four articles introduce a new heat insulation method for use in a combustion chamber, which was developed in-house and recently put into mass-production. The unique specialty of this method is the large temperature fluctuation at the surface of the heat insulation coating, which is caused by the high-temperature combustion gas. The concept, insulation coating, heat insulation effect and thermal efficiency, and verification of temperature fluctuation with laser diagnostics are described in the first through fourth articles, respectively. The fifth and sixth articles focus on processing technology of bio-fuels for compression ignition and spark ignition engines, respectively. The catalytic conversion process of *Botryococcus braunii* oil under mild reaction conditions described in the fifth report and the ionic liquids-based bioprocessing of cellulosic ethanol described in the sixth report are fundamental research topics opening up new possibilities for internal combustion engines.