



Special Feature: Powertrain and Environment

Overview

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The development of powertrains cannot be discussed without considering energy and the environment. Moreover, as such issues are overcome, the commercial benefit to the vehicle industry continues to grow. Related research fields and subject areas are quite extensive. This special issue describes four areas of recent progress in research and development. Although they are not necessarily closely related to each other, each of them individually reaches a high degree of success in R&D. The first review article introduces a series of studies we have done over a number of years on molecular dynamics analysis to understand the relationship between traction performance and the molecular structures of traction fluid. The method as well as the findings of the study could lead to further progress in the development of traction fluid. The second review focuses on fine particulate matter suspended in the air. Studies including investigations by JCAP II (Japan Clean Air Program II) and JATOP (Japan Auto-Oil Program) have shown that there are various potential sources of fine particles besides vehicle emissions and also that photochemical reactions further complicate the problem. Carbon isotope analysis is found to be an effective way to distinguish between fossil fuels and biomass as the carbon source. The third and fourth articles describe our attempts to break through conventional technological limitations by utilizing an accumulation of knowledge and experience. The third article proposes a low emission diesel combustion concept consisting of a unique spray, moderate compression ratio, restrained air charge motion and a shallow dish piston cavity without a lip. The fourth article introduces a newly developed optical engine featuring an extended engine speed and load. It enables us to visualize and understand in-cylinder mixture formation and combustion up to 6000 rpm for SI combustion and up to 20 MPa of cylinder pressure for CI combustion.