Feasible Study of Spray and Combustion Control Using Dual Component Fuel Based on Multicomponent Spray Model

Y. Kobashi* and J. Senda**
*Department of Mechanical Engineering, Kanazawa Institute of Technology
7-1 Ohgigaoka, Nonoichi, Ishikawa, 921-8501 Japan
**Department of Mechanical Engineering, Doshisha University

Abstract

To achieve further improvement of thermal efficiency and emissions reduction in compression ignition engines, the authors propose a novel concept for spray and combustion control, using dual component fuel, as illustrated in Fig.1. By injecting a dual component fuel which consists different boiling point (b.p.) components directly into a combustion chamber, each component would grow to distribute separately with the development of spray. In general, since a high b.p. fuel has high ignitability and a low b.p. one has low ignitability, if a dual component fuel consisted of different b.p. components, the components which have different chemical characteristics would be spatially separated in a combustion chamber. This is attractive because the chemical reaction would develop independently in different regions and thus there is a possibility of achieving spatial-temporal control of combustion and emissions formation processes. Therefore, in order to explore the feasibility of this approach, the present study evaluates spray characteristics of dual components fuels by use of a multicomponent spray model.

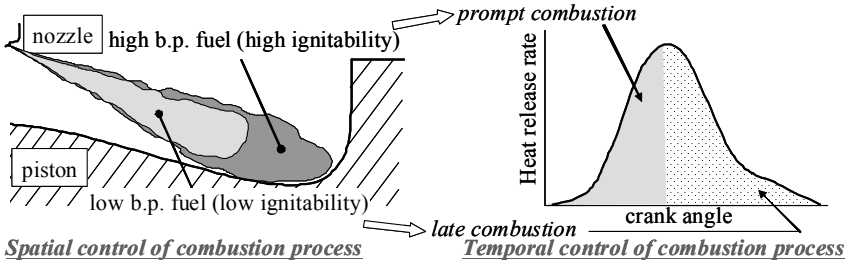

Fig.1 Spatial-temporal combustion control concept using dual component fuel

In the present paper, firstly, the accuracy of the present multicomponent spray model was validated by comparison of predicted spray tip penetration and liquid phase penetration with experimentally-measured ones for several kinds of dual component fuels. Subsequently, by taking into account the application of the authors' concept into compression ignition engines, the effect of injection timing on vapor distributions of each component were investigated in a wide range of in-cylinder conditions. As an example of predicted results, the vapor mass distribution of dual component fuel consisting n-tridecane and i-pentane are shown in Fig.2, where the advanced injection timing promotes the spatial separation of each component

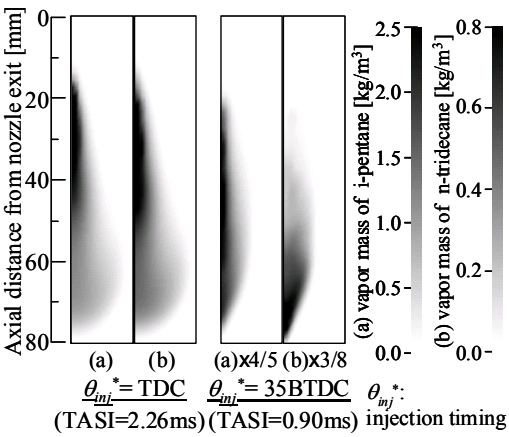

Fig.2 Example of predicted vapor distributions of dual component fuel at two injection timings (dual component fuel : n-tridecane + i-pentane)

Key words: diesel spray, dual component fuel, multicomponent spray model, KIVA-3V

*Corresponding author, yos-wada@neptune.kanazawa-it.ac.jp