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Editorial

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Experimental Investigation of Injector Internal Component Modification Effects on Diesel Spray Characteristics

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High-pressure fuel injection technology has been used in automotive diesel engines for many years, improving engine performance, including higher fuel combustion efficiency and reduced emissions. Researchers and engineers continue to refine fuel injector spray characteristics to optimize further combustion quality, engine performance, and exhaust emissions. Previous studies have primarily focused on spray behavior and its influence on combustion using production-type multi-hole diesel injectors. However, the potential to improve engine performance and emission characteristics through modifications to injector internal components has not been sufficiently explored. This article focuses on experimental investigations into the effects of injector internal component modifications on diesel spray characteristics, with the aim of clarifying the relationship between internal injector configuration and spray behavior [1].

High-speed imaging is a valuable tool for characterizing the temporal evolution of injected spray and measuring injection rate, enabling evaluation of changes in fuel delivery behavior resulting from internal modifications. By analyzing the experimental results, the correlation between injector internal modifications and the resulting spray characteristics can be established. The experimental results show that modifying injector internal components significantly influences diesel spray behavior, particularly during the early stage of injection, through changes in injection-rate development and spray formation processes.

Fuel spray injection plays a critical role in diesel engine operation, as the structure and spatial distribution of the injected spray strongly influence in-cylinder combustion behavior and engine exhaust emissions. In diesel engines, emissions reduction relates to optimizing the combustion system and improving exhaust after-treatment systems. Among these approaches, fuel injection quality is particularly important, as it directly affects mixture formation and combustion efficiency, thereby contributing to higher thermal efficiency—a key indicator of engine performance.

Considerable efforts have been made to improve the quality of diesel engines in automotive applications by modifying diesel fuel injection strategies to enhance engine performance. One useful method is remapping fuel injection parameters via the engine control unit (ECU) and physically modifying the internal components of the diesel fuel injector. ECU remapping typically involves adjustments to injection timing, injection pressure, and injection strategies such as multi-pulse or split injection. In contrast, modifications to injector internal components may involve adjusting shim thickness, altering nozzle geometry to achieve a desired nozzle hole configuration, or applying a combination of these approaches. Through this research, it is hoped that researchers and engineers can gain a deeper understanding of fuel injectors and fuel injection systems to help enhance diesel engine performance and reduce exhaust emissions.

Conflicts of Interest: The author declares no conflict of interest.

Use of AI and AI-Assisted Technologies: No AI tools were utilized for this paper.

Reference

1. Pratama, R. H.; Huang, W.; Senzai, Y. Experimental Investigation of Diesel Spray Behavior Influenced by Injector Internal Component Modification. *Int. J. Automot. Manuf. Mater.* **2026**. https://doi.org/10.53941/ijamm.2026.100020.