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A Brief Review of Reactivity Controlled Compression Ignition Engine

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Abstract

To solve the problems of emissions from diesel engines, which are recognized as a major contributor to environmental pollution and various health concerns. The Reactivity Controlled Compression Ignition (RCCI) has been proposed as an effective solution. RCCI is a low-temperature combustion (LTC) method aimed to decrease engine tailpipe emissions such as NOx and CO_2 which are the primary contributors of global warming and smoke or PM is the reason for urban air pollution as well as improving thermal efficiency. RCCI technology operates by creating reactivity stratification within the cylinder using two fuels with varying cetane numbers and reactivity. This stratification allows precise control over combustion phasing, duration, and intensity, resulting in decreased emission levels in internal combustion engines. To achieve the desired reactivity stratification, the fuel with lower reactivity (LRF) is mixed with air before being introduced into the combustion chamber. In contrast, the high-reactivity fuel (HRF) with good auto-ignition properties is directly injected into the combustion chamber during the compression stroke. Through careful management of fuel quantity and injection timing, this method efficiently controls the combustion phase, heat release rate (HRR), and pressure rise rate (PRR), achieved by modifying the concentration distribution and reactivity stratification of mixtures inside the combustion chamber. Consequently, the combustion process can be enhanced without catalytic techniques or after-treatment systems. To comprehend RCCI combustion thoroughly, this paper provides an overview of RCCI engine management. It examines recent research progress in RCCI, including the use of alternative fuels, the impact of premixed ratio, exhaust gas recirculation ratio, compression ratio, numerous injection schemes, and bowl shape on engine performance and emissions formation.

Keywords: RCCI; emissions; LTC; Engine management.