Liquid Spray Penetration Under HCCI Conditions

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Abstract

Homogeneous charge compression ignition (HCCI) offers the potential for very low Nitrous Oxide and Particulate matter emission as well as increased thermal efficiency compared to conventional diesel engines. The ability to control HCCI combustion utilizing a cost effective and commercially practical system is of utmost importance. Injection strategy is an important control component in HCCI operation. Injection timing, injection pressure and nozzle configuration all effect homogeneity of the mixture and thus the NO_x and HC emissions. Higher fuel pressure will lead to higher spray velocity, greater penetration and therefore a greater chance of wall impingement. On the other hand, higher pressures lead to faster mixing, so similar mixing can be achieved with later injection timing and high spray pressure. In this experimental study, a high-speed camera was used to visualize the spray development and measure the spray penetration for diesel fuel sprays injected under HCCI conditions. The fuel sprays were injected into a constant-volume pressure vessel with optical access. The pressures in the vessel were in the range that would be encountered during a very early injection in a diesel engine that would allow the fuel and air enough time to form a homogeneous mixture before the piston approaches TDC and ignition conditions are met. The liquid penetration was measured for different fuel injectors for varying ambient pressures.

Key words: Spray penetration, HCCI.

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