Application of a Micro Nozzle Array Fuel Injector to Cold-Start Experiments of a 4 Stroke-cycle Gasoline Engine

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Abstract

Micro nozzle array ultrasonic fuel injectors (MNA injectors) were applied to cold start experiments of a 4 stroke cycle gasoline engine. In the MNA injector, a numerous number (order of 10^5) of micro nozzles (order of 10^{-6} m) are mounted on a thin nickel film. Gasoline is periodically pushed out at an ultrasonic frequency (order of 10^5 Hz), and a fine and uniform-diameter spray can be obtained. Two kinds of MNA injectors were applied to cold start experiments, whose nozzle exit diameter d = 4 and 6 μm, respectively. A conventional port fuel injector (PFI injector) was also applied for comparison. The Sauter mean diameters (SMDs) of the sprays are 15 μm (for MNA, d = 4 μm), 23 μm (for MNA, d = 6 μm), and 59 μm (for PFI), respectively. An air cooled, single cylinder, 4 stroke cycle, gasoline engine was used for cold start experiments. The test engine is cranked using a cell motor, and the first ignition cycles after fuel injection start and the cumulative fuel amount before the first ignition were investigated at a wide range of the air fuel ratio A/F. For the MNA injector (d = 4 μm), the first ignition cycles became much earlier when compared with the PFI injector, and the cumulative fuel amount during cranking reduced by about 30 %. It is shown that, by use of the MNA injector, the unburned hydrocarbon emissions during cold starting could be reduced.

Key words: Micro nozzle array, PFI injector, Cold starting, UHC emissions

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