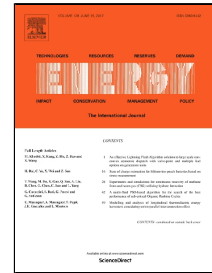


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Effects of lean combustion coupling with intake tumble on economy and emission performance of gasoline engine

Feng Zhou ^a, Jianqin Fu ^{a,*}, Wenhui Ke ^a, Jingping Liu ^b, Zhipeng Yuan ^b, Baojun Luo ^a

^a State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body, Hunan University, Changsha 410082, China

^b Research Center for Advanced Powertrain Technology, Hunan University, Changsha 410082, China

Abstract: To improve the economy and emission performance of automotive gasoline engine, the approach of lean combustion coupling with intake tumble was investigated. A port blocker was designed on intake manifold so as to generate intake tumble, and then the sweeping test of excess air coefficient was conducted under engine common conditions (2000 r/min, 2.6 bar) in two port blocker states (opening and closing). On this basis, the effects of lean combustion coupling with intake tumble on the working process, combustion and emission performance of gasoline engine were studied. The tested results indicate that lean combustion limit is obviously extended with acceptable combustion stability by utilizing intake tumble, thus the potential of energy conservation and emission reduction by lean combustion can be further enhanced. Compared with the initial state of original engine ($\lambda=1.0$, port blocker closing), the indicated thermal efficiency can be increased by 7.2%, and the specific emissions of CO₂, CO, HC and NO_x can be reduced by 5.8%, 72.2%, 12.0% and 85.3% at most, respectively. In particular, the minimum specific emission of NO_x is only 2.0 g/(kW·h). The results demonstrate that lean combustion coupling with intake tumble has great potential of energy conservation and emission reduction for gasoline engine.

Key words: internal combustion engine; lean combustion; intake tumble; thermal efficiency; energy conservation and emission reduction

1. Introduction

As the global energy crisis and environmental pollution become increasingly severe, countries all over the world have made the demands of “Higher efficiency, Energy conservation and Low emissions” for internal combustion (IC) engine. Energy conservation and emission reduction have become a general trend of the automotive industry [1-4]. On one hand, as one of the main power sources of mobile devices such as automobiles, agricultural machineries and engineering machineries, IC engine is the main consumer of petroleum [5]. Taking China as an example, the petroleum consumed by IC engine has accounted for more

*Corresponding author. State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body, Hunan University, Changsha 410082, China. Tel.: +86 073188983108. Fax: +86 073188664452. Email address: fujianqinabc@163.com.

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