عنوان مقاله:

Reformer gas application in combustion onset control of HCCI engine

محل انتشار:

پنجمین همایش موتورهای درونسوز (سال: 1386)

تعداد صفحات اصل مقاله: 23

نویسندگان:

Vahid Hosseini - *Mechanical Engineering Department, University of Alberta, Edmonton, Canada*

M David Checkel - *Mechanical Engineering Department, University of Alberta, Edmonton, Canada*

خلاصه مقاله:

Homogenous charge compression ignition (HCCI) combustion is defined as spontaneous multi-site combustion of a nominally premixed mixture that causes fast pressure rise and short combustion duration. To avoid excessive pressure rise rate and knocking, HCCI engines are fueled with highly diluted mixture using a combination of excess air and/or EGR. HCCI combustion is attractive due to extremely low NOx emission output and high thermal efficiency but practical engines must overcome de-rating to a part-load power level and high HC and CO emissions. More importantly, HCCI engines lack a direct method of combustion timing control and this limits operating flexibility. One method of timing control is to adjust mixture ignitability using a fuel blending agent with differing ignition properties than the base fuel. Reformer gas (RG) is a mixture of light gases dominated by hydrogen and carbon monoxide that can be produced from base hydrocarbon fuels by several reforming techniques such as partial oxidation, autothermal or steam reforming. In a series of experimental studies, reformer gas was used to control combustion timing using a CFR engine and various base fuels: compressed natural gas (gas, high octane), iso-octane (liquid, high octane) and n-heptane (liquid, low octane). The effects of reformer gas on engine operating parameters and combustion characteristics were shown to differ for different base fuel. Keeping other influential parameters constant, increasing RG mass fraction in a natural gas mixture advanced combustion timing and shifted the operating range of the engine toward leaner mixtures. This enabled the natural gas-fueled HCCI engine to operate at leaner mixtures with decreased knock intensity and smoother combustion behavior. For iso-octane and n-heptane base fuels, combustion timing was retarded significantly as RG blend fraction increased. For the case of isooctane the operating region did not change. However, for the n-heptane base fuel, the operating range was shifted toward richer mixtures, enabling higher indicated power and thermal efficiency. A chemical kinetic study of n-heptane / RG ignition showed that the influence of hydrogen was to suppress the first stage combustion and decrease the radical concentration after first stage combustion, thus delaying the main stage combustion, (despite faster major reaction rates during the main combustion period).

کلمات کلیدی: