

# DME

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## The investigation of Diesel Spray Combustion in DME HCCI

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**Key Words :** Diesel Combustion( ), Dimethyl ether(DME : ), Homogeneous Charge Compression Ignition(HCCI; ), Rapid Compression Machine.(R.C.M; )

### Abstract

The purpose of the research is to investigate of diesel spray combustion for simultaneously reduce way NOx and PM . The pressure diesel injection were done into intermediates that are generated by very lean DME HCCI combustion using a RCM. The concentration of intermediate could not be directly measured; we estimated it by CHEMKIN calculation. DME HCCI characteristic is surveyed . Validations of the CHEMKIN calculation were confirmed pressure rise of an experiment and pressure rise of a calculation . Using a framing streak camera captured two dimensional spontaneous luminescence images from chemical species at low temperature reaction(LTR) and high temperature reaction (HTR) . Also , the combustion events were observed by high-speed direct photography , the ignition and combustion were analyzed by the combustion chamber pressure profiles .

LTR: Low Temperature Reaction

HTR: High Temperature Reaction

$t_{LTR}$ : (ms)

$t_{HTR}$ : (ms)

$T_{LTR}$ : (K)

$T_{HTR}$ : (K)

$t_{10\%}$ : 10% (ms)

$t_{50\%}$ : 50% (ms)

$t_{90\%}$ : 90% (ms)

NOx

, , O<sub>2</sub>, Ar

가

(1) (2) (3) (4)

HCHO, H<sub>2</sub>O<sub>2</sub>

DME

. HCHO, H<sub>2</sub>O<sub>2</sub>

DME

1.

, PM,

A) HCHO, H<sub>2</sub>O<sub>2</sub>

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CHEMKIN

SENKIN

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( )

, DME

C) HCHO, H2O2

가

JIS2

B) DME

(flaming streak camera)

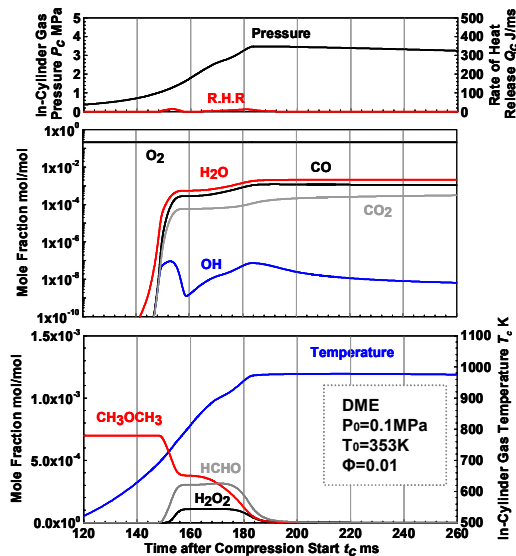


Fig. 1 Pressure histories, heat release rate, temperature histories and mole fraction of major chemical species at DME = 0.01

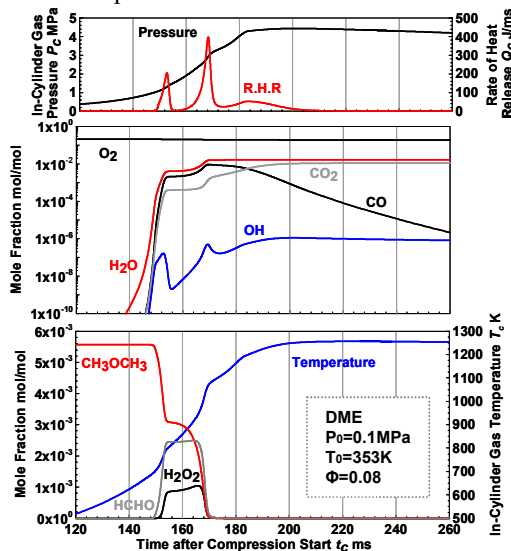


Fig. 2 Pressure histories, heat release rate, temperature histories and mole fraction of major chemical species at DME = 0.08

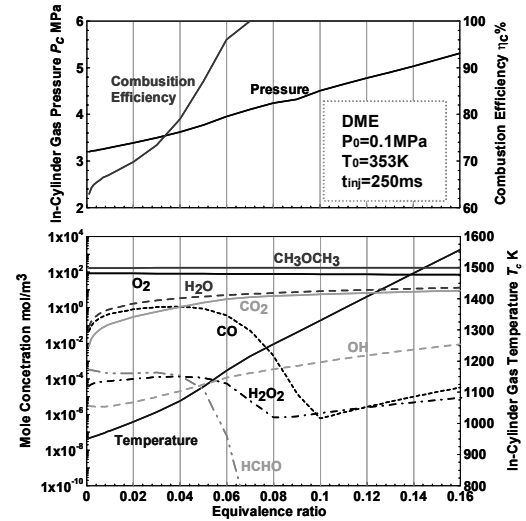


Fig. 3 Pressure histories, heat release rate, temperature histories and mole fraction of major at injection time (250ms)

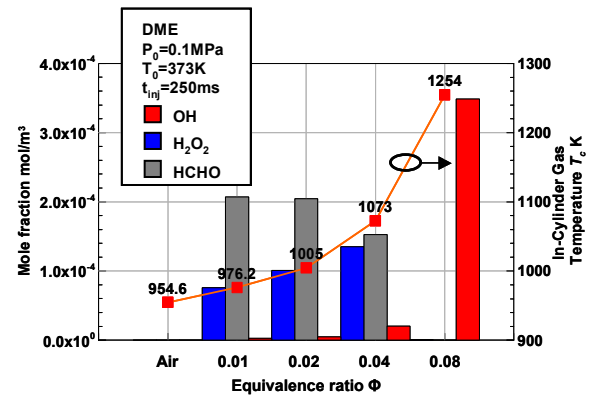


Fig. 4 In-Cylinder Gas Temperature and Mole Concentration of OH, H2O2, HCHO at injection time (250ms)

2. DME

HCHO, H2O2, OH

(想定)

(scheme)

Curran

(5) (

79,

336)

=14.6,

가

T0=353K,

가

H<sub>2</sub>O<sub>2</sub>

OH 가  $3.5 \times 10^{-4}$  mol/m<sup>3</sup>

DME 가 가 1100K

HCHO, H<sub>2</sub>O<sub>2</sub>

DME 가 =0.04

Driving Air

Trigger

Accumulator

Oil Damper

Piston

Quartz Window

Aluminum Plate

BDC

Stroke 692mm

TDC

Safety Enclosure

Mirror

Quartz Window

Exhaust Gas

Band Heater

Air Compressor

Intake Air

Mixture

Fuel

Heat Exchanger

Intake Gas

Manometer for Air Flow

Manometer for Back Pressure

Manometer for Fuel Flow

**Fig. 5** Rapid compression machine apparatus

**Table 1** Specification of Rapid Compression Machine

Specification	
Items	Value
Bore x Stroke	145 x 692mm
Cylinder volume	$12.2 \times 10^{-3} \text{m}^3$
Combustion Chamber volume	$0.0793 \times 10^{-6} \text{m}^3$
Compression Ratio	14.6
Combustion Chamber Thickness	48mm
Combustion Chamber type	Pancake type
Compression Duration	200ms
Quartz Maximum Endurable Pressure	5MPa

3. DME



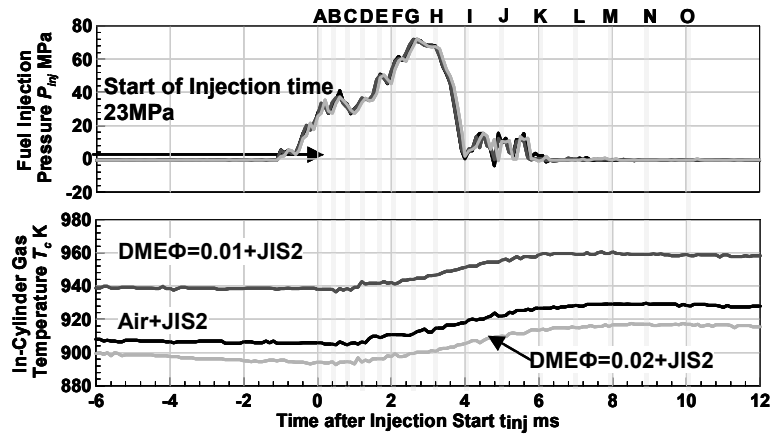


Fig.9 Injection pressure , cylinder volume , cylinder temperature and cylinder pressure at Air+JIS2 , DMEΦ=0.01+JIS2 , DMEΦ=0.02+JIS2

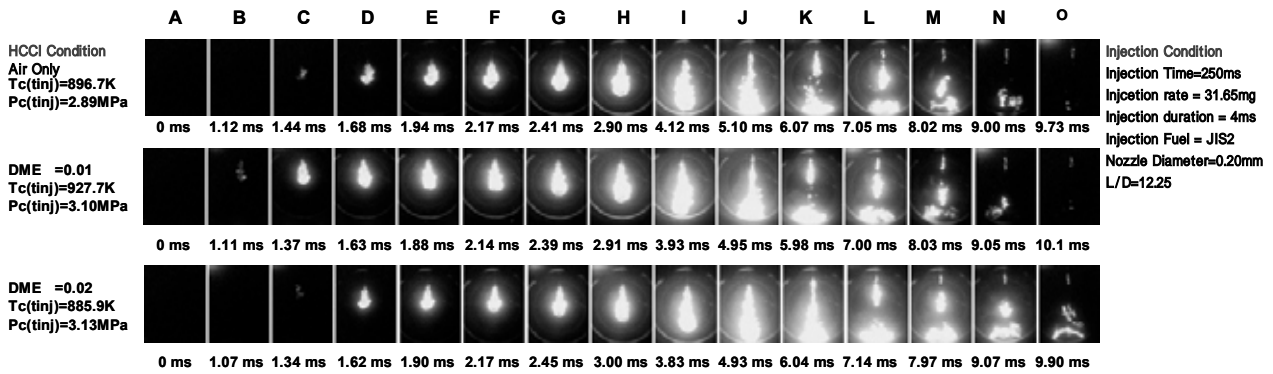


Fig. 10 Direct photograph at Air+JIS2 , DME/Air Φ=0.01+JIS2 , DME/Air Φ=0.02+JIS2

23MPa 1 31.65mg , =0.01 =0.04  
4ms 2 가 가 30K 가 ,  
가 , Air = 0.02 0.04  
HCHO, H2O2 OH 가 가 , 0.2ms  
가 가  
906.01K, 2.89MPa, =0.01 937.93K, 3.09MPa, 가  
=0.08 916.46K, 3.13MPa . 2 4 , Air  
가 가  
가 9, 10 가 DME  
Air DME = 0.01  
=0.01,0.02 , HCHO  
=0.08 HCHO  
Air 1.42 ms, =0.01 1.11 H2O2 , OH 가  
ms, =0.02 1.12 ms 3.5 × 10<sup>-4</sup> mol/m3  
Air 8.704ms, =0.01 OH 가  
9.324ms, =0.02 9.462ms 가  
9 가  
DME 가 t<sub>id</sub>, 8 가  
10%, 50%, 90%

‘10%  $t_{10}$ , ‘50%  $t_{50}$ , 90%  $t_{90}$  가 , OH 가 =0.08 , =0.01 , =0.02 , HCHO, H<sub>2</sub>O<sub>2</sub>, OH 가 =0.01 =0.02 =0.01 가 , = 0.01 가 , 가 , 가

Air , = 0.08 , HCHO H<sub>2</sub>O<sub>2</sub> , OH 가  $3.5 \times 10^{-4}$  mol/m<sup>3</sup> , OH 가 , 가

## 5.

, DME , DME , DME , DME 1) , DME =0.01 , LTR  $t_{LTR}=148\text{ms}$ ,  $T_{LTR}=690\text{K}$  , LTR  $t_{LTR\_end}=154\text{ms}$ ,  $T_{LTR\_end}=800\text{K}$  . LTR DME 1/3 가 , DME HCHO 가 HCHO, H<sub>2</sub>O<sub>2</sub> 150ms , 가 가 800K 가 . HTR  $t_{HTR}=175\text{ms}$ ,  $T_{HTR}=900\text{K}$  HCHO, H<sub>2</sub>O<sub>2</sub> HTR = 0.08 =0.01 , LTR , LTR HCHO, H<sub>2</sub>O<sub>2</sub> =0.01 . HTR  $t_{HTR}=170\text{ms}$  , =0.01 0.5ms ,  $T_{HTR}=950\text{K}$  50K 2) 가 가 가

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