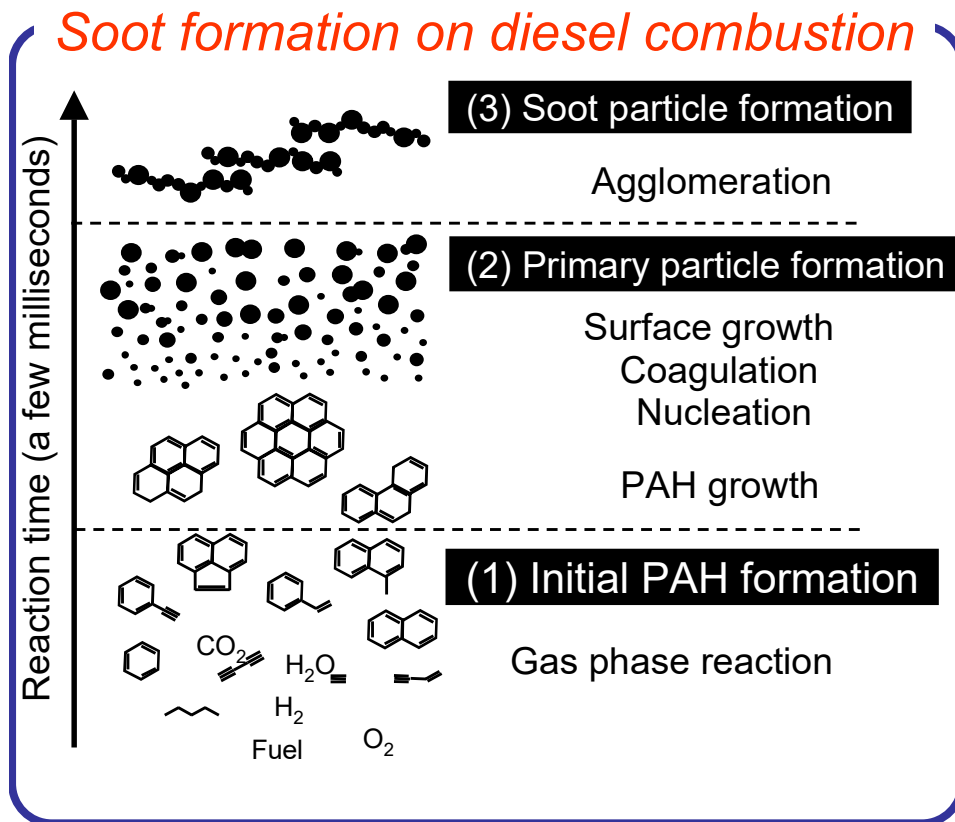


Chemical kinetic modeling of oxygenated fuels



Oxygenated fuels



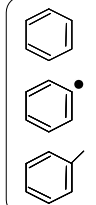
Soot suppression effect

Reaction Model of Soot Formation

Step.1 Gas Phase Chemistry

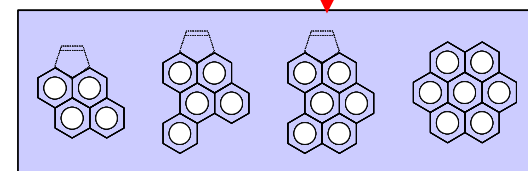
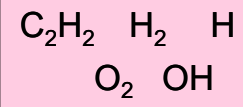
Fuel chemistry

n-Heptane fuel
MB fuel
DME fuel
DMM fuel
MeOH fuel



PAH growth chemistry

HACA reaction sequence
Ring-ring condensation
Combination of resonantly stabilized radicals



Surface growth
and oxidation

Particle
coagulation

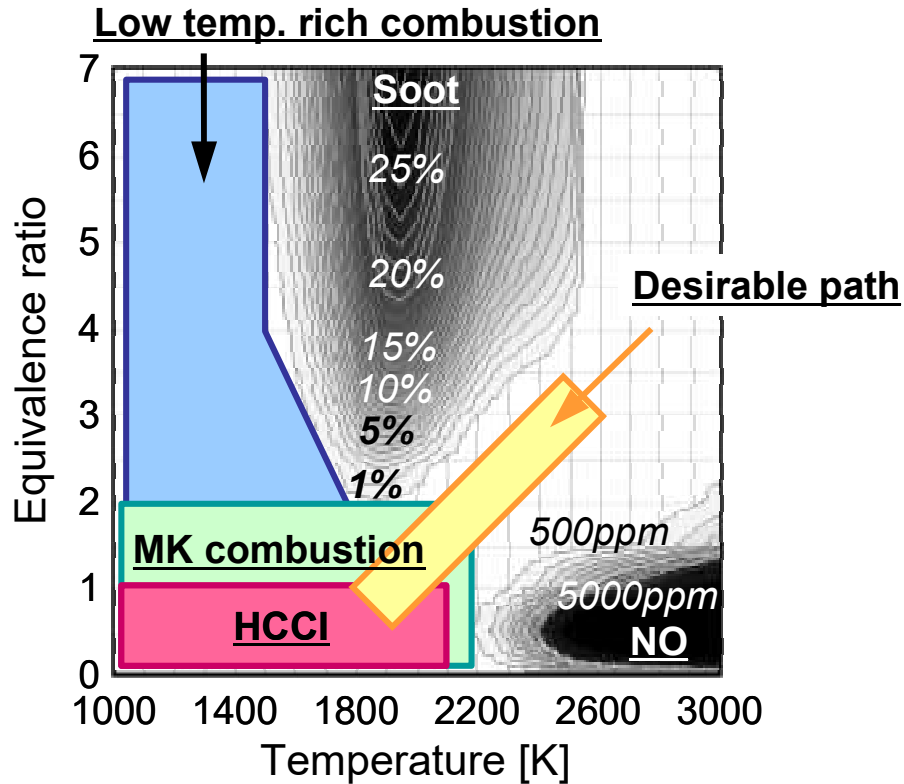
Particle
inception

PAH
condensation

Step.2 Soot Formation Model

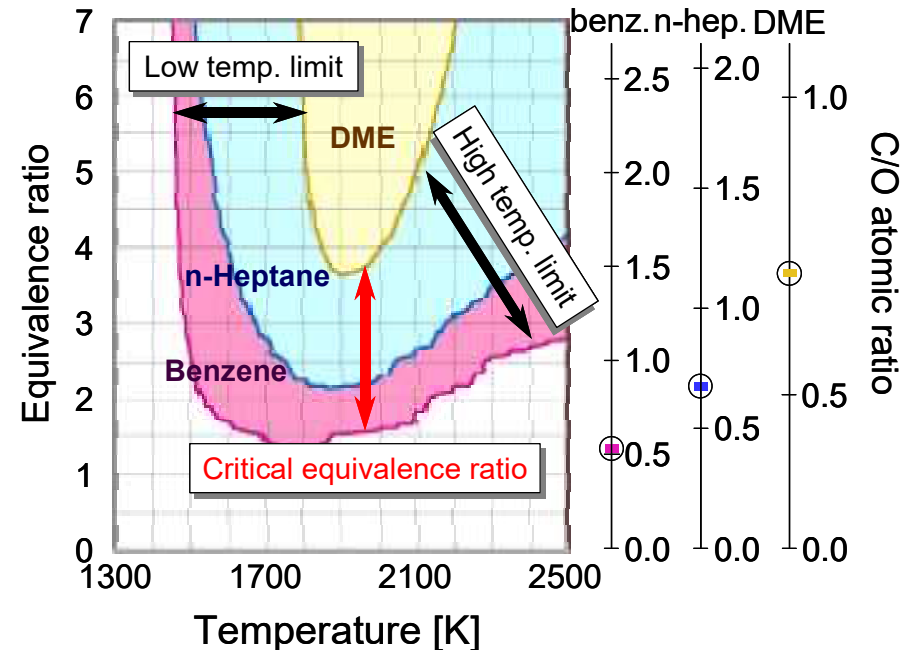
Soot model { PAH particle formation
Initial PAH formation

Chemical kinetic modeling of oxygenated fuels

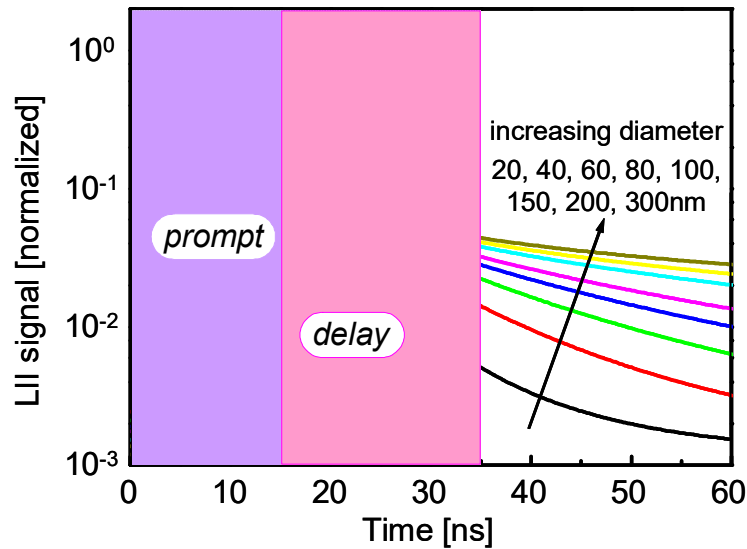


Comparison of Representative Diesel Combustion Methods on ϕ -T Diagram

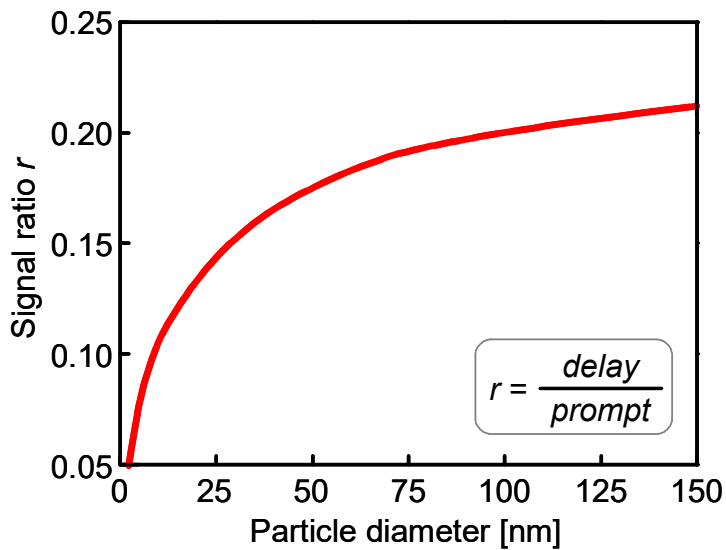
Variation of Soot Formation Limits among Different Type of Fuels on ϕ -T Diagram



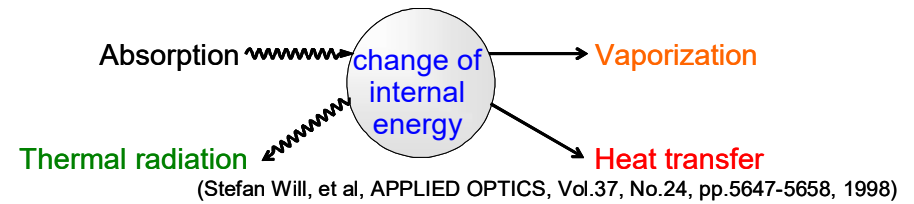
Time-resolved LII



$P_{amb}=4.1\text{MPa}$, Laser fluence= 1.67J/cm^2 , $T_{flame}=2200\text{K}$



$P_{amb}=4.1\text{MPa}$, Laser fluence= 1.67J/cm^2 , $T_{flame}=2200\text{K}$



Energy balance equation

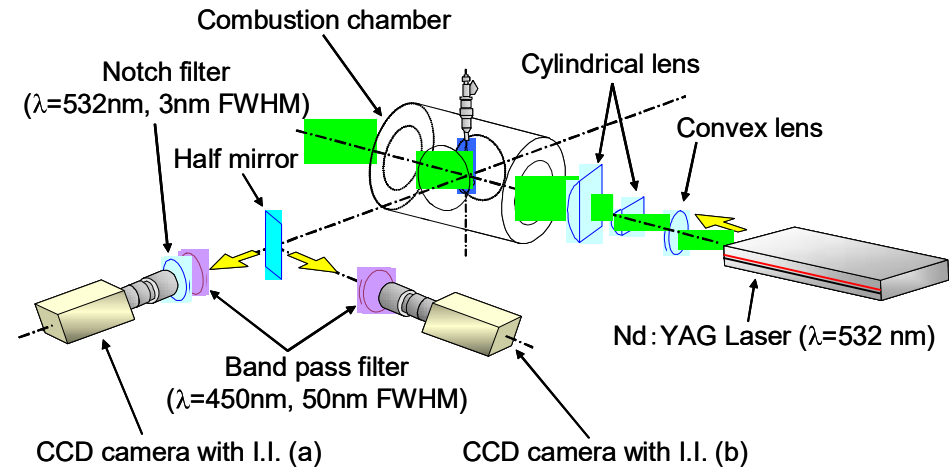
$$Q_{abs} \pi a^2 q_{(t)} - 4\pi a^2 (T - T_0) \Lambda - \frac{\Delta H_v}{W_s} \cdot \frac{dM}{dt} - q_{rad} - \frac{4}{3} \pi a^3 \rho_s C_s \frac{dT}{dt} = 0$$

absorbed laser energy	heat transfer loss	heat loss soot evaporation	heat loss thermal radiation	internal energy change
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Mass conservation equation

$$\frac{dM}{dt} = 4\pi a^2 \rho_s \frac{da}{dt} = 4\pi a^2 \rho_s \sqrt{\frac{RT}{2W_v}}$$

(Stefan Will, et al, APPLIED OPTICS, Vol.37, No.24, pp.5647-5658, 1998)



f_v and d_p distribution for heptane ($\Delta t_{inj}=4.0ms$)

