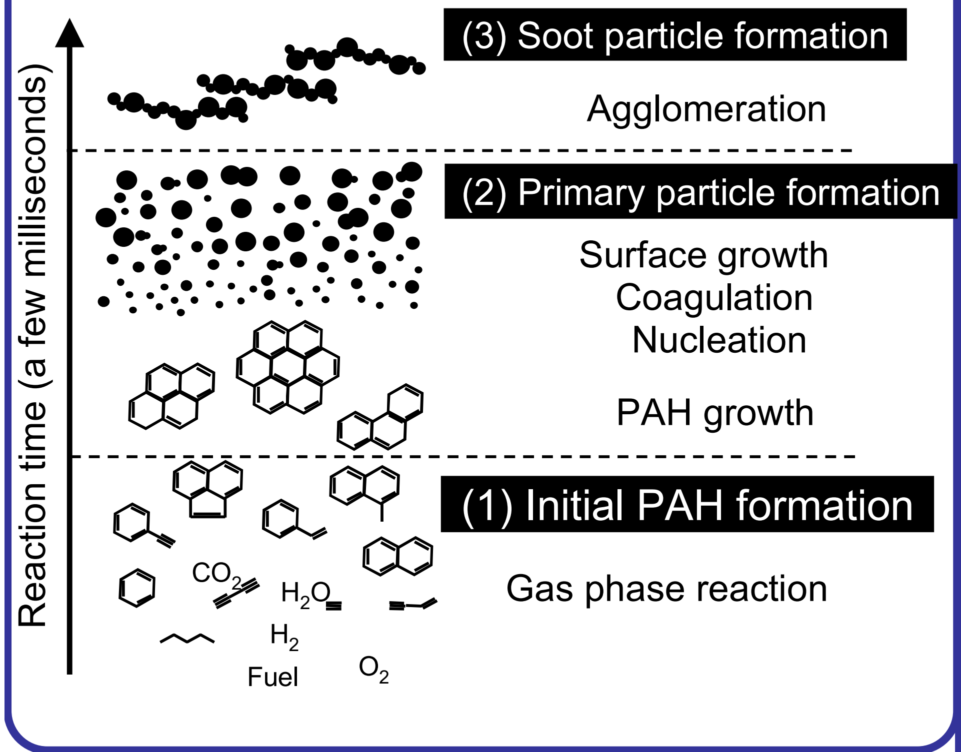
Chemical kinetic modeling of oxygenated fuels

Soot formation on diesel combustion



Oxygenated fuels

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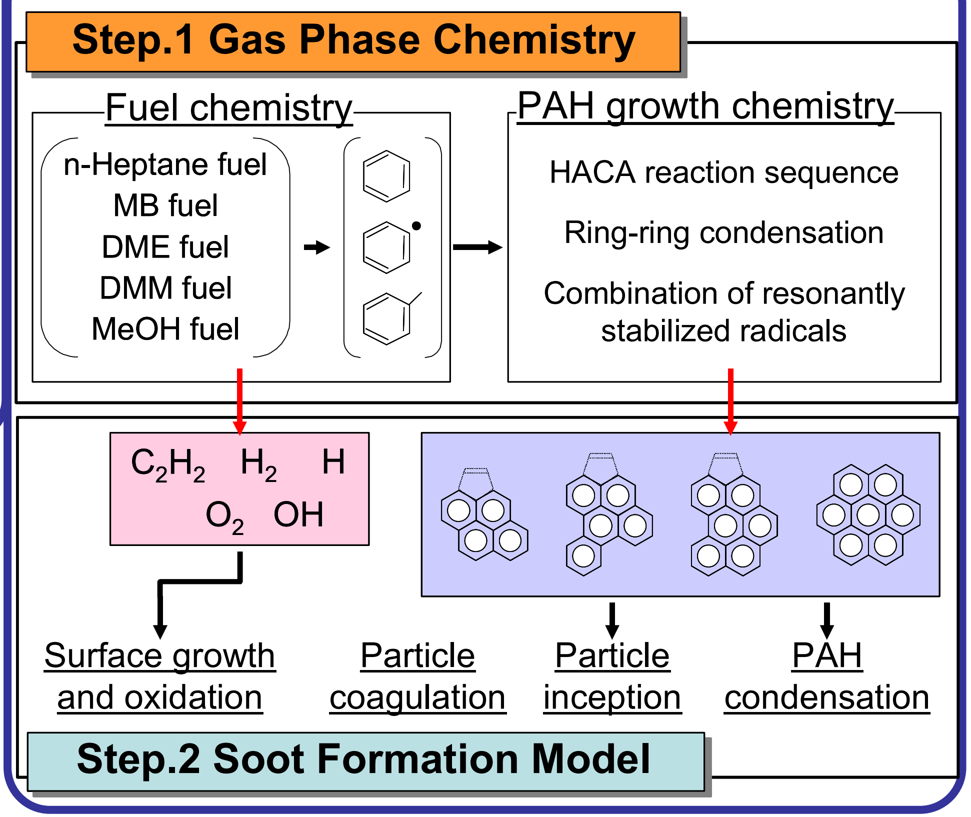
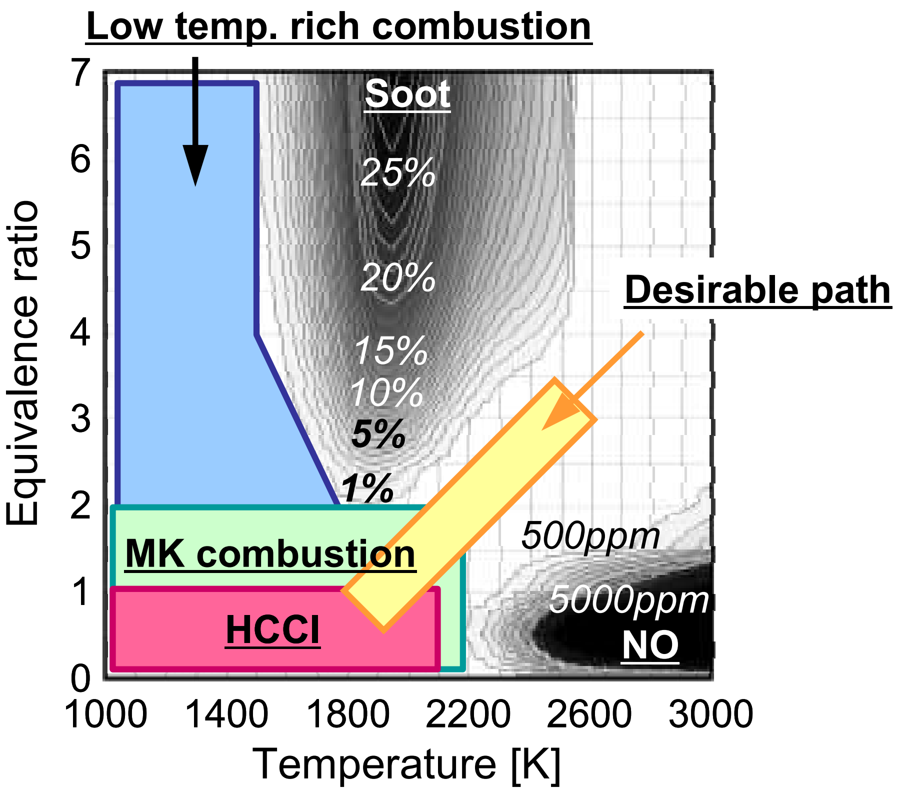
Soot suppression effect

Soot model { PAH particle formation / Initial PAH formation

Reaction Model of Soot Formation

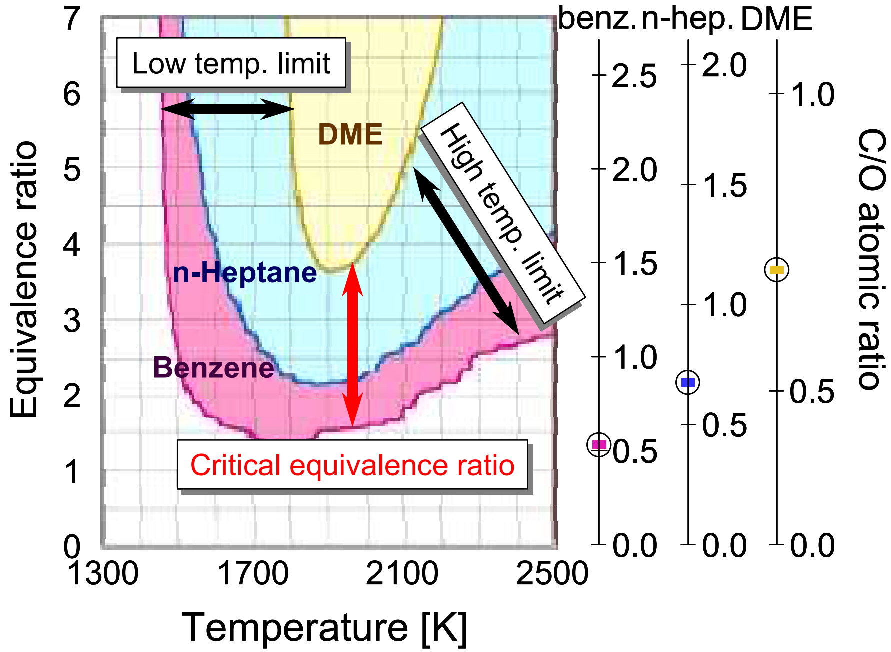


Chemical kinetic modeling of oxygenated fuels

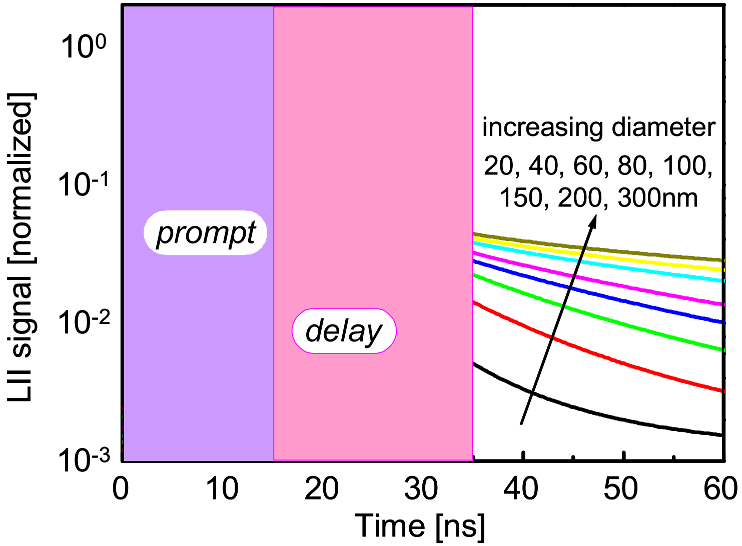


Comparison of Representative Diesel Combustion Methods on ϕ-T Diagram

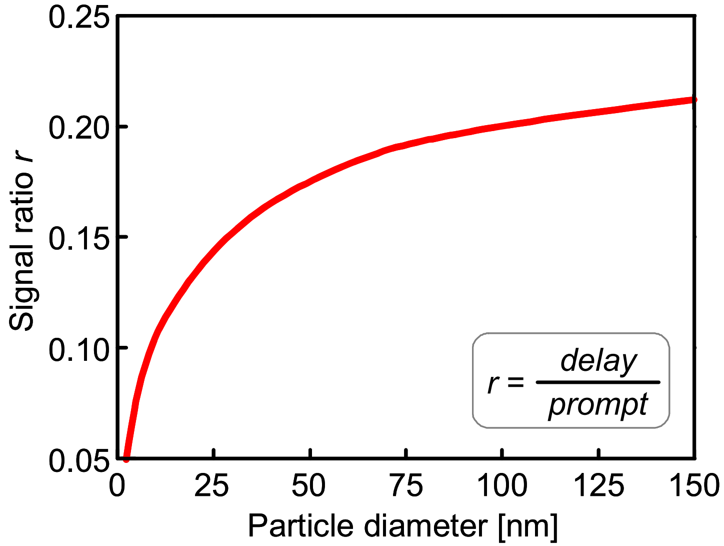
Variation of Soot Formation Limits among Different Type of Fuels on ϕ-T Diagram



Time-resolved LII



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



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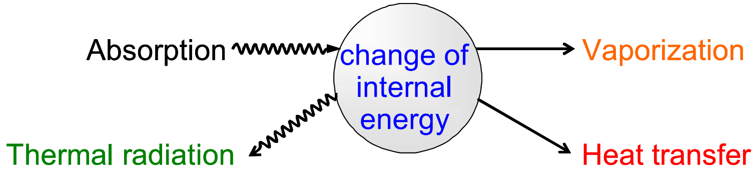


(Stefan Will, et al, APPLIED OPTICS, Vol.37, No.24, pp.5647-5658, 1998)

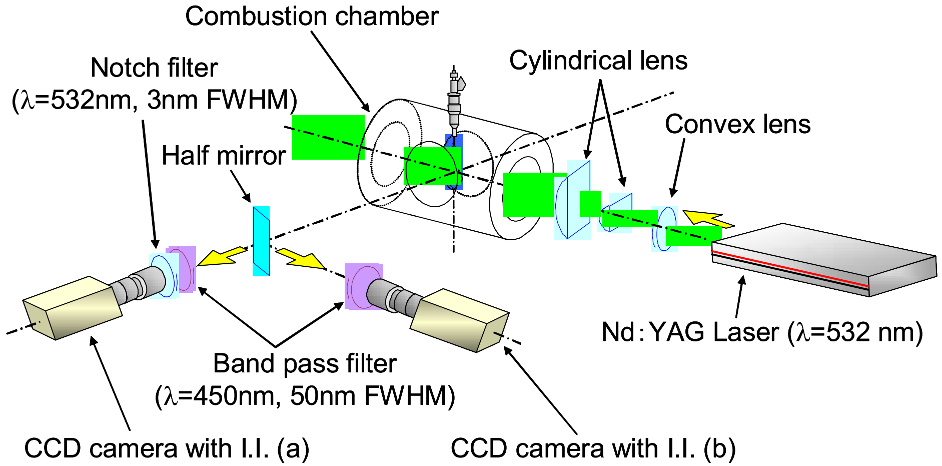
Energy balance equation

$$\underbrace{Q_{abs}\pi a^2 q_{(t)}}_{\text{absorbed laser energy}} - \underbrace{4\pi a^2 (T - T_0)\Lambda}_{\text{heat transfer loss}} - \underbrace{\frac{\Delta H_v}{W_s}\cdot\frac{dM}{dt}}_{\text{heat loss soot evaporation}} - \underbrace{q_{rad}}_{\text{heat loss thermal radiation}} - \underbrace{\frac{4}{3}\pi a^3 \rho_s C_s \frac{dT}{dt}}_{\text{internal energy change}} = 0$$

Mass conservation equation

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

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



f_v and d_p distribution for heptane (Δt_{inj}=4.0ms)