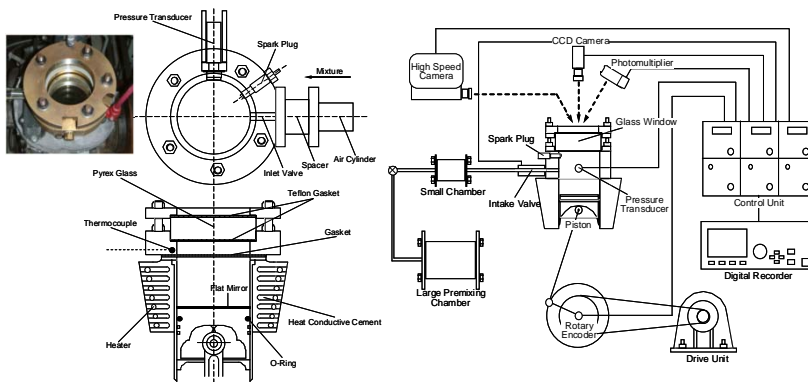


可視化エンジン・可視化容器を用いた燃焼観測 シリーズ

- エンジンやバーナーなど様々な**燃焼機器の内部を可視化するノウハウ**を保有
- 燃焼現象の可視化により燃焼機器の性能改善に貢献することが可能
- 燃焼は化学反応により支配された現象であり、物理的可視化のみにより基本原理の解明は不可能
- 数千の化学種と素反応から構成される詳細化学反応モデルを用いて燃焼現象を数値的に解読し、**化学反応過程を可視化するノウハウ**を保有
- ふたつの可視化のノウハウにより燃焼現象の原理解明や新しい燃焼技術の開発に貢献することが可能



可視化エンジン実験装置

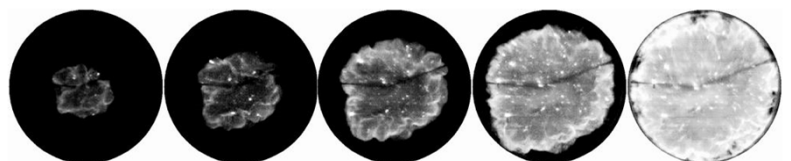
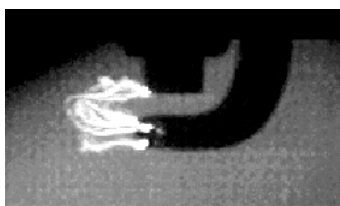
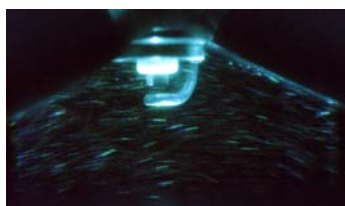
Fuel: $n\text{-C}_4\text{H}_{10}$, ϕ 0.5, T_p : 759 K, p_0 : 2.0 MPa, Reactions Extracted by Contribution Ratio > 3

| | T_p | 750 | 760 | 770 | 780 | 790 | 800 | 810 | 820 | 830 | 840 | 850 | 860 | 870 | 880 | 890 | 900 | 910 | 920 | 930 | 940 | 950 | 960 | 970 | 980 | 990 | 1000 | |
|----------------------------|-------|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| Sum(C7H16+OH=C7H15+H2O) | 15 | 11 | 8.4 | 3.4 | 5.9 | 1.3 | 0 | 0.5 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| nC7H16+OH=C7H15+H2O | 5.2 | 3.7 | 2.1 | 1.1 | 0.6 | 0.5 | 0.3 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| nC7H16+OH=C7H15+H2O | 5.2 | 3.7 | 2.1 | 1.1 | 0.6 | 0.5 | 0.3 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Sum(C7H15+O=C7H15O2) | 26 | 19 | 9.3 | 3.0 | 2.7 | 1.2 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| C7H15+O=C7H15O2-1 | 4.5 | 3.1 | 1.5 | 0.4 | 0.4 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| C7H15+O=C7H15O2-2 | 8.7 | 5.9 | 3.1 | 0.9 | 0.9 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| C7H15+O=C7H15O2-3 | 8.7 | 6.0 | 3.1 | 1.1 | 0.9 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| C7H15+O=C7H15O2-4 | 4.3 | 3.0 | 1.6 | 0.6 | 0.4 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Sum(C7H14OCH+O=C7H14OOCH2) | 4.0 | 2.7 | 1.3 | 0.4 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| C7H14OCH+O=C7H14OOCH2-1 | 3.6 | 2.4 | 1.1 | 0.3 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Sum(C7H14OCH+O=C7H14OOCH2) | 17 | 8.5 | 3.3 | 0.4 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| C7H14OCH+O=C7H14OOCH2-2 | 4.0 | 2.7 | 1.3 | 0.4 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| C7H14OCH+O=C7H14OOCH2-3 | 4.0 | 2.7 | 1.3 | 0.4 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Sum(C7H14OCH+O=C7H14OOCH2) | 17 | 8.5 | 3.3 | 0.4 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| HC3H7CO+O=C7H14OOCH2 | 0.0 | 0.0 | 0.0 | -0.1 | -3.0 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | |
| CH3+O=C7H14OOCH2 | 0.5 | 1.7 | 3.5 | 3.9 | 2.6 | 1.7 | 1.2 | 0.7 | 0.5 | 0.3 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | -0.1 | -0.2 | -0.6 | -0.8 | -1.2 | -0.4 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | |
| CH3+O=C7H14OOCH2 | 0.0 | 0.1 | 0.4 | 0.8 | 3.3 | 3.4 | 3.6 | 3.8 | 3.5 | 3.4 | 3.2 | 2.9 | 2.5 | 2.0 | 1.5 | 1.1 | 0.7 | 0.5 | 0.3 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| CH2CO+O=C7H14OOCH2 | 1.2 | 2.4 | 2.9 | 2.4 | 1.5 | 1.6 | 1.8 | 2.0 | 2.2 | 2.5 | 2.8 | 3.0 | 3.1 | 2.9 | 2.5 | 2.0 | 1.4 | 1.0 | 0.6 | 0.4 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | |
| CH3CO+O=C7H14OOCH2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| CH3CO+O=C7H14OOCH2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| CH2CO+O=C7H14OOCH2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| CH2CO+O=C7H14OOCH2 | 0.1 | 1.5 | 4.1 | 6.7 | 12 | 13 | 12 | 12 | 11 | 11 | 8.8 | 7.8 | 6.8 | 5.9 | 5.1 | 4.3 | 3.5 | 2.5 | 1.5 | 1.0 | 0.6 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | |
| H2O2(M)+OH=H2O+M | 0.0 | 0.0 | 0.0 | 0.0 | 6.3 | 11 | 15 | 15 | 12 | 11 | 10 | 9.9 | 8.0 | 7.1 | 6.2 | 5.2 | 4.3 | 3.3 | 2.4 | 1.6 | 0.8 | 0.4 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | |
| H2O2(M)+OH=H2O+M | 0.0 | 0.9 | 2.8 | 4.6 | 6.2 | 6.7 | 7.0 | 7.3 | 7.1 | 6.8 | 6.3 | 5.8 | 5.2 | 4.6 | 4.2 | 3.8 | 3.5 | 3.4 | 3.3 | 3.0 | 2.7 | 2.4 | 2.1 | 1.8 | 1.6 | 1.4 | 1.2 | |
| H2O2(M)+OH=H2O+M | 0.1 | 1.5 | 4.1 | 6.7 | 12 | 13 | 12 | 12 | 11 | 11 | 8.8 | 7.8 | 6.8 | 5.9 | 5.1 | 4.3 | 3.5 | 2.5 | 1.5 | 1.0 | 0.6 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | |
| H2O2(M)+OH=H2O+M | 0.2 | 0.9 | 2.3 | 4.0 | 5.6 | 6.0 | 6.2 | 6.3 | 6.2 | 6.1 | 5.9 | 5.6 | 5.2 | 4.7 | 4.3 | 3.9 | 3.6 | 3.4 | 3.2 | 3.0 | 2.8 | 2.6 | 2.4 | 2.2 | 2.0 | 1.9 | 1.7 | |
| H2O2(M)+OH=H2O+M | 0.0 | 1.3 | 4.1 | 7.7 | 13 | 13 | 12 | 12 | 11 | 11 | 8.8 | 7.8 | 6.8 | 5.9 | 5.1 | 4.3 | 3.5 | 2.5 | 1.5 | 1.0 | 0.6 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | |
| H2O2(M)+OH=H2O+M | 1.0 | 1.7 | 2.4 | 3.1 | 3.8 | 4.4 | 4.8 | 5.2 | 5.6 | 6.7 | 7.6 | 8.7 | 9.9 | 11 | 14 | 16 | 18 | 20 | 21 | 22 | | | | | | | | |
| H2O2(M)+OH=H2O+M | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.7 | 0.9 | 1.2 | 1.5 | 1.9 | 2.3 | 3.1 | 4.2 | 5.2 | 6.0 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 | |
| H2O2(M)+OH=H2O+M | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | -0.2 | -0.2 | -0.4 | -0.5 | -0.8 | -1.2 | -1.6 | -2.1 | -2.7 | -3.3 | -4.0 | -4.7 | -5.5 | -6.0 | -6.5 | -7.8 | -8.1 | -8.0 | -8.1 | -8.1 | | |
| H2O2(M)+OH=H2O+M | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | -0.2 | -0.3 | -0.5 | -0.8 | -1.3 | -2.1 | -3.5 | -4.3 | -4.8 | -5.7 | | | |
| H2O2(M)+OH=H2O+M | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| H2O2(M)+OH=H2O+M | 0.3 | 0.5 | 0.6 | 0.8 | 1.1 | 1.4 | 1.8 | 2.2 | 2.6 | 3.1 | 3.7 | 4.4 | 5.5 | 7.5 | 11 | 15 | 19 | 20 | 22 | | | | | | | | | |

着火反応過程の可視化

研究実施例

- リーンバーンガソリンエンジン内の燃焼現象の解明
- リーンバーンガソリンエンジン内の点火にともなう多重放電の発生メカニズムの解明
- 直噴式ガソリンエンジン内の燃焼現象の解明
- 冷炎反応に同期させた火花放電による着火過程促進のメカニズムの解明
- ガソリンエンジン用強力点火システムによる火炎核成長促進のメカニズムの解明
- トラック室内用独立式バーナーヒーターの開発
- ロータリーエンジンへの固体潤滑剤添加による点火プラグ汚損のメカニズムの解明



点火プラグ近傍流れ 放電経路の吹き飛び

ガソリンエンジン内の火炎伝播