

## Influence of momentum ratio control mode on spray and combustion characteristics of a LOX/LCH<sub>4</sub> pintle injector

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### Cite this as:

Rui ZHOU, Chi-bing SHEN, 2022. Influence of momentum ratio control mode on spray and combustion characteristics of a LOX/LCH<sub>4</sub> pintle injector. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 23(5):415-420. <https://doi.org/10.1631/jzus.A2100402>

# Aims

Based on the functioning principle of [pintle injector](#), the paper put emphasis specifically on [the influence of momentum ratio on spray and combustion characteristics in an oxidant-centred LOX/LCH<sub>4</sub> pintle injector](#).

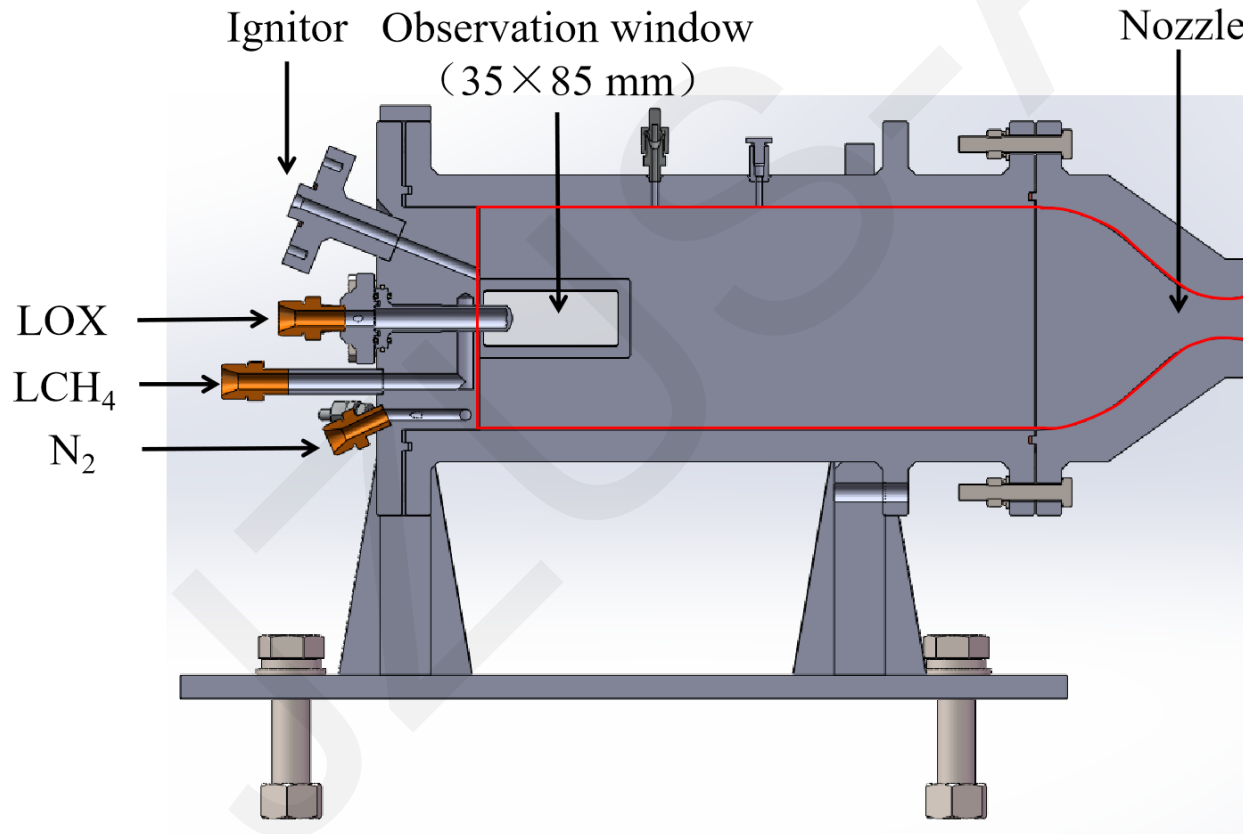


Fig 1. Test instrument model

# Methods

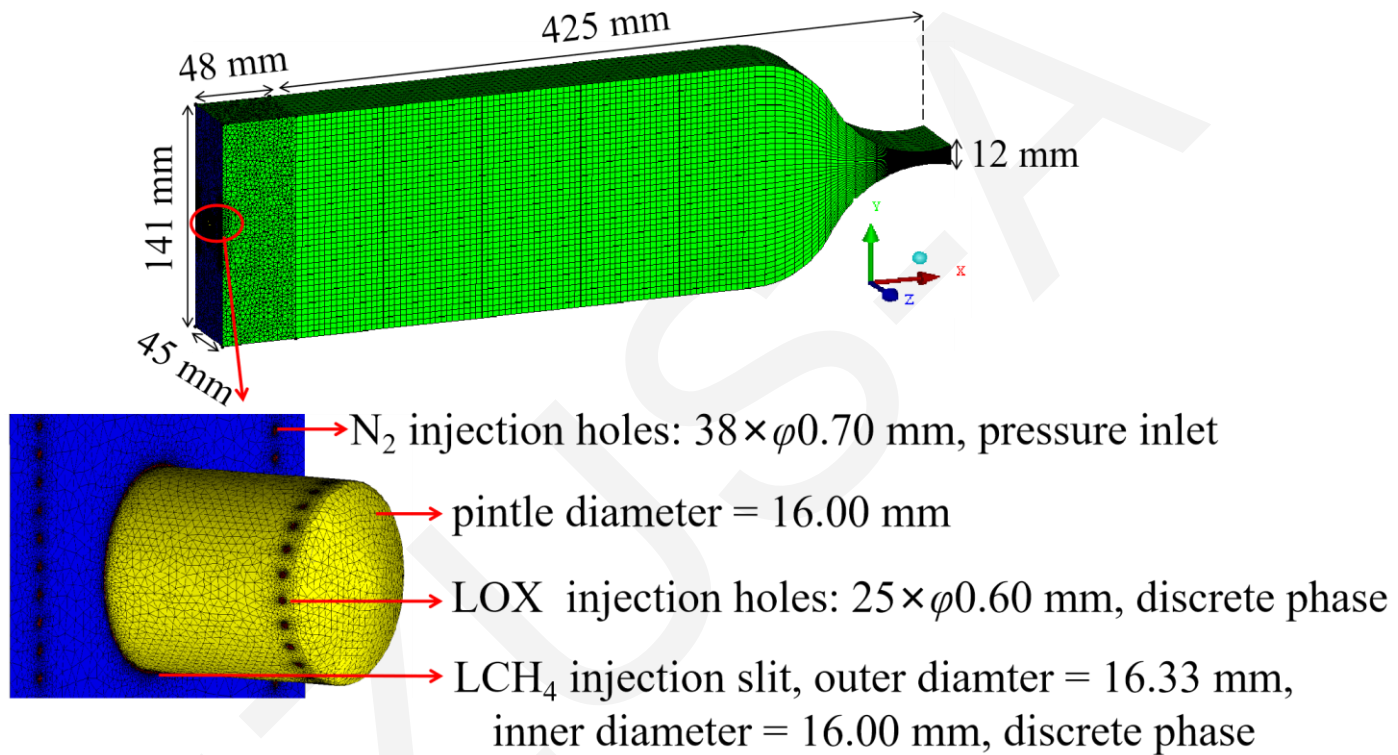


Fig.2 Simulation setup

Particularly, holes near the observation windows on both sides of combustion chamber are used to inject normal temperature nitrogen to prevent the observation windows from bursting, and to establish the desired combustion chamber pressure quickly.

# Extract Results

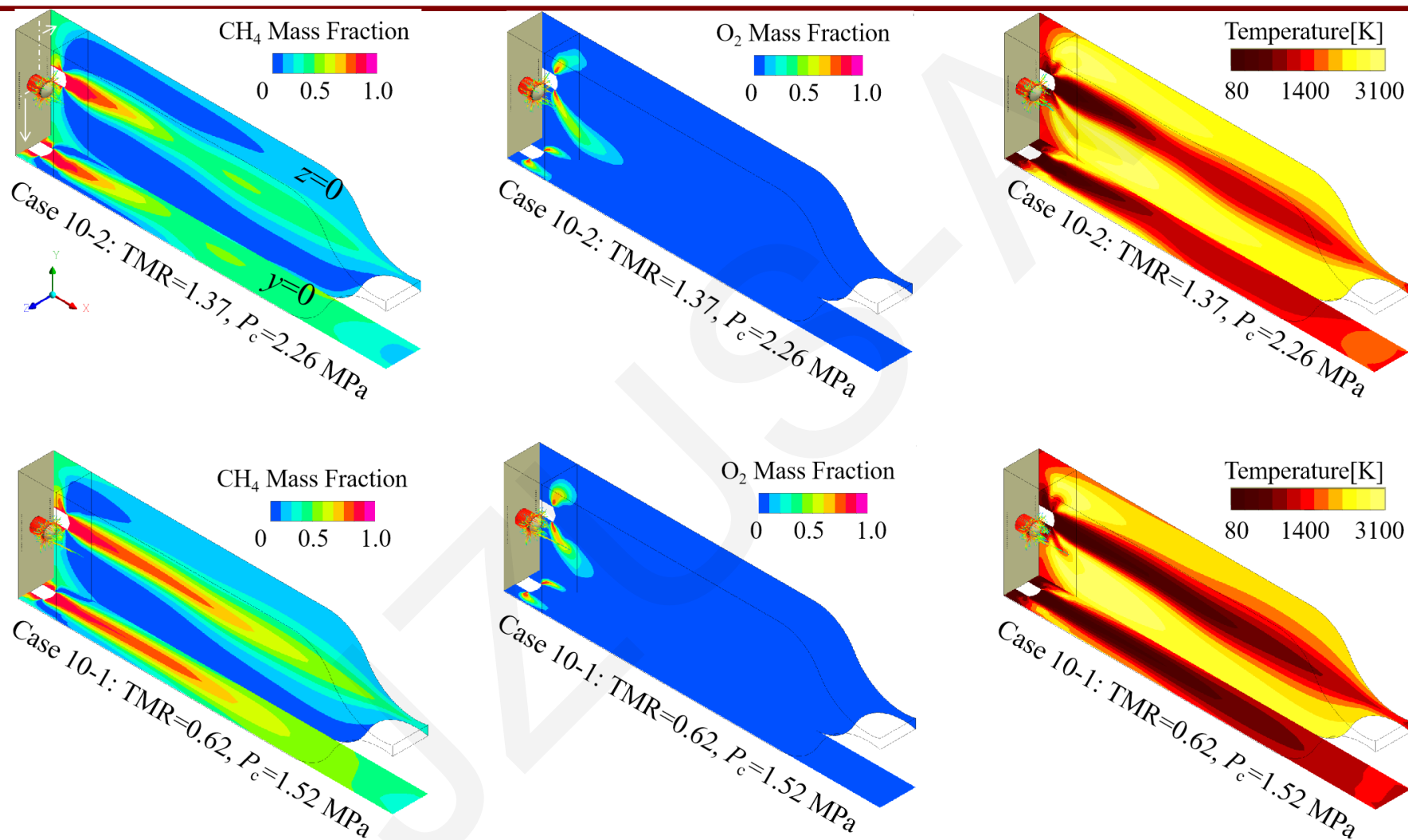


Fig.3 Methane contour, oxygen contour, temperature contour and liquid phase trajectory (colored lines)

# Extract Results

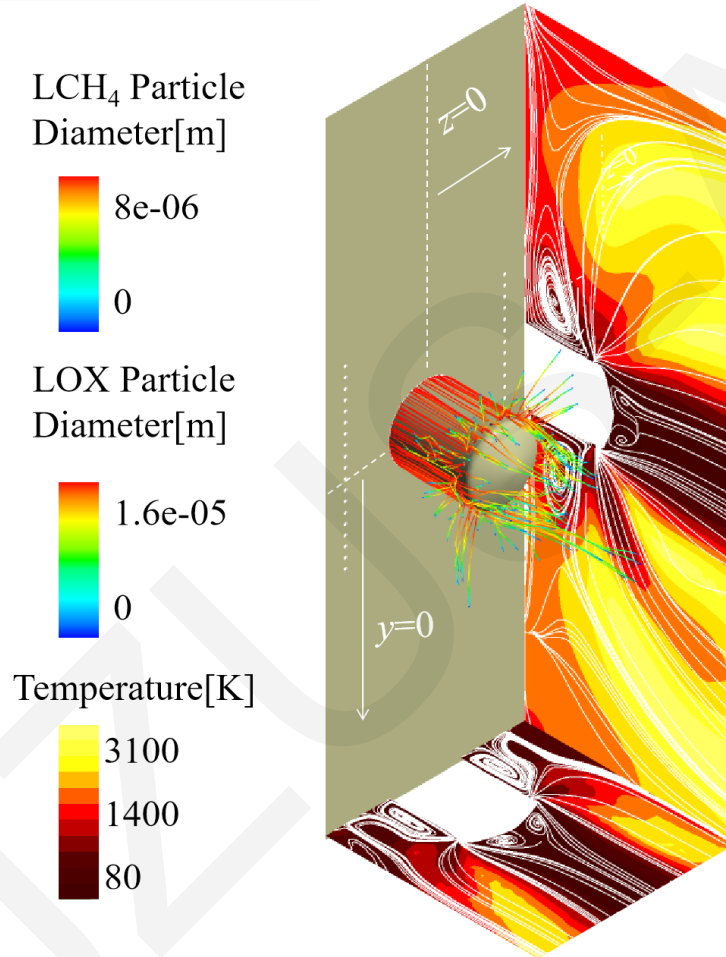


Fig. 6 Temperature contour, streamlines and discrete phase trajectory in the combustion chamber head in Case 1

# Conclusions

1. High TMR can be helpful for achieving high  $c^*$  with strong impact of propellants and good mixing. In particular,  $LCH_4$  vaporizes faster and contributes to faster chemical combustion under conditions of  $TMR=1.37$ , and concentrates less at the pintle tip, compared with the conditions of  $TMR=0.62$ .
2. Flame develops from the place where two propellants are in contact. As the mixing process increases the surface area of the flame, forming an arc-shaped shear flame.
3. The spray structure of a pintle injector presents a three-dimensional distribution, which is beneficial for diffusing energy rapidly, thus creating good combustion stability.
4. Vortices can promote flame stability by extending the mixing time of gases, and effectively preventing high temperature from developing at the combustion chamber head or at the pintle tip.