講演番号	237

Development of Ammonia/Hydrogen SI Engine

- Impact of Port Fuel Injection Applied to the Ammonia/Hydrogen Fuel Supply System on Engine Performance -

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In this study, the effects of applying port fuel injection (PFI) to the ammonia/hydrogen supply system on engine performance have been investigated. In our previous study, we developed an ammonia/hydrogen engine in which hydrogen reformed by an onboard reformer was supplied via direct injection (DI), while ammonia was supplied through PFI. In this engine, stable combustion was achieved by optimizing the in-cylinder hydrogen concentration distribution using a DI hydrogen jet model developed with the gas parcel method. However, the DI hydrogen system requires not only a high-pressure injection device but also a large reformer, making it difficult to secure sufficient installation space. Therefore, the application of PFI to the fuel supply system was considered. For this purpose, a new PFI jet model was constructed based on the previously developed DI hydrogen jet model, and the effects of applying PFI on mixture formation were evaluated.

The main results of this study are as follows:

1. The constructed PFI jet model was able to accurately reproduce the penetration and spreading angle of a free jet within a short computational time (Fig. 1).
2. The constructed PFI jet model successfully reproduced the behavior and shape of the jet when impinging on a flat plate.
3. The effects of applying PFI to the ammonia/hydrogen SI engine were investigated using the developed PFI jet model. The results indicate that advancing the start of injection can reduce the amount of residual hydrogen in the intake port and promote a more homogeneous mixture distribution(Fig. 2 and 3).

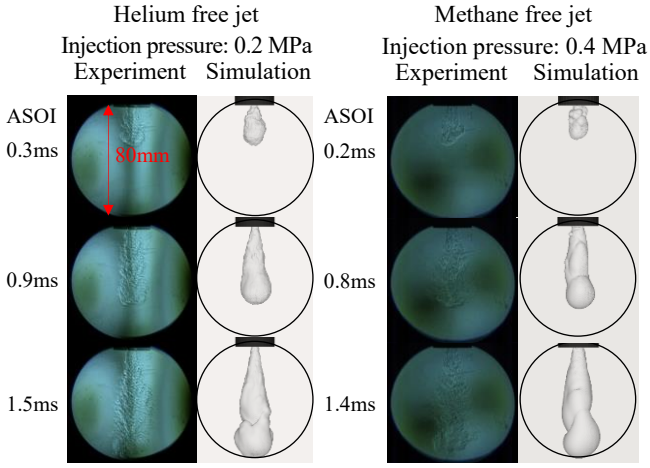

Fig. 1 Comparison of jet behaviors in constant volume vessel

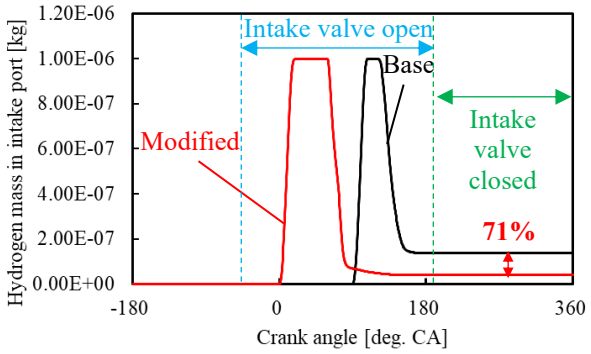

Fig. 2 Temporal variations of hydrogen mass in the intake port

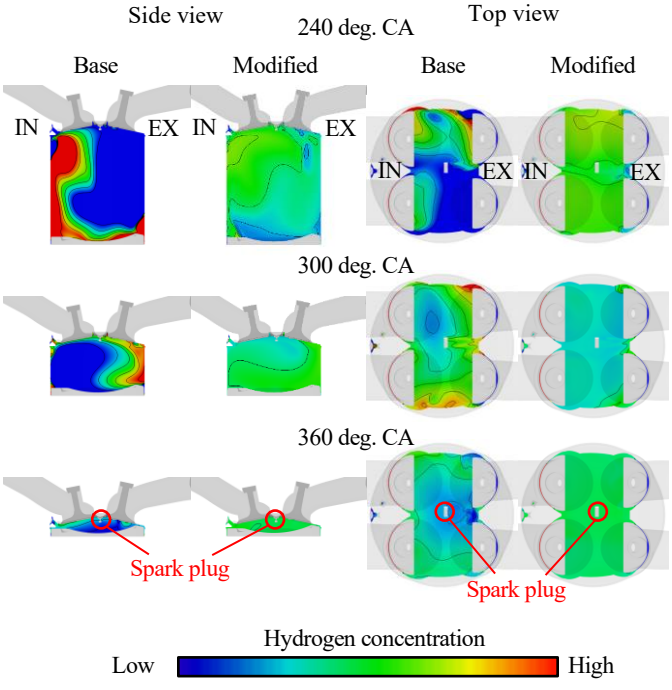

Fig. 3 Hydrogen concentration distribution