Two Stage Ammonia Combustion in a Gas Turbine like Combustor for Simultaneous NO and Unburnt Ammonia Reductions

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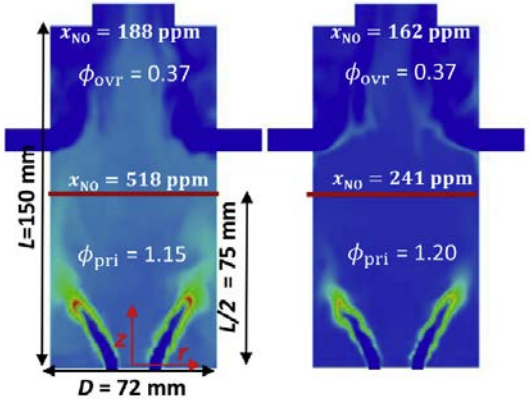
Background and objective

- We have studied the use of ammonia as for the use in gas turbine facility.

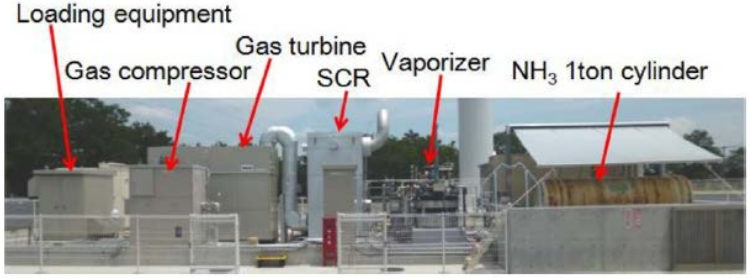
Numerical simulation



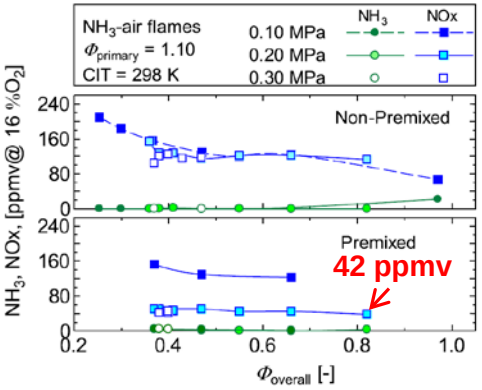
- 3D LES simulation with Miller's mechanism.
- Two stage combustion concept was proposed for the first time.

[1]K.D.K.A. Somarathne et al., IJHE, 2017.

Collaboration with AIST

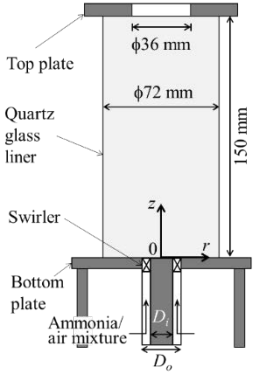


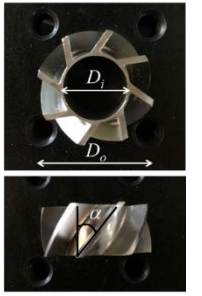
NH_3 gas turbine test facility at FREA.

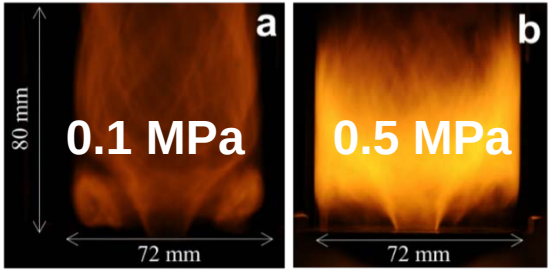


[2]O. Kurata et al., PROCI, 36, 2017.
[3]E.C Okafor et al, PROCI, 37, in press.

Model swirl burner







[4]A. Hayakawa et al., IJHE, 2017.
[5]A. Hayakawa et al., Proc. TFEC9, 2017.

Objective: confirm experimentally the two stage combustion concept using the model swirl burner.

Conclusions

- Reaction quenching of primary zone by secondary air injection may cause significant increase in unburnt NH_3 emission.
- Experimentally confirmed that potential of secondary air injection. The amount of NO can be reduced lower than the Japanese emission regulation (70 ppmv@16%O_2).
- The overall emission characteristics is drastically changed with the primary zone equivalence ratio, but overall equivalence ratio is less sensitive to the emission characteristics.

Acknowledgment

This study was supported by the Council for Science, Technology and Innovation (CSTI), the Cross-ministerial Strategic Innovation Promotion Program (SIP), “Energy carriers” (Funding Agency: the Japan Science and Technology Agency (JST))