Research topics for graduate students for 2023

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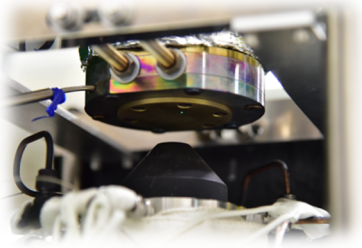
Acceptable course(s)

- Master's Degree
- Doctoral Degree

Research Topics

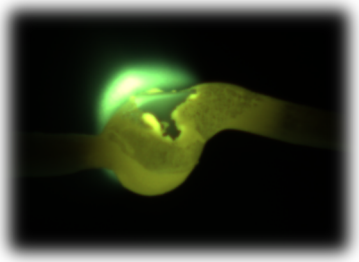
With a particular focus on efficiency improvements and reduction in environmental loading of the energy conversion process, we elucidate complicated reacting thermo-fluid phenomena involving homogeneous and heterogeneous chemical reactions simultaneously.

1. Cool flames for advanced combustion control



Cool flames are responsible for autoignition, knocking, and multi-ignition phenomena occurring in IC engines. Therefore, understanding their combustion characteristics and modeling the low-temperature chemistry are crucial issues to realizing high thermal efficiency with low-level pollutant emissions. We mainly focus on the elucidation of cool flame characteristics and wall chemical effects on the cool flame with the aid of advanced laser diagnostics and numerical simulations.

2. Clean energy conversion based on metal oxidation/reduction



Specific metals have attracted attention as a next-generation carbon-free energy due to their high volumetric energy density and recyclability. We focus on their potential not only as an energy carrier to realize the efficient energy conversion process but also as a medium for the reduction of CO_2 and H_2O to synthesize clean hydrocarbon fuels.

3. Ammonia as a hydrogen carrier and clean fuel

Ammonia is expected to be used as a hydrogen carrier, but its combustible nature allows direct use as a carbon-free fuel. Our focus is not only on the fundamental aspect of ammonia combustion and cracking (reforming) but also on resolving practical issues that arise when applying ammonia to industrial scenes such as gas turbines and furnaces.

Articles Related to Research Topics

[1] P. Feng et al., *Int. J. Hydrog. Energy* (2023). (in press) [DOI: 10.1016/j.ijhydene.2023.04.106]

[2] T. Mizuno et al., *Fuel*, **348**, 128587 (2023). [DOI: 10.1016/j.fuel.2023.128587]

[3] M. Lee et al., *Combust. Flame*, **231**, 111476 (2021). [DOI: 10.1016/j.combustflame.2021.111476]

Lab. Web page: http://www.mesl.t.u-tokyo.ac.jp