Hokkaido University Syllabus					
Course Title					
Combustion Science					
Subtitle					
Instructor (Institution)					
Osamu FUJITA (Faculty of Engineering)					
Other Instructors (Institution)					
Osamu FUJITA (Faculty of Engineering)					
Course Type				Open To Other Faculties / Schools	NG
Year	2019	Semester	2nd Semester (Winter Term)	Course Number	016014
Type of Class	Lecture	Number of Credits	2	Year of Eligible Students	3〜
Eligible Department / Class				Other Information	
Numbering Code	ENG_MISE 3530				
Major Category Code	Major Category Title				
ENG_MISE	Engineering_Mechanical and Intelligent System Engineering				
Level Code	Level				
3	General Education Courses offered in upper years; Specialized Subjects (advanced)				
Middle Category Code	Middle Category Title				
5					
Small Category Code	Small Category Title				
3					
Language Type					
Classes are in Japanese.					
Course list by the instructor with practical experiences					

Key Words

Fuel, combustion calculation, chemical reaction kinetics, chemical equilibrium, combustion phenomenology, combustion products, combustion equipment

Course Objectives

Combustion phenomena are effectively used in industrial many scenes such as automobile engines, jet engines, boilers, heating devices, etc. It is indispensable in our lives. On the other hand, it is also directly related to global warming, atmospheric environmental problems, energy problems. In this lecture, after understanding the fuel, combustion calculation, chemical reaction kinetics, chemical equilibrium, flame structure, etc., which are the basis for understanding combustion phenomena, students learn apparatuses using the combustion reaction, and mechanisms of environmental pollutant generation from combustion.

Course Goals

· Able to explain basic properties and characteristic values (combustible range, burning speed, etc.) related to combustion.
· Able to calculate the amount of air required for combustion, the amount of exhaust gas, and the composition of exhaust gas.
· Able to explain the concept of chemical reaction kinetics related to combustion.
· Able to understand the concept of chemical equilibrium and calculate equilibrium composition.
· Able to explain the concept of adiabatic flame temperature.
· Able to explain the basic structure of premixed flame and diffusion flame.
· Able to explain the basic generation mechanism of environmental pollutants.
· Able to explain the technical terms that people involved in combustion technology should know.

Course Schedule

1. Introduction (once)
Combustion science and its applications, environment and combustion
2. Fuel (once)
Fuel type: solid fuel, liquid fuel, gaseous fuel
3. Combustion fundamentals (4 times)
Combustion reaction equation, heat generation, combustion products
4. Combustion chemistry (3 times)
Elementary reaction, reaction kinetics, chemical equilibrium, flame temperature
5. Combustion phenomenology (3 times)
Ignition phenomenon and theory, mechanism of flame propagation, mechanism of flame stabilization, structure of turbulent flame, solid combustion, droplet burning, environmental pollutant generation mechanism
6. Combustion basic technology (twice)
Burner, flame holding technology, combustion promotion, combustion of a furnace, combustion of an engine, combustion of a gas turbine
7. Innovative combustion technology (once)
Catalytic combustion, high temperature air combustion, advanced combustion technology

Homework

Although preview is unnecessary, it is desirable to review the lecture after each lecture. During the period, there will be 5 reports about lecture content.

Grading System

Evaluation based on the results by the final exam. Those who attend less than 60%, will not have the qualifications to attend the exam. The test questions about (1) calculation on combustion chemistry, (2) combustion phenomenology, (3) fuel and combustion equipment, etc. In addition, the report submitted during the lecture, the score of each report is appropriately included in the final result. 90 points or higher: excellent, 80 or more: very good, 70 or more: good, 60 or more: fair.

Practical experience and utilization for classes

Condition of tasking the subject

Textbooks

Reading List

燃焼現象の基礎 / 新岡・河野・佐藤 : オーム社, 2001, ISBN:4-274-08713-1
燃焼工学　第３版 / 水谷幸夫 : 森北出版, 2001, ISBN:4-627-67023-0

Websites

http://www.combustionsociety.jp/
https://www.combustioninstitute.org/

Website of Laboratory

Additional Information

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