

NPRE 470 – Fuel Cells and Hydrogen Sources

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Hydrogen is proposed as the basis for a worldwide energy economy which can resolve current issues of supply and meet environmental requirements for a greener future. Though, to achieve this vision many obstacles must be overcome starting with a greenhouse free production method and development of a distribution infrastructure. This course will address key issues, including hydrogen production, transport, storage and uses, especially fuel cells. Lectures will cover hydrogen production by both nuclear and non-nuclear power sources, hydrogen handling and safety, transportation and storage methods from high pressure or cryogenic tanks to metal or chemical hydrides. The basic science and technology of fuel cells will be presented, including electrochemical processes, fuel cell thermodynamics, and various types of low- and high- temperature fuel cells designed for uses such as portable electronics, automotive and space power. The final exam includes a term paper and group presentation. Work will include 5 times of homework, 2 midterm exams, and an in-class team presentation as the final. Jr./Sr./Grad Level or instructor permission.

2024 Spring ; <https://courses.engr.illinois.edu/npre470/sp2024/web/NPRE-470.htm>

1. Course introduction
2. Introduction to Hydrogen Economy and Fuel Cell
3. Hydrogen Property and Production
4. Hydrogen Transportation
5. Hydrogen Conversion Technology : (I) Combustion
6. Hydrogen Conversion Technology : (II) Metal Hydrides and applications
7. Fuel Cell Introduction : Chapter 1. of Fuel cell fundamentals
8. Fuel Cell Thermodynamics : Chapter 2 of Fuel Cell Fundamentals
9. Fuel Cell Reaction Kinetics : Chapter 3 of Fuel Cell Fundamentals
10. Fuel Cell Charge Transport : Chapter 4 of Fuel Cell Fundamentals
11. Fuel Cell Types : Chapter 8 of Fuel Cell Fundamentals
12. Overview of Fuel Cell System : Chapter 10 of Fuel Cell Fundamentals
13. Fuel Cell Application - Stationary Applications, Mobile Device Applications, Wearable Power Pack, Transportation Applications

