

Course Name: Hydrogen Production: I. Methane steam reforming II. Electrolysis III. Biomass

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Objectives: The course "Hydrogen Production" aims to provide students with a comprehensive understanding of methane steam reforming, electrolysis, and biomass gasification for hydrogen generation. Students will learn about the principles, mechanisms, and operational aspects of each method. The course focuses on equipping students with the knowledge and skills to analyze, evaluate, and optimize hydrogen production processes for various applications, considering factors such as efficiency, environmental impact, and purification techniques.

Course Contents:

Introduction to Hydrogen Production: Importance and applications of hydrogen as an energy carrier, Overview of methane steam reforming, electrolysis, and biomass gasification

Methane Steam Reforming: Principles and mechanisms of methane steam reforming, Catalysts and reactor design for steam reforming, Process optimization and efficiency improvement, Environmental considerations and carbon capture

Electrolysis: Principles of electrolysis for hydrogen production, Alkaline, proton exchange membrane, and solid oxide electrolysis technologies, Electrolyzer design and operation, Power sources for electrolysis (renewables, grid electricity), Electrolysis efficiency and cost considerations

Biomass Gasification: Biomass gasification for hydrogen production, Thermochemical and biochemical pathways, Feedstock selection and preparation, Gasification reactor types and operation, Gas cleanup and hydrogen purification

Efficiency and Environmental Considerations: Evaluation of hydrogen production efficiency, Environmental impacts and mitigation strategies, Carbon capture and utilization in hydrogen production

Purification Techniques: Purification methods for obtaining high-purity hydrogen, Membrane separation, pressure swing adsorption, and other techniques

Applications of Hydrogen: Hydrogen utilization in transportation, power generation, and industry, Fuel cells and hydrogen storage technologies, Integration of hydrogen into existing energy systems

Optimization and Analysis: Analysis of hydrogen production processes, Evaluation of process efficiency and performance, Optimization techniques for enhanced hydrogen production

Reference Text books:

"Hydrogen Production and Remediation of Carbon and Pollutants" by E.E. Smolinski and S.J. Huang

"Hydrogen Energy: Economic and Social Challenges" by Yi Zhang

"Hydrogen Production: Processes, Technologies, and Economics" by A.S. Gokhale and A.K. Dalai