

DOE의 수소생산 연구 동향

한국에너지기술연구원

이승재

수소생산의 연구 동향을 살펴보기 위하여, DOE의 R&D 현황을 조사하여 보았다. 자세한 내용은 <http://www.eere.energy.gov/hydrogenandfuelcells/production/>을 참고하기 바란다. 또한 2004년의 Annual progress Report 중 수소 생성 관련 연구 제목들을 살펴보았다.

1. 화석연료 기반의 수소 생산 연구

Technology	Organizations	Project Focus
Distributed Reforming of Natural Gas and Liquid Fuels	Praxair	Oxygen transport membrane for reforming followed by hydrogen transport membrane shift reactor/Low-cost hydrogen production platform
	Air Products and Chemicals, Inc.	Hydrogen refueling station using advanced natural gas steam methane reforming technologies
	GE Global Research	Fuel-flexible autothermal reformer
	National Energy Technology Laboratory	Advanced water gas shift membrane reactors
	Innovatek	Novel catalytic fuel reforming
	Startech Environmental	Plasma gasification and ceramic membrane hydrogen separation
Separations	Sandia National Laboratories	Defect-free thin film membranes for hydrogen separation
	Oakridge National Laboratory	Transport membrane development/Porous support tube fabrication
	Los Alamos	Microstructured membrane development

	National Laboratory	
Centralized Hydrogen from Coal or Natural Gas	DOE Fossil Energy Office (FE)	Central natural gas reforming, coal gasification, carbon sequestration
	EERE in collaboration with FE	Advanced technologies for reforming natural gas and producer gas, shift technology, and separations and purification

2. 생물학적 기반의 수소 생성 연구

Technology	Organizations	Project Focus
Hydrogen production from biomass	National Renewable Energy Laboratory	Biomass pyrolysis followed by reforming of the resulting bio-oil
	Iowa State University	Indirectly heated gasification system to convert switchgrass into hydrogen
	Pacific Northwest National Laboratory	Aqueous phase biomass gasification

3. 전기적 수소 생산 연구

Technology	Organizations	Project Focus
Hydrogen production from water via electrolysis	National Renewable Energy Laboratory	Renewable electrolysis integrated system development
	Idaho National Engineering and Environmental Laboratory	Improved methods for producing hydrogen via electrolysis
	Teledyne; Proton Energy Systems	Hydrogen generation from electrolysis
	Sandia National Laboratory	High-efficiency electrolysis materials
	Giner Electrochemical Systems	Low-cost, high-pressure hydrogen generator

4. 태양광을 이용한 수소 생산 연구

Technology	Organizations	Project Focus
Photobiological production of hydrogen	National Renewable Energy Laboratory	New strains of algae/systems with improved oxygen tolerance/Reactor design and development
	UC Berkeley	New strains of algae with improved electron transport
	Oak Ridge National Laboratory	New strains of algae with improved solar conversion efficiency (truncated Chl antenna size)
Photoelectrochemical production of hydrogens	National Renewable Energy Laboratory; University of Hawaii	Development of durable and cost-effective photoelectrochemical hydrogen production systems
	UC Santa Barbara; SRI International	High-throughput analysis to identify candidate materials for further study

5. 고온에서의 수소 생산 연구

Technology	Organizations	Project Focus
High-temperature (700°-1000°C) thermochemical water splitting	University of Nevada, Las Vegas	Thermocatalytic decomposition of natural gas; high-temperature thermochemical water-splitting cycles
	DOE Office of Nuclear Energy, Science, and Technology	Initial research on high-temperature thermochemical production of hydrogen

6. 2004 Annual Progress Report

A. Distributed Production Technologies

- Ceramic Membrane Reactor Systems for Converting Natural Gas to Hydrogen and Synthesis Gas (ITM Syngas), Christopher Chen, Air Products

- Integrated Ceramic Membrane System for Hydrogen Production, Joseph Schwartz, Praxair
 - Low Cost Hydrogen Production Platform, Tim Aaron, Praxair
 - Autothermal Cyclic Reforming Based Hydrogen Generating and Dispensing System, Ravi Kumar, GE Energy
 - Novel Catalytic Fuel Reforming, Patricia Irving, InnovaTek
 - Water-Gas Shift Membrane Reactor Studies, Richard Killmeyer, NETL
 - Hydrogen Production from Biomass Reformation, David King, PNNL
- B. Biomass Gasification/Pyrolysis
- Hydrogen from Biomass: Catalytic Reforming of Pyrolysis Vapors, Bob Evans, NREL
 - Startech Hydrogen Production (New Project), David Lynch, Startech Environmental Corporation
- C. Photobiological Production
- Maximizing Photosynthetic Efficiencies and Hydrogen Production in Microalgal Cultures, Tasios Melis, UC Berkeley
 - Biological Systems for Hydrogen Photoproduction, Maria Ghirardi, NREL
 - Algal H₂ Production Systems: Creation of Designer Alga for Efficient and Robust Production of H₂, James Lee, ORNL
 - Hydrogen Reactor Development and Design for Photofermentation and Photolytic Processes, Dan Blake, NREL
- D. Photoelectrochemical Production
- Photoelectrochemical Systems for H₂ Production, John Turner, NREL
 - Photoelectrochemical Hydrogen Production Program, Eric Miller, University of Hawaii
 - Discovery of Photocatalysts for Hydrogen Production, Brent MacQueen, SRI International
 - Photoelectrochemical Hydrogen Production Using New Combinatorial Chemistry Derived Materials, Eric McFarland, U of California Santa Barbara
- E. Electrolysis
- High Temperature Solid Oxide Electrolyzer System, Steve Herring, INEEL
 - Renewable Electrolysis Integrated System Development and Testing, Carolyn Elam, NREL
 - Alkaline, High Pressure Electrolysis, Steve Cohen, Teledyne
 - Hydrogen Production - Increasing the Efficiency of Water Electrolysis, David Ingersoll, SNL

- Low-Cost, High-Pressure Hydrogen Generator, Cecelia Cropley, Giner Electrochemical
- Hydrogen Generation from Electrolysis, Stephen Porter, Proton Energy Systems

F. High-Temperature Thermochemical Processes

- High Efficiency Generation of Hydrogen Using Solar Thermochemical Splitting of Water, Bob Perret, Univ. of Nevada