

A2-4

Development of high-efficient photoelectrochemical system for hydrogen production

A photoelectrochemical cell(PEC) is consisted of the photoelectrodes absorbing solar light, catalytic films improving reaction rate, and membrane separating O₂ & H₂ produced in the cell. In this research, the system fabrication of the PEC will be optimized to produce hydrogen efficiently from water.

- PEC fabrication using photoelectrode being active and stable in aqueous solution.
- Selection of catalytic films to replace Pt mesh for H₂ production.
- Selection of catalytic films to reduce the overpotential for O₂ production.
- PEC fabrication using CIGS photoelectrode and the evaluation of the cell

Goal

Development of photoelectrode for photoelectrochemical cell and the fabrication of high-efficient PEC system using the photoelectrode to produce H₂: target efficiency in STH(solar to hydrogen) is 5%.

- Development and optimization of element technologies for PEC system
 - Fabrication of PEC using high-efficient photoelectrode and measurement of H₂
 - Coating of Pt on several substrates and establishing stability for 1000 hr.
 - Producing oxide thin films and establishing stability for 1000 hr.
- Evaluation of the PEC performance
 - Measuring H₂ production using Wet-test meter in an electrolyte at room temperature

Objective

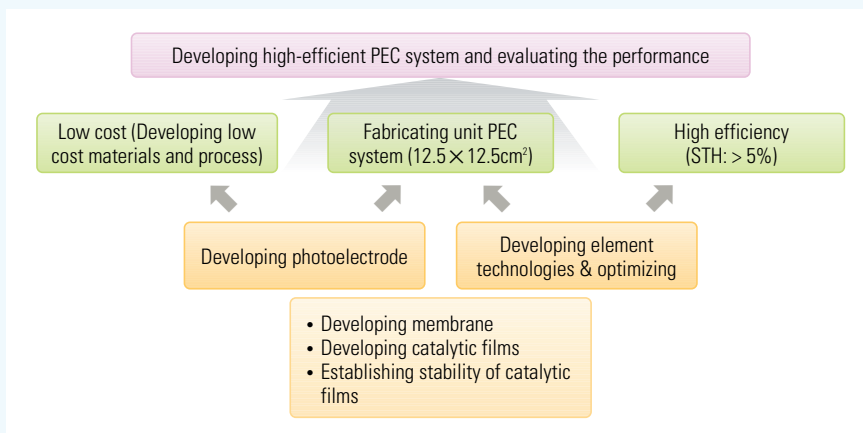
- 1st year
 - Development of element technologies for an unit PEC system (12.5 x 12.5 cm²).
 - Production of catalytic films for H₂ and O₂ production.
 - Development of the paste for CIGS photoelectrode.
- 2nd year
 - Improvement of the performance for catalytic films and membrane.
 - Establishment of the stability during 1000 hr for catalytic films.
 - Development of heat treatment increasing the particle size of CIGS.
- 3rd year
 - Fabrication of unit PEC system(12.5 x 12.5 cm²) using high-efficient photoelectrode
 - Optimization of the thickness for the unit PEC system.
 - Production of the CIGS photoelectrode and fabrication of the unit PEC system.
- 4th year
 - Fabricating unit PEC system(12.5 x 12.5 cm²) and evaluating the performance.
 - Optimizing the performance of the catalytic films.
 - Developing element technologies for CIGS photoelectrode.



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Strategy



Outcomes & benefits

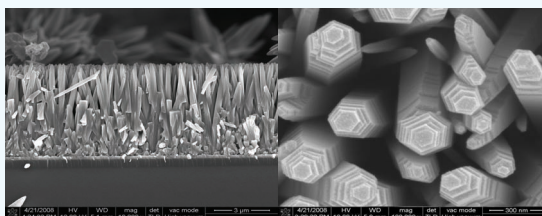
- Establishing technical foundation of PEC system.
- Establishing landmark of hydrogen production technology on the technology roadmap in Korea
- Expecting synergy effects between PEC system and solar cell technology.
- Technology protection for high efficient PEC system for H₂ production.
- Developing a system of electric generation linking with fuel cell.

Publications (2nd stage)

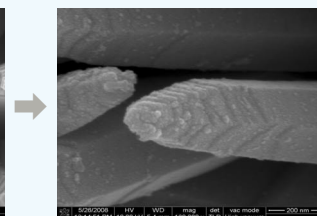
Patent		Theses							Proceedings		
		domestic			foreign			total sum			
domestic	foreign	SCI	Non SCI	sum	SCI	Non SCI	sum		domestic	foreign	sum
2/8	2/0		1	1	15	2	17	18	8	8	

■ Publications

1. "Electrodeposition of photoactive 1D gallium selenide quantum dots", Electrochimica Acta, 54, 829, 2008
2. Oh-shim Joo, Byoung Koun Min, Kwang Deog Jung, Jun-haeng Lee, "PREPARATION OF THIN FILM FOR SOLAR CELL" 12/261,566



ZnO nanorod



QD CdSe/ZnO nanorod