A2
Development of hydrogen production technology by photoelectrochemical water splitting

This project aims at development of hydrogen production technology by photoelectrochemical water splitting with 5% solar-to-hydrogen(STH) efficiency under AM 1.5 solar irradiation.

- Development of oxide and composite photocatalysts for photoelectrochemical cell with high efficiency (Development of computational design & synthesis methods for highly efficient H_2 production photoelectrode materials)
- Development of large-scale photoelectrode, bias-power, water splitting system, using solar light
- Development of system configuration and element PEC system

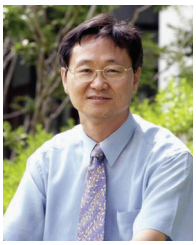
Goal

Development of hydrogen production technology by photoelectrochemical water splitting with 5% STH efficiency under AM 1.5G

- Development of oxide and composite photocatalysts for PEC cell with high efficiency
  - Design and synthesis of composite photocatalyst materials for PEC cell
  - Development of 1-D nanostructured electrode for PEC cell
  - Development of TiO_2-dye sensitizer composite under visible light
  - Establishment of preparation techniques of photoelectrode
- Development of computational design & synthesis methods for highly efficient H_2 production photoelectrode materials
  - Optimization of material synthesis via study of structure-photocatalytic activity corelation
  - Development of synthesis method for photoelectrode material synthesis with high efficiency
  - Development of design method for photocatalyst synthesis and photocatlyst-substrate interaction
  - Enhancement of novel photocatalyst
- Development of large-scale photoelectrode, bias-power, water splitting system, using solar light
  - Development of photoelectrode lamination technique
  - Development of large-scale(photoelectrode)
- Development of system configuration and element PEC system
  - Establishment of long-term stability via study of catalyst synthesis and stability
  - Establishment of cell configuration and flow path for system optimization
  - Evaluation of PEC performance

Objective

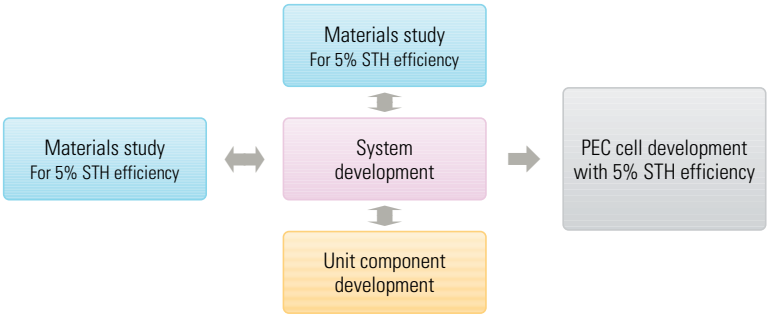
- 1st year
  - Design and synthesis of composite photocatalyst materials for PEC cell
  - Development of photoelectrode preparation method
  - Development of nanocrystal synthesis and its paste for photoelectrode preparation
- 2nd year
  - Establishment of high efficiency via photocatalyst modification
  - Development of design for electrode interface model



Jae Sung Lee
Eco-friendly Catalyst and Energy Laboratory,
Department of Chemical Engineering
POSTECH
E-mail : jlee@postech.ac.kr
Participants : POSTECH, KRICT, KIST, KERI, Sejong Univ., KBSI, Sungkyunkwan Univ., Kangwan Univ.
Researchers : 56 persons (National Institute 28, Univ. 28)

- 3rd year
  - Establishment of photoelectrode preparation and its stability
  - Developement of photoelectrode lamination method
- 4th year
  - Scale up photoelectrode for PEC cell
  - Preparation of proto-type PEC cell

Strategy



Outcomes & benefits

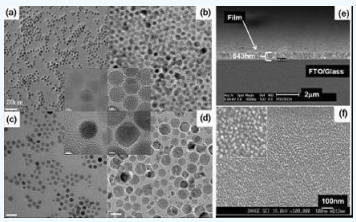
- Establishment of hydrogen production process using photocatalyst with 5% STH efficiency
- Establishment of basic technology and industrialization
- Foundation of technology to economical hydrogen production for hydrogen society
- Possible spin-off of visible light photocatalytic materials for environmental applications

Publications (2nd stage)

Patent		Theses							Proceedings		
		domestic			foreign			total sum			
domestic	foreign	SCI	Non SCI	sum	SCI	Non SCI	sum		domestic	foreign	sum
5/12	2/0	11	4	15	68	4	72	87	84	82	166

- Publications

1. P.H.Borse, H. Jun, S.H. Choi, S.J. Hong, J.S. Lee,: "Phase and photoelectrochemical behavior of solution-processed Fe_2O_3 nanocrystals for oxidation of water under solar light", Appl. Phys. Lett., 93, 173103, 2008
2. J.S. Jang, C.J. Yu, S.H. Choi, S.M. Ji, E.S Kim, J.S. Lee, "Topotactic Synthesis of Mesoporous ZnS and ZnO Nanoplates and Their Photocatalytic Activity", J. Catal., 254(11). 2008



SEM images of synthesized 0-D Fe_2O_3 nanocrystal and its photoelectrode