A2-1
Development of oxide and composite photocatalysts for photoelectrochemical cell with high efficiency

This project aims at development of oxide and composite photocatalysts for PEC cell with 5% solar-to-hydrogen(STH) efficiency under AM 1.5 solar irradiation. The scope of work includes
- Selection of optimized material for PEC application
- Structure and morphology control of the selected photocatalyst materials to fabricate 1D nanostructure for efficient water splitting
- Establishment of long-term stability and preparation techniques of electrode for scale-up
- Establishment of hydrogen production techniques using photoelectrochemical cell

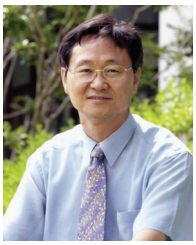
Goal

Development of photocatalyst materials for photoelectrochemical cell with 5% STH efficiency under AM 1.5G

- Development of photocatalyst materials for PEC application
  - Design and synthesis of 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
- Preparation of proto-type PEC cell and establishment of long term stability
  - Common project collaboration

Objective

- 1st year
  - Design and screening of novel photocatalyst
  - Development of composite photocatalyst materials
  - Synthesis of 1-D nanostrucutred Fe_2O_3 electrode
  - Synthesis of photosensitizers with high efficiency and good stability
- 2nd year
  - Synthesis and optimization of novel photocatalyst
  - Development of p/n junction technology with synthesized photocatalysts
  - Optimization and modification of 1-D nanostructured Fe_2O_3
  - Fabrication of photosensitizer/TiO_2 composite
- 3rd year
  - Fabrication of photoelectrode with synthesized photocatalysts
  - Evaluation of photoelectrochemical properties with photoelectrode
  - Establishment of long term stability of photoelectrode
  - Establishment of essential techniques for scale up of PEC cell
- 4th year
  - Scale up photoelectrode for PEC cell (collaboration project)
  - Preparation of proto-type PEC cell (collaboration project)



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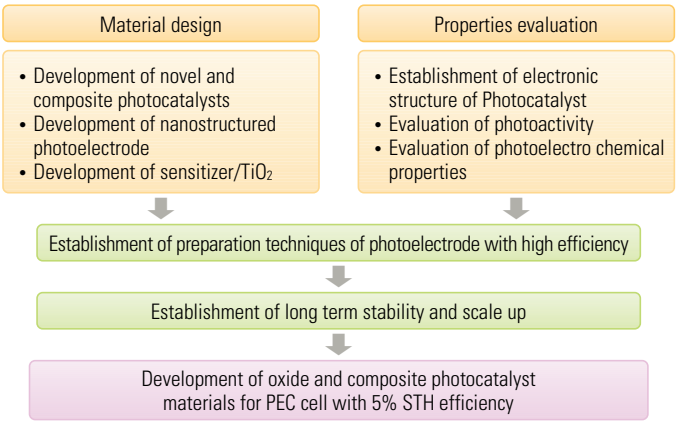
Strategy



Outcomes & benefits

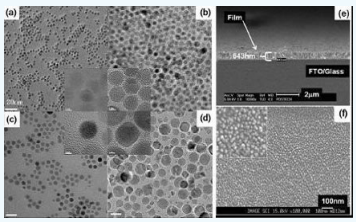
- Establishment of hydrogen production process using photocatalyst with 5% STH efficiency
- Establishment of basic technology and industrialization
- Acquisition of photocatalyst-design technique on molecular level
- Technical foundation for economical hydrogen production for hydrogen society
- Possible 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		5	29	2	31	36	25	23	48

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