International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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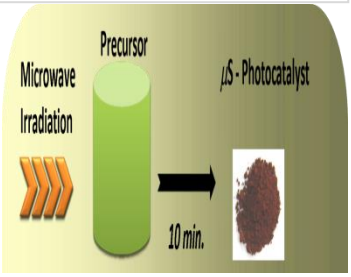
Solar Hydrogen Generating Nanostructures Photocatalyst

Overview

Low cost and eco-friendly solar active photocatalytic material is highly desirable for generating hydrogen fuels. Nanostructured ferrite (Fe_2O_3, MFe_2O_4) and composite systems are potential candidates which gives high yield from water splitting. Titanates (TiO2) lack the ability to absorb the visible light photons and hence there is need to identify and develop efficient photocatalysts. Fe_2O_3 and II-VI metal chalcogenide (CdS, CdZnS) systems exhibit ability to absorb solar light photons as well as proper band energetics to split water molecule. They can be used in slurry type solar hydrogen generator.

Key Features

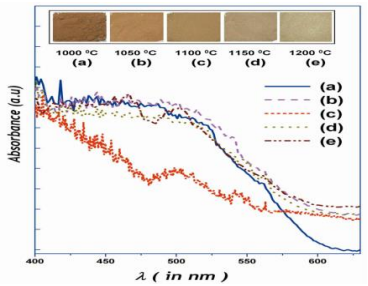
- Eco-friendly photocatalyst
- Rapid process to synthesize nanocrystalline photocatalyst
- Scalable process



Schematic of rapid photocatalyst synthesis produced by microwave sintering

Potential Applications

- Solar Hydrogen generator, Fuel gas-*cooking, cutting, welding*
- Optical material for absorber, photo-chromic display, optical sensor
- Photo-decomposition- Pollutant removal , water purification



Optical response of Visible light active photocatalysts

Technology Readiness Level (TRL): 4

- Performance is validated at laboratory scale
- Improved efficiency

IPDI*	1	2	3	4	5	6	7	8	9	10
Activities	*Basic concepts and understanding of underlying scientific principles*	*Short listing possible applications*	*Research to prove technical feasibility for targeted application*	*Coupon level testing in stimulated conditions*	*Check repeatability/ consistency at coupon level*	*Prototype testing in real-life conditions*	*Check repeatability/ consistency at prototype level*	*Reassessing feasibility (IP, competition technology, commercial)*	*Initiate technology transfer*	*Support in stabilizing production*
Status										

IPDI : Intellectual Property Development Indices

Major Patents / Publications

1. Dom, R., Kim H.G. and., **Borse, P.H**, Photo Chemical Hydrogen Generation from Orthorhombic $CaFe_2O_4$ Nanoparticles Synthesized by Different Methods , Chemistry Select 2017; 2 (8), 2556-2564
2. Dom, R, Chary, AS , **Borse, PH**. Solar hydrogen generation from spinel $ZnFe_2O_4$ photocatalyst: Effect of synthesis methods. INTERNATIONAL JOURNAL OF ENERGY RESEARCH 2015;39(10):1378-1390
3. **Borse** PH et.al.. Synthesis of a hydrogen producing nanocrystalline $ZnFe_2O_4$ visible light photocatalyst using a rapid microwave irradiation method. RSC Advances 2012;2(33):12782-91
4. **Borse** PH, et al.. Fabrication of $CaFe_2O_4/MgFe_2O_4$ bulk heterojunction for enhanced visible light photocatalysis. Chemical Communications 2009(39):5889-91

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