IDCOL R&D Initiatives

Community Based Decentralized DC Nanogrids for Combined Household and Productive Use

R&D institute

Centre for Energy Research, United International University

Achievement

This project received worldwide recognition and acclamation from many renowned international bodies. It was Winner of the 2016 Intersolar Award – "Outstanding Solar Project". This project also won the 2016 UN Momentum for Change Award as the first Bangladeshi institution.

Objective

- ✓ Integration of local generation and storage of SHSs
- ✓ Allowing electricity sharing through bi-directional power flows
- ✓ Allowing an efficient use of generation and storage

Outcome

In the framework of this R&D project, different topologies of solar powered smart DC nanogrids have been developed and piloted in rural Bangladesh. The project owes its innovative character due to the following achievements:

- A comparative assessment has been performed of three different topologies, namely

  a) Central storage and generation couple with smart supply and demand response system

  b) Central storage and generation in interconnected nanogrids

  c) Decentralized storage and generation in peer-to-peer bottom-up nanogrids.

- A new Pay-As-You-Go and (PAYG) and Cash-In-As-You-Go (CAYG) technology has been successfully tested within the nanogrids.
- Higher power DC appliances like water pumps and rice hullers have been successfully incorporated into SHS-based low voltage nanogrids.

For detailed project report, click here.

Addressing the energy consumption issues of electrically assisted rickshaw-vans using torque sensor based assist

R&D institute

Control and Applications Research Centre (CARC), BRAC University, Dhaka

BRAC University was awarded a contract to conduct a one year long pilot project to provide a complete off-grid solution for power conversion for electric rickshaw-vans with PV panel and torque sensor paddle. The project completed in time and final report was submitted to IDCOL.

Objective

To evaluate:

- ✓ Feasibility and applicability of the developed technology
- ✓ Performance of the designed systems
- ✓ Socio-economic impact
- ✓ Impact on the national grid

Outcome

- 15 Units of solar powered vehicles are developed under the R&D Project. The vehicles are field tested and their performances are analyzed.
- Socio-economic analysis is done extensively to understand the future market production of these products in both local and global market.
- A business model is developed that uses the concept of the already successfully

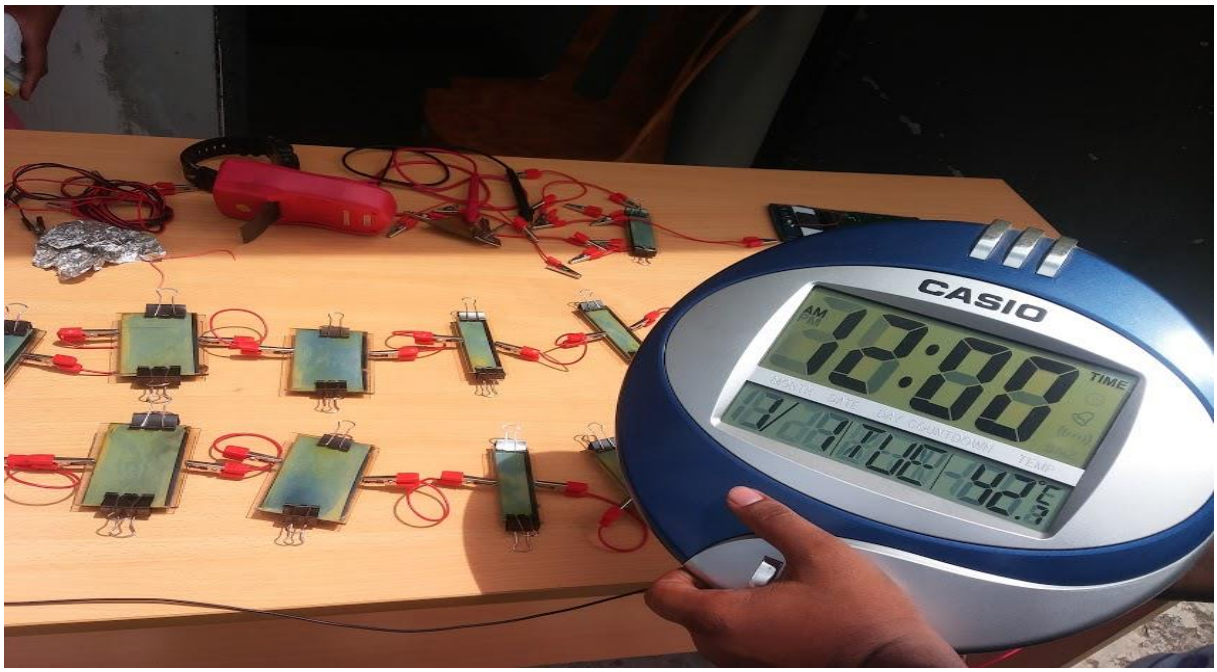
implemented project of solar home system in Bangladesh. Thus, despite having seemingly high cost initially, the payback calculations prove to be of greater advantage for the rural people.

For detailed project report, click here.

Fabrication and Characterization of Dye Sensitized Solar Cell (DSSC) Using Natural Dye and its Impact in Bangladesh

R&D institute

Institute of Polymer & Radiation Technology, Atomic Energy Research Establishment, Bangladesh Atomic Energy Commission



IDCOL awarded a contract to Atomic Energy Research Establishment, Bangladesh Atomic Energy Commission to produce solar panel using local technology and resources.

Objective

The project was meant to produce solar panel using local technology and resources by:

- ✓ Preparing natural dye absorbed TiO_2 coating based solar cell and characterizing the films to test the compatibility to use as solar cell.
- ✓ Identifying locally available natural dyes to increase the photoelectric performance.
- ✓ Exploring suitable solvent for extracting dye and purification of these days.
- ✓ Separating the dyes and compare the cell performance with crude extract.
- ✓ Optimizing the thickness and annealing temperature of electrode for the best photoelectric performance.
- ✓ Find out suitable low cost carbon catalyst for counter electrode.
- ✓ Incorporation of other conductive nanoparticles e.g. carbon nanotube to maximize the cell efficiency.

Outcome

- The energy conversion efficiency of the fabricated cell was analyzed by varying different parameters. The TiO_2 coating

thickness and annealing temperature was also optimized.

- Best thickness and temperature were found 12-17 μm and 450°C respectively.
- Promising impact of gamma radiation for semiconductor band gap engineering was magnificently optimized.
- As natural sensitizers viz. red amaranth, carrot, pomegranates, turmeric, beet root, water melon, mango seed kernel, berry seed, etc. were tested.
- In the present condition 25cm^2 prepared cell sample has equal energy conversion ability of 1.5V dry cell.

For detailed project report, click here.

Solar Hydrogen Production via Water Splitting Using Locally Synthesized Nanoparticles as a Photocatalyst

R&D institute

Department of Physics, Bangladesh University of Engineering and Technology (BUET)

IDCOL awarded a contract to Bangladesh University of Engineering and Technology to conduct a research and development project on Hydrogen fuel production from water by solar irradiation

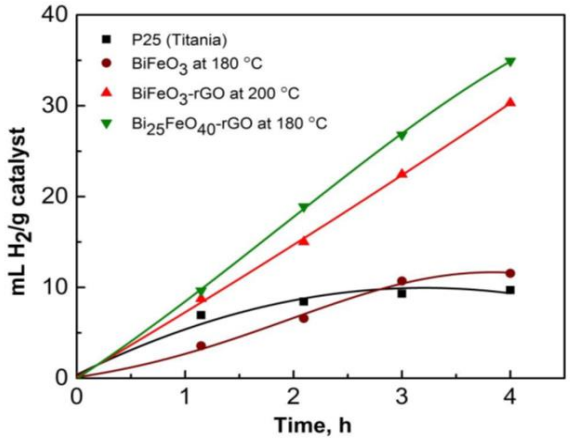


Figure: Volume versus time graph showing the volume of hydrogen evolved during the photocatalytic splitting water.

Objective

The main objectives of this research project were as follows:

- ✓ To synthesize and characterize multiferroic nanoparticles to enhance their photocatalytic activity.
- ✓ To produce hydrogen by photocatalytic decomposition of water under ultraviolet–visible light irradiation using the synthesized nanoparticles as photocatalysts. The product hydrogen will be a good alternate fuel and can be used for power generation.

Outcome

- The rare earth element Gd was doped for improving the property of BFO but in hydrothermal process BFO itself shows improved property and after doping Gd the property of BFO were actually deteriorated at reaction temperature 160 °C.
- In the case of nanocomposite materials, both sillenite and perovskite phase bismuth ferrite reduced graphene oxide nanocomposites were successfully formed using a low cost hydrothermal process at reaction temperatures of 180°C and 200°C respectively. Such a phase transition can be useful for the formation of nanocomposites of graphene with either perovskite or sillenite phase of bismuth ferrites as desired.
- The obtained results bear significance since it provides a means of selective phase formation of bismuth ferrites while

forming composites with rGO by simply tweaking the temperature by 20°C. The magnetic properties of the synthesized nanocomposites were notably increased compared to that of pure BiFeO3.

- The lower bandgap of the composite would be able to generate higher number of e--h+ pairs and might be useful in photocatalytic experiments.
- The improved photodegradation activity toward Rhodamine B is attributed to the structural characteristics of sillenite type Bi25FeO40 and the great charge mobility of rGO, which retard the recombination of photoexcited pairs.
- The synthesized nanocomposites are particularly useful for solar hydrogen production via water splitting. In case of pure $BiFeO_3$, doping of expensive rare-earth elements like Gd is required for improved properties. However, the synthesized composites demonstrate enhancements of their properties without addition of such a dopant.

For detailed project report, click here