IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Artifical Leaf for Hydrogen Generation from Waste water**	
Project Number	**IMURA0468**	
Monash Main Supervisor (Name, Email Id, Phone)	Associate Professor Xiwang Zhang xiwang.zhang@monash.edu	*Full name, Email*
Monash Co-supervisor(s) (Name, Email Id, Phone)	Dr Gita Pendharkar <gita.pendharkar@monash.edu>	
Monash Department:	Department of Chemical Engineering	
IITB Main Supervisor (Name, Email Id, Phone)	Siddhartha Prakash Duttagupta, sdgupta@ee.iitb.ac.in,sid_duttagupta@yahoo.com,	*Full name, Email*
IITB Co-supervisor(s) (Name, Email Id, Phone)	Arindam Sarkar, sarkara7.ut@gmail.com, Sanjay Mahajani, mahajani.sanjay@gmail.com,	
IITB Department:	Electrical Engineering, Chemical Engineering	

Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?
(*Feel free to nominate more than one. For more information, see www.iitbmonash.org)*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

In India both water availability and water quality are questions that need resolving. The focus is on zero-discharge systems whereby waste water is re-cycled and re-used. The key issue is development of robust, cost-effective processes for waste water re-use. The proposed artificial leaf is a nano-bi-layer catalyst coated solar photovoltaic cell which generates hydrogen (and oxygen) by splitting (waste) water using photo-electro-chemical (PEC) pathways. The above can be recombined using a fuel cell to generate energy and create (pure) water. The PEC process mimics photosynthesis activity within a natural leaf that converts photon energy into chemical energy by splitting water.

Project aims

1. Develop thin film semiconductor based solar photovoltaic cells.
2. Develop cost effective photocatalysts for hydrogen (and oxyden) generation from synthetic waste water
3. Develop micro fuel cell for regeneration of pure water based on hydrogen/oxygen supply from (2)

Expected outcomes

1. Optmized materials, structures, devices and systems for waste water recycling.
2. Test platforms for in-situ process monitoring.

3. Compact system models to help resolve scaling up challenge (large area, high volume).
4. Documentation and dissemination of research results through multiple media.

How will the project address the Goals of the above Themes?

1. Nano metal catalyst design- efficient, robust, scalable (large area).
2. Photo electro chemical pathways optimized for hydrogen/oxygen generation.
3. Hydrogen buffer designed for energy storage application
4. System integration (coupled photovoltaic, photoelectrochemical cell) for cost-effective wastewater recycling

Capabilities and Degrees Required

1. M.E./M.Tech in Engineering.
2. Strong interest in experimental work.
3. Strong interest in development of computational models.
4. Prior experience in areas relevant to project (electrochemistry, optics/optoelectronics) will be given preference.

Potential Collaborators

Prof. Raman Singh and Prof Gita Pendharkar