



“EG Ramachandran Institute Chair Professorship”

Report

Date: 10th Sep 2020



Broad Bio



Introduction of the Chair Occupant:

Name: Prof. S. Ramaprabhu

Designation: EG Ramachandran Institute Chair Professor (April 2016 –June 2020)

Present: Emeritus Professor

Education Background:

Year	Degree	University/Institution
1984	Ph.D.	IITM
1977	M.Sc.	MADRAS
1975	B.Sc.	MADRAS



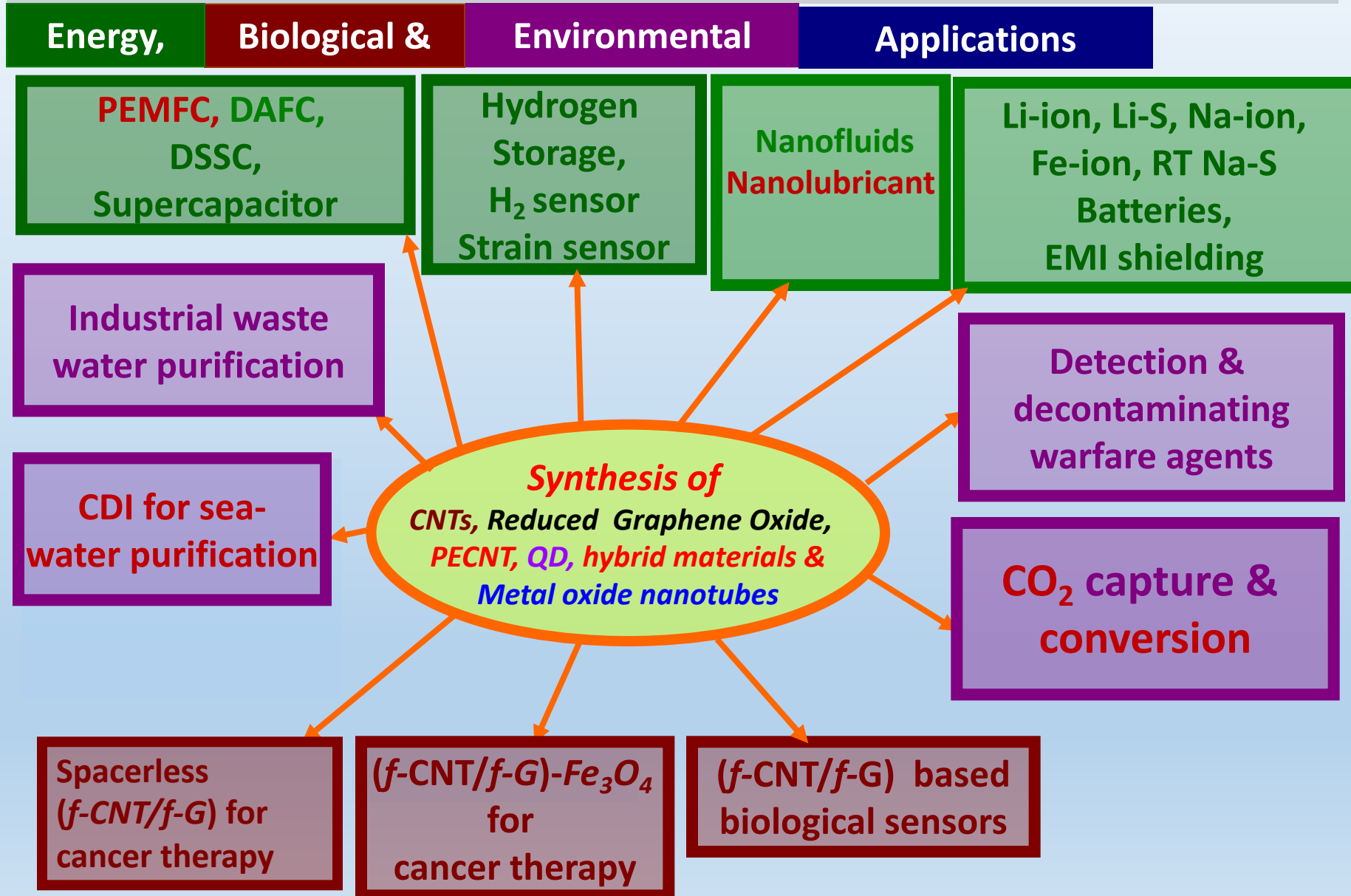
Brief about experience

Year(s)	University/Institution	Position held
June 1984 - June 1986	IIT, Madras	Post doctoral fellow
Nov 1986 - Feb 1989	Technische Universitat, Darmstadt, Germany	Alexander von Humboldt fellow
March 1989 - Sep 1993	University of Geneva, Switzerland	Post doctoral fellow
Oct 1993 - Aug 2000	IIT, Madras	Assistant Professor
Sep 2000 - Jan 2004	IIT, Madras	Associate Professor
Jan 2004 - March 2016	IIT, Madras	Professor
April 2016 –June 2020	IIT, Madras	EG Ramachandran Institute Chair Professor
July 2020-Present	IIT, Madras	Professor Emeritus

Link to you webpage: <http://www.physics.iitm.ac.in/~ramp>

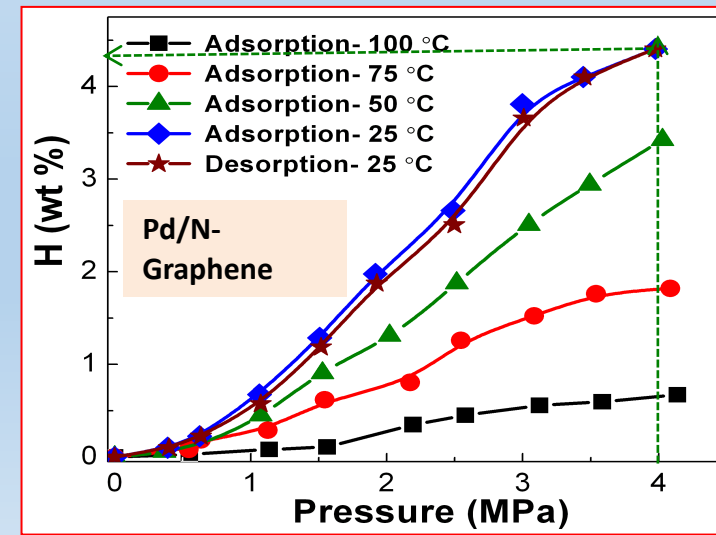
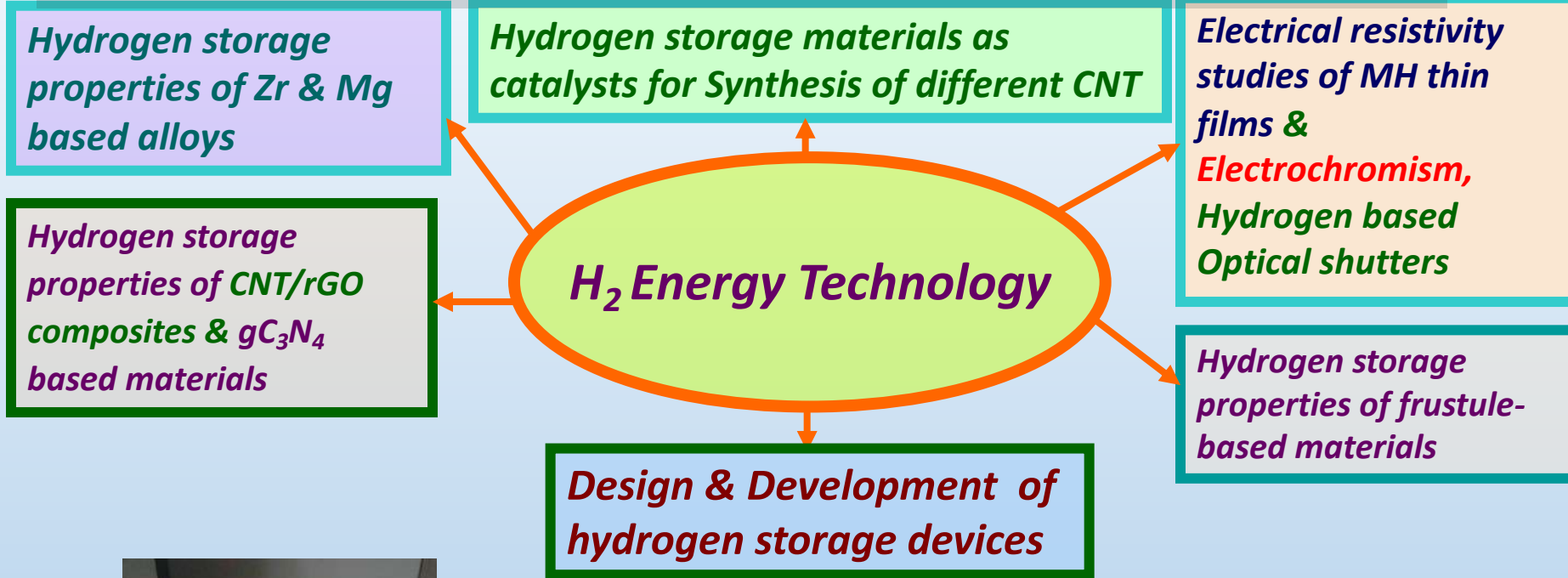
Broad Area of Research

Alternative Energy and Nanotechnology Laboratory (Physics)



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Alternative Energy and Nanotechnology Laboratory (Physics)





Specific Research Areas and Motivation

- ❖ Development of *large-scale synthesis techniques* for **CNT, Graphene**.
- ❖ Development of new concept on improving the cycle life of **Li ion and Li S & Li O₂ batteries**.
- ❖ Development of efficient cost-effective energy storage technologies like **Na ion, Na S, Fe ion** and **Al ion batteries**.
- ❖ Energy conversion and storage devices like **Fuel Cell** and **Hydrogen storage**.
- ❖ Development of nanostructured materials for **Nanofluids** and **Nanolubricants**.
- ❖ Design of **Strain sensors, gas sensors** and **Biosensors**.



Contribution to the societal problems

- Li ion battery is currently used in all portable electronic devices and are reaching the **market of electric vehicles**, but Li resources are limited.
 - Developed a *new battery technology* from *Iron*, a globally abundant element.
 - Developed *Na ion battery* electrode materials and *polymer electrolytes* for *high energy density* and *safer battery*.
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- ❖ *One of the challenges of **high cost of PEMFC (electrocatalyst)** is addressed; attained a 3-fold enhancement in performance of indigenously developed electrocatalyst.*
 - ❖ *By a **unique CDI technique, purification of seawater & industrial wastewater** is demonstrated.*

Research impact



- Developed ***Fe ion battery*** exhibits a reversible specific capacity of 200 mAh g⁻¹ and an average discharge voltage of 1.1 V and an **energy density of ~220 Wh kg⁻¹**. Considering the factor of weight and energy density, Iron ion battery can be a ***replacement to Lead acid battery***.
- *Developed **RT safer Na-S battery** with low self discharge and safety, as compared to molten type Na-S battery.*
- Developed a ***prototype cell with low-cost ionic liquid-based nanomaterials for capture and conversion of CO₂ into formic acid with the release of O₂*** by a novel ***photoelectrochemical technique***.

Students contributions (who were involved in Research from 2016)



- **Dr. Madhumita Sahoo** graduated with her Ph.D in 2016, she was a 'Research associate' at the University of Manchester, UK. Her research interests are proton exchange membrane fuel cells and Li-ion batteries.
- **Dr. Ashok P** graduated with his Ph.D in 2017 and his area of research is focused on heteroatom doped nancarbon supported noble and non- noble metal as cathode catalyst for polymer electrolyte membrane fuel cell.
- **Dr.Divya N** graduated with her Ph.D. in 2017, she is currently working as a 'Research Associate' at the Indian Institute of Science Education and Research, Pune. Her research interests are solar cells, fuel cell electrocatalysts and transport properties of graphene
- **Dr. Rashmi Chandrabhan Shende** graduated with her Ph.D. in 2017. She is working as a 'postdoctoral research associate' at IIT Bombay, Mumbai. Her research interests are nanofluid, nanolubrication, supercapacitors and rechargeable batteries.
- **Ms. Sneha Sruthi V** graduated with her M.S. degree in 2017. She is working as a 'Research Engineer' at Gypsum, Saint-Gobain India Pvt. Ltd.- R&D, Chennai. Her research interests are carbon nanomaterials and nanolubrication.
- **Dr. A.S. Asalatha** graduated with her Ph.D. in 2018, she is currently working as a 'project officer' at IIT Madras. Her research interest is focussed on hydrogen storage

Students contributions (who were involved in Research from 2016)

- **Dr. Arpita Ghosh** graduated with her Ph.D. in January 2019, She is currently a 'postdoctoral fellow' at IIT Mumbai, her research interests are proton exchange membrane fuel cells, direct methanol fuel cells, Li-ion and sulfur batteries.
- **Dr. Priji C** graduated with her Ph.D. in July 2019. Her research interests are proton exchange membrane fuel cells, direct ethanol fuel cells and sodium-ion batteries.
- **Dr. Sreetama Ghosh** graduated with her Ph.D. in July 2019, currently she is a 'postdoctoral fellow' at the Department of Chemistry and Chemical Engineering, Chalmers University of Technology, Göteborg, Sweden. Her research is focused on CO₂ capture and conversion.
- **Dr. Vasumathy Ravishankar** graduated with her Ph.D in April 2020. Her research work is focused on Studies on Ion Transport Through Graphene Oxide Membranes. She is currently a 'post doctoral fellow' at IISC, Bangalore.
- **Dr. Sai Smruti Samantaray** graduated with her Ph.D. in May 2020. She is presently working as a 'Research Associate' at the Department of Physics, IIT Madras. Her research interests include hydrogen storage and Lithium-ion batteries
- **Dr. Meenakshi Seshadhri** graduated with her Ph.D. in May 2020. She is currently working as a 'Research Associate' at the Department of Physics, IIT Madras. Her research interests are proton exchange membrane fuel cells, Li-ion and sulfur batteries.

Students contributions (who were involved in Research from 2016)

- **Dr. Ajay Piriya V.S.** graduated with her Ph.D. in May 2020. She is currently working as a 'Senior Project Officer' at the Department of Physics, IIT Madras. Her research interests are development of electrode materials for Sodium-ion batteries, Aluminum-ion batteries, Sodium-sulfur batteries, and Rechargeable Iron-ion battery.
- **Dr. Vani** graduated with her Ph.D. in May 2020. Her research work focused on the development of ion conducting membrane for proton exchange membrane fuel cells.

Plans for the year 20-21



- **Fe ion coin cell prototype** is being **scaled up for pouch cell**.
- The cathode material development and **full cell Na ion battery** is on the progress.
- On the aspect of safety, **Na metal free anode for RT Na-S battery** is of current focus.

Thank you