PONDICHERRY UNIVERSITY

School of Physical, Chemical & Applied Sciences

Department of Physics

Invited Lecture

On

Nanostructures and Green Energy Conversion & Storage: Challenges and Opportunities

By

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Date: 1st August 2011.
Time: 11.00 A.M
Venue: Raman seminar Hall, Dept. of Physics.

All are invited

Head of the Department of Physics

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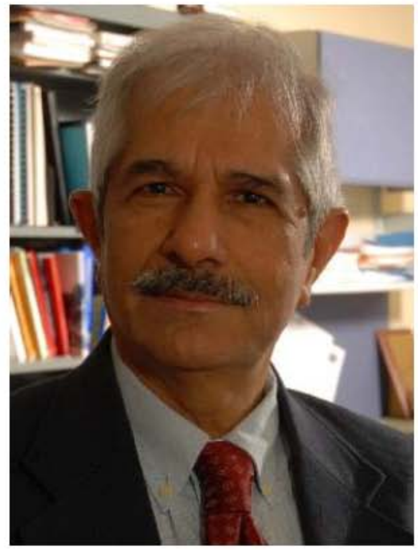

Brief Bio-data of Prof. Rajendra Singh

Dr. Singh received the B.Sc. degree from Agra University, Agra, India, in 1965, the M.Sc. degree in physics (electronics as the special subject) from Meerut University, India, in 1968, and the Ph.D. degree in physics (thesis on solar cells) from McMaster University, Hamilton, Ont., Canada, in 1979. He was Visiting Assistant Professor at the University of Waterloo, Waterloo, and Ont., Canada from 1979 to 1980 and Department of electrical Engineering at Colorado State University, Fort Collins. Dr. Singh is a leading photovoltaic (PV) and semiconductor expert with over 32 years of industrial and academic experience of photovoltaic and semiconductor industries. He has published over 330 papers and several patents. He has presented over 50 keynote addresses and invited talks in various national and international conferences. His research contributions have been primarily in the field of solar cells, rapid thermal processing, ultra-thin gate dielectrics, low and high-k dielectrics, superconductivity, manufacturing of silicon integrated circuits, thermoelectric devices, energy storage and nanotechnology. He was the first one to report the fundamental differences between furnace processing and rapid thermal processing. His work on rapid thermal processing has led to various new applications, such as novel chemical vapor deposition techniques for the deposition of high- and low-dielectric constant materials and manufacturing of solar cells.

Awards and Honors

- IEEE Electron Device Society distinguished Lecturer (1994-2011)
- Outstanding Researcher Award, Clemson University, Sigma Xi Chapter (1997)
- Five Clemson University awards for Faculty Excellence
- Thomas D. Callinan Award of the Electrochemical Society (1998)
- J.F. Gibbons Award from the 11th IEEE International Conference on Advanced Thermal Processing of Semiconductors (2003)
- McMaster University Distinguished Alumni Award
- Fellow of the Society of Optical Engineering
- Fellow of American Society of Metals (ASM)

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ABSTRACT

Nanostructures in dimensions less than about 10-20 nm show interesting structural, electrical, mechanical, and chemical properties, which have the potential to manufacture semiconductor and related products with improved performance. In theory, two routes exist to manufacture such a product - top-down and bottom-up. In top-down approach, a part is made by removing excess material from a larger block of material. Many layers of materials are assembled to make the final product. In the semiconductor world, often, all the required parts are made in a deposit and etch away process, or by selectively depositing a material using a mask Products such as integrated circuits, lasers, light emitting diodes, detectors, solar cells etc. are being manufactured using the conventional top-down approach. During the last two decades "self-assembly" has been advocated as an alternate of lithography. This bottom-up method claims that one can manufacture parts by using the tendency of molecules to aggregate to form larger blocks. A part of this approach stems from the nature's marvelous method that creates living organisms. True self assembly processes involve programmed cell death or apoptosis [1-2] For instance, when a fetus develops, it grows in a pre-defined fashion, this controlled growth is true self assembly. However, till date, the possibility of true self assembly has not been proved experimentally. All the experiments conducted till date under the umbrella of "self-assembly" are based on simple selective chemistry. In future, a clever idea might make self-assembly possible. However, at this time, all the existing "self-assembly" methods cannot result in useful green energy conversion and storage products because of certain inherent problems.

REFERENCES

[1]. G Melino, R A Knight and D R Green," Publications in Cell Death: the golden age", *Nature*, 8, 1-3, 2001.

[2]. R. Singh, T. Boland, R. Mulye, G. Gaur, J.Steelman, D. Arya, N. Srinidhi, & P.Deshmukh "*Prospects of Incorporating Directed Self Assembly into Semiconductor Manufacturing*", *Semiconductor Fabtech*, 36th edition, 67-72, 2007.