Photovoltaic materials and systems

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Research Interests

- Nanocrystalline silicon oxide and silicon carbide materials.
- Graphene, and graphene oxide, rGO.
- Crystalline and thin film silicon solar cells
- Photovoltaic systems

Dr. Matsumoto is Professor in the Department of Electrical Engineering. He completed his MSc at the Research Center and Advanced Studies of the National Polytechnic Institute (Cinvestav) in Mexico city and PhD at Osaka University, Japan. He did post-doctoral stay at AIST, in the laboratory of Dr. Shimokawa in 1995. During that time, he contributed with the electron-beam recrystallized thin film silicon materials on ceramics. In 1994, he accepted full-time professor position at Cinvestav. In 2013 he did a semi-sabbatical stay at Gifu University in the group of Dr. Nonomura, developing PV system analysis. Dr. Matsumoto is author of more than 50 publications that received approx. 500 citations, with H=11. He has received independent grants to develop his own unique lines of research on investigating nanocrystalline silicon- oxide and amorphous silicon based solar cells.

Selected Awards

- Award for paper, Japanese Solar Energy Society, 1994
- Renewable Energy Award in Innovation, CONUE-SENER 2006

Selected Funding

- Conacyt (4 basic science projects; 2005-2014)
- Conacyt Energy Resource Network 2014

Research Project: Study on nanostructured silicon for next-generation solar cell – materials and photovoltaic systems

I.The objective of this project is to extensively investigate the silicon nanostructures for application in high efficiency *all-silicon* photovoltaic solar cells. The study includes fabrications of different Si nanostructures such as Si nanocrystals (nc-Si) embedded in different silicon oxide dielectric matrixes. Efficient *p*- and *n*-type doping for Si nanostructures, nc-Si based *pn* and *pin* homo- and hetero-junctions, as nc-Si / poly-Si tandem solar cell structure. The involved effect of Si nanostructures, such as multiple excitons generation (MEG) and carrier transport in Si nanocrystals. This project will have important impact on development of high efficiency low cost all-silicon solar cells to establish challengeable new technology against bulk-c-Si technologies.

II. Collaboration and development of an efficient solar cells, either crystalline silicon with new ideas to improve conversion efficiencies. The approaches through different materials and structures of solar cells, their research, development and innovation, mostly in antireflecting coat and black cells. Spectral response or external quantum efficiency, conversion efficiency, stability through the time and temperature or its reliability.

Also characterization-evaluation of photovoltaic modules of different technologies. To analyze and to know their performance in different climates and their reliability. Due to the different climates that exist in the countries, it is to evaluate the operation of the photovoltaic modules of different technologies in arid-warm, coastal-humid regions and at heights up to 3,900 meters above sea-level. Response of the modules to the different spectral components of the region.