Experimental semiconductor research at Najah: Enhancement of nanotech electrodes in solar energy utilization

Hikmat S. Hilal
College of Sciences, An-Najah N. University,
PO Box 7, Nablus, West Bank, Palestine. Fax. No. +970-9-2944082
hikmathilal@yahoo.com

Participants:

S. Saleh, I. Sadeddin, M. Masoud, W. Atteereh, S. Shakhshir, L. Majjad, A. Hamouz, N. Zaatar, and R. Shubaitah, R. Ismael, A. Zyoud, Wajdi Atterih, sahar Khudruj, G. Nour, H. Sabri, M. Al-Hasan, and others (An-Najah N. University, Palestine). G. Campet (University of Bordeaux, France). N. Jisrawi (University of Birzeit, Palestine). J. Turner (NREL, CO.),

Abstract

Palestine should develop a knowledge-based technology starting with advanced materials and their applications, in oprder to achieve sustainable development. Advanced materials include a wide range of areas such as nanotechnology, thin films, nanodevices, conductive polymers and others. Applications of advanced materials span a number of areas such as: Energy storage devices (super batteries supercapacitors, fuel cells), clean energy (photovoltaics PV, photoelectrochemistry PEC) biotechnology (drug delivery, cancer treatment), superconductivity & superconducting magnets (MRI, supertrains) and other applications (LEDs, electrochromics).

Semiconductors (SC) are a very important area of advanced materials. Almost all contemporary technologies rely on SC systems such as p-n junctions (transistors, diodes, PV, PEC, refregiration, ….).

In this presentation, one specific example where Palestinian young scientists have been able to make breakthroughs in advanced material research and contributed effectively despite limited resources. Semiconductor research activity has been established in the laboratories of An-Najah N. University in the mid 1990s. The activity started with modification of mono-crystalline n-Si and n-GaAs semiconductor surfaces for the purpose of controlling band edge positions. This was for the purpose of tailoring

band edge positions to catalyze water splitting (into hydrogen and oxygen) by solar light. The objectives were successfully achieved by graduate students at ANU. To simultaneously achieve stability and efficiency of the SC electrode, other techniques were developed here. The increasing cost of mono-crystalline SC materials shed light on our goals. The efforts were then focused at synthetic thin film SC electrodes. Preparation of enhanced semiconducting materials, in the forms of thin films and nano-scale particles, have then been conducted for the purposes of light-to-electricity and water decontamination strategies.

Recently ANU students have been heavily engaged in preparing new classes of n-type semiconducting materials (CdS and CdSe) in the forms of thin films and nano-scale particles using Chemical Bath Deposition (CBD) and Electro-Chemical Deposition (ECD) techniques. Thin CdS and CdSe films were deposited onto FTO/glass systems and are currently being used for light-to-electricity conversion processes. Modification of semiconductor surfaces shows promising potential to enhance their efficiencies and stabilities. For the first time, ANU students were able to stabilize CBD-based CdSe films in PEC processes. Moreover, ANU students have been able to sensitize TiO2 and ZnO2 nano-sized particles using non-hazardous natural dyes extracted from flowers.

The main theme of this presentation is to give examples to young Palestinian scientists on what they can achieve should they work in advanced materials research, directed towards solving Palestinian society problems. It is also intended to attract the attention of decision makers to put materials R&D as a high priority area in the near future.