



School of Nano Science



IPM Condensed Matter &  
Statistical Physics Group

## Weekly Seminar

### Design and fabrication of dye-sensitized solar cell using zinc oxide nanostructure

Invited Speaker:

**Dr. Fatemeh Dehghan Nayeri**

*Thin Film and Nano-Electronics Lab., Department of Electrical and Computer Engineering,  
University of Tehran, Iran,*

#### **Abstract:**

Design, fabrication and characterizing dye sensitized solar cell based on one dimensional (nanowires, nanotubes) zinc oxide (ZnO), new structure of hetrostructure MWCNT/ZnO nanowire arrays as a photoanode, and using multiwall carbon nanotubes as replacement for pt as expensive electrode are the main purpose of this research. Growth of ZnO nanowire was investigated through two methods including chemical vapor transport and condensation (CVTC) and chemical bath deposition (CBD) on different substrate. Morphology, crystal structure and photoluminescence (PL) of grown structures were surveyed as every stage In final the bath chemical deposition were selected for growing ZnO nanowire to be used in dye solar cell. Several parameters affect performance of solar cell. Electrochemical impedance analysis revealed for single-crystal ZnO nanowire DSSCs that electron transport and recombination time constants and electron diffusion are factor of length and diameter of nanowire and seeding method. Increase in height of nanowire results in higher performance of the cell. ZnO based solar sell at length of about  $5.5\mu\text{m}$  and diameter of  $100\text{nm}$  recorded a performance of 1.02%. Electrochemical impedance results showed that transfer and recombination time of the electrons have increased for two times. The lengthier the nanowire, the longer the electron transfer time. The electron transport improved an order of magnitude by replacing ZnO with AZO.

To improve effective surface on the layers through sputtering method, ZnO nanoparticles were sprayed using sputtering method and ZnO was also grown on some of the ZnO nanowires. ZnO nanowires, ZnO composite nanowires, nanoparticles, and tree nano-structures were used in the dye sensitized solar cells. The results of survey showed an improvement of performance of 42% compared with nanowires solar cells. One may conclude that along with effective surface, anode electron structure plays an important role in performance of dye sensitized solar cells. As development of lengthier nanowires is time consuming process, we adopted different nanostructures with higher porosity. ZnO nanotubes are classified as ZnO nano-structures used in solar cells.

Wednesday, 31<sup>th</sup> of Khordad (1396) (June 21<sup>th</sup>, 2017), 14:00-15:00

Farmaniyeh seminar room(A)