STEVENS INSTITUTE of TECHNOLOGY
THE INNOVATION UNIVERSITY

University Seminar Series

Sponsored by Nanotechnology Seminar Program

Fulfilling a Dream: Low Cost Synthesis of Thin Film Solar Cells

By Dr. Lili Deligianni

IBM, Thomas J. Watson Research Center

ABSTRACT

The global energy demand is predicted to reach 28 Terawatts by 2050. Solar energy can meet a sizeable fraction of this demand. To harvest this energy, we propose the fabrication of solar cells from thin films of direct bandgap semiconductors composed of earth-abundant, environmentally friendly materials. A promising material for low cost, thin film, solar cell absorber layers is the quaternary compound of Cu_2ZnSnS_4 (CZTS), the equivalent of $CuInS_2$ with Sn and Zn replacing In that is scarce and expensive. Electrodeposition of nanoscale metallic films and annealing in a sulfur atmosphere is one of the most promising, low cost green methods of synthesis. Dilute aqueous solutions are used, and materials utilization is over 90% due to the selectivity and due to the extensive know-how that we have on the re-use and recycling of the solutions. In other work, we have demonstrated the scalability of thin film solar cells was demonstrated with a CuInS2 (CIS) absorber on 30 cm x 60 cm size glass substrates. A methodology similar to the one used for the scale-up of electrodeposited CIS can be used for the electrodeposited earth abundant materials. Lastly, we have successfully fabricated electrodeposited CZTSe and CZTS solar cell with 7.3% record high power conversion efficiency for electrodeposition. Since the solar cell devices with world record efficiency contain both Se and S in the absorber layer, this work on electrodeposited CZTSe and on CZTS demonstrates a promising route for the development of low cost $Cu_2ZnSn(Se,S)_4$ thin film solar cells with even higher efficiency.

BIOGRAPHY

Lili Deligianni is a Senior Leader & Researcher at IBM's Thomas J. Watson Research Center in Yorktown Heights, NY, where her current research interests include the development of materials for low power on-chip converters and for thin film solar cells. These are game changing technologies which can be used in low power electronics and in flexible solar panels with applications in electric cars, smarter buildings and data centers. She also played a leading role in the successful introduction of electrochemical processes in the solder bump technology. Dr. Deligianni has co-authored 46 peer-reviewed publications and 130 patents and patent applications, and is an elected member of the IBM Academy of Technology. She is also a Fellow of the Electrochemical Society and has been the recipient of the Electrochemical Society Electrodeposition Research Award, and currently serves on the Board of Directors as the Secretary of the ECS. Lili also serves as the chair of the Watson Women's Network and leads Engineer's Week in local K-12 schools. She has received the 2006 Inventor of the Year Award of the New York Intellectual Property Law Association and two IBM Corporate Awards.

EVENT DETAILS

DATE:
Wednesday,
February 12, 2014

TIME:
11:00 AM

LOCATION:
Babbio 122
Stevens Institute of Technology

ATTENDANCE:
Public

Co-Sponsored by the Mechanical Engineering and the Chemical Engineering and Material Science Departments