Πανεπιστήμιο Κύπρου
University of Cyprus

School of Engineering
Department of Electrical and Computer Engineering

IEEE Advancing Technology for Humanity

Department of Electrical and Computer Engineering

Title: «Spectrally tuned solar cells for improved energy harvesting»

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Wednesday 22th April 2015, 17:00 – 18:00
Room KENTP. A019, Old Campus – University of Cyprus

Abstract:
Photovoltaic cells that incorporate several active junctions in electrical series are exhibiting ever-higher laboratory efficiencies. However, due to the presence of only two terminals in multi-junction PV cells, Spectral Response (SR) or External Quantum Efficiency (EQE) measurements on these cells present additional challenges compared to single-junction devices. Furthermore, optical interactions between such junctions are more likely to occur due to their series connection. To this end, EQE measurements at different voltage-light bias conditions have been performed for the development of characterization protocols of multi-junction devices. Moreover, in an attempt to determine the magnitude of coupling current as well as the factors affecting the optical interactions between junctions, excitation and voltage dependent Photoluminescence (PL) measurements of GaInP/GaInAs/Ge have been carried out. The coupling efficiency depends on the shunt resistance of the top junctions as well as on their temperatures. Significant radiative losses from tandem PV cells can lead to underestimation of the cells' efficiency. For this purpose, combined Electroluminescence (EL) and Photoluminescence (PL) measurements under a high-intensity solar simulator were conducted in order to investigate the presence of radiative losses in a multi-junction cell at different operating conditions of the tandem. Outdoor assessment of tandem devices is required to examine the impact of spectral sensitivity of junctions upon their operating efficiencies. Initial analysis of outdoor measurements has revealed differences between the short-circuit currents and fill factors of the cells that is attributed to their spectral response. A detailed and reliable spectral irradiance dataset is needed to assess how the variations in solar spectrum can affect energy yield. The SMARTS atmospheric radiative transfer model was used to generate long-term irradiance data.

Biography:
Vasiliki Paraskeva received her undergraduate and Master degree in Physics from the University of Cyprus in 2007 and 2009 respectively. During her Master thesis, she conducted research at the Research Centre of Ultrafast Science in the Department of Physics. She joined the PV Technology Laboratory in 2009 at the Department of Electrical & Computer Engineering as a graduate level researcher (PhD). She is currently working on a project for the study of the impact of spectral response on multi-junction PV cells efficiency. Her research interests include characterization of novel PV cells with a number of methods such as Electroluminescence (EL), Photoluminescence (PL) and External Quantum Efficiency (EQE) as well as testing and monitoring of CPV modules.

Acknowledgments: This work has been co-financed by the European Regional Development Fund and the Republic of Cyprus in the framework of the project 'PV-TUNE' with grant number ΤΕΧΝΟΛΟΓΙΑ/ΕΝΕΡΓ/0311(ΒΙΕ)/13.