Contribution ID: **266** Type: **Poster Presentation**

Wavelength-modulated spectroscopy of the sub-band gap response of solar cell devices

Wednesday, 1 July 2015 16:10 (1h 50m)

Abstract content
   (Max 300 words)
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In the global effort to improve the efficiency of solar cells, many structures and materials are currently being investigated. These various technologies can generally be classified into three generations, of which the third generation overcomes the Shockley-Queisser limit. One such approach is to incorporate quantum structures into a single junction solar cell. The quantum structure has a lower band gap energy than the matrix material and therefore extends the photo-response of the solar cell towards longer wavelengths, reducing transmission losses. In order to better understand the sub-band gap photo-response of this type of solar cell, we make use of wavelength-modulated spectroscopy to evaluate the contribution by the embedded quantum structures. The excitation wavelength is modulated by oscillating the exit slit of the monochromator used for the photo-response measurements. However, due to the spectral dependence of most excitation sources, the optical intensity is inherently also modulated. The challenge is therefore to maintain that intensity at a constant level. To do so, this work proposes a method to control the photon flux density of the light using a flux control module. We will also report on the wavelength-modulated spectroscopy of GaSb/GaAs quantum dot solar cells.

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MC Wagener
Magnus.Wagener@nmmu.ac.za
Nelson Mandela Metropolitan University

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Primary author: Mr HASINJATOVO MANDANIRINA, Nambinintsoa Romeoh (Nelson Mandela Metropolitan University)

Co-authors: Prof. BOTHA, J R (Nelson Mandela Metropolitan University); Prof. WAGENER, M C (Nelson Mandela Metropolitan University)

Presenter: Mr HASINJATOVO MANDANIRINA, Nambinintsoa Romeoh (Nelson Mandela Metropolitan University)

Session Classification: Poster2

Track Classification: Track C - Photonics