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Région Alsace

Affiliations : 1Laboratoire de Photonique et de Nanostructures (LPN-CNRS), Marcoussis, France; 2Institut de Recherche et Développement sur l'Energie Photovoltaïque - UMR EDF / CNRS / Chimie Paristech, Chatou, France; 3Laboratoire de Physique des Interfaces et Couches Minces (LPICM-CNRS), Ecole Polytechnique, Palaiseau, France; 4Laboratoire Photonique, Numérique et Nanosciences (LP2N), Université Bordeaux 1/CNRS/Institut d'Optique Talence, France

Resume : We propose here a design using multi-resonant absorption to achieve efficient light trapping in ultra-thin (≤ 100 nm) solar cells and a patterned front contact as an alternative to conventional transparent conductive oxide layers. In this architecture, a one-dimensional metallic array is embedded in a non-absorbing material layer used as the front window of ultra-thin flat absorber layers deposited on a metallic mirror. Parasitic losses are reduced at short wavelengths, and light absorption is enhanced at longer wavelengths, leading to a gain in the short-circuit current density. This general approach is first applied to ultra-thin a-Si:H solar cells. We show that for both TE and TM polarizations, broadband absorption is achieved leading to a theoretical short-circuit current density of 14.6 mA/cm2 for a 90 nm-thick a-Si:H absorber layer [1]. The same approach is applied to III-V solar cell materials. We have shown numerically and experimentally strong light confinement in a 25 nm-thick GaAs layer leading to a 40-fold thickness reduction with respect to conventional GaAs solar cells, with limited drop in the conversion efficiency. Currently, ultra-thin GaAs devices with resonant patterned front contacts are fabricated. Electro-optical characterization of ultra-thin (≤ 100 nm) GaAs solar cells will be presented. [1] I. Massiot et al., Appl. Phys. Lett. 101, 163901 (2012).

add to my program (close full abstract)

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Electrochemical deposition of CZTS thin films on flexible substrate

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Resume : Solar cells based on semiconductor thin films are emerging as alternative to silicon; however, the materials giving the highest efficiency, CdTe and CuInGaSe, contain toxic (Cd) and rare (In) elements. In this field, the challenge is to substitute In and Cd with abundant and non-toxic elements without lowering the high efficiency achieved with these technologies. Compounds based on copper, zinc, tin and sulfur (CZTS) are potentially promising materials, because they present all the above listed features. Among the different methods to obtain CZTS, the electrochemical route appears of great interest because easy to conduct. Up to date, the literature shows that non-uniformity in composition and/or the presence of secondary phases prevent the obtainment of electrochemical CZTS thin-film of high quality. In this paper, we present the principal results of an extensive investigations conducted in order to find suitable conditions for growing CZTS thin films with good performance through the simultaneous electrodeposition of elements having different standard electrochemical potentials. Thin films were obtained on a flexible substrate by potentiostatic deposition from aqueous baths by changing different deposition parameters (bath composition and temperature, deposition time). Chemical composition and structure of the electrodeposited films were evaluated by EDS, SEM, RAMAN and XRD. Preliminary results on the photoelectrochemical behaviour of the films will be also presented.

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17:30

Polymer Wrapped Single Walled Carbon Nanotubes as a Transparent Electrode for Large Area Opto-Electronics

Authors : G.D.M.R. Dabera, K.D.G.I. Jayawardena, A.A.D.T. Adikaari, P.D. Jarowski, S.R.P. Silva

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Resume : One of the key ingredients of any flat panel display, touch screen, solar cell or large area solid state light (eg. OLED) is the transparent conducting layer applied to the glass. This is nominally indium tin oxide (ITO) or another transparent oxide conductor (TCO). The price of indium has been increasing significantly in the last decade due to its scarcity and there is no replacement technology with the accelerated use of large area electronic devices and sensors on glass and plastics. In this work

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