ITPP0939
ICT

ARC'14
مؤتمر مؤسسة قطر السنوي للبحوث
QATAR FOUNDATION ANNUAL RESEARCH CONFERENCE
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CuNWs/rGO Based Transparent Conducting Electrodes As A Replacement Of ITO In Opto-electric Devices

10.5339/qfarc.2014.ITPP0939

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Abstract

Transparent electrodes that conduct electrical current and allow light to pass through are widely used as the essential component in various opto-electric devices such as light emitting diodes, solar cells, photodectectors and touch screens. Currently, Indium Tin oxide (ITO) is the best, commercially available transparent conducting electrode (TCE). However, ITO is too expensive owing high cost on indium. Furthermore ITO thin films are too brittle to be used in flexible devices. To fulfill the demand of TCEs for wide range of applications, high performance ITO alternatives are required. Herein we demonstrate an approach for the successful, solution based synthesis of high aspect ratio copper nanowires, which were later combined with reduced graphene oxide (rGO), in order to produce smooth thin film TCEs on both glass and flexible substrate. Structure and component characterization for these electrodes was carried out through Four Probe, Spectrophotometer, Scanning electron Microscope (SEM), Transmission Electron Microscope (TEM) and Atomic Field Microscopy (AFM). In addition to the morphological and electrical characterization, these samples were also tested for their durability by carrying out experiments that involved exposure to various environmental conditions and electrode bending. Our fabricated transparent electrodes exhibited high performance with a transmittance of 91.6% and a sheet resistance of 9 Ω/sq. Furthermore, the electrodes showed no notable loss in performance during the durability testing experiments. Such results make them as replacement for indium tin oxide as a transparent electrode and presents a great opportunity to accelerate the mass development of devices like high efficiency hybrid silicon photovoltaics via simple and rapid soluble processes.