UNIVERSITI TEKNOLOGI MARA

BORON DOPED AMORPHOUS CARBON BY NEGATIVE BIAS ENHANCED CHEMICAL VAPOUR DEPOSITION METHOD FROM PALM OIL PRECURSOR FOR SOLAR CELL APPLICATIONS

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-institution for any other degree or qualification.

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ABSTRACT

The boron doped amorphous carbon (a-C:B) thin films was successfully deposited by customized self-fabricated negative bias enhanced chemical vapor deposition using palm oil ($C_{67}H_{127}O_8$) precursor. Current-voltage measurement, thickness profilometry, field-emission scanning electron microscopy (FESEM), energy-dispersive X-ray spectroscopy, Raman spectroscopy, ultraviolet-visible-near-infrared spectroscopy, and solar simulator were conducted for investigate carbon thin film and solar cell devices, respectively. In this study, two deposition parameters were carried out; the substrate deposition temperatures (200 - 350°C), and negative bias (0 to -50 V). Based on this investigation, it can be found that, the a-C:B thin film deposited at different substrate temperatures (200 to 350°C) and negative biases (0 to -50 V) formed ohmic contact with gold. The conductivity of boron doped of a-C thin films was strongly influenced by substrate temperature, and negative bias under deposition condition. The conductivity of a-C:B thin films achieved approximately around 10^{-4} to 10^{-7} $S.cm^{-1}$. The FESEM images revealed the minimum measured particles of a-C:B thin film were approximately 26.3 nm at 350°C and -50 V. High transmittance spectra (>75%) in the visible wavelength region of boron doped a-C:B thin film with absorption coefficient, α between 10^4 to 10^5 cm^{-1}. The estimated optical band gap is ~2.05 to 1.92 eV decreased as substrate temperature increased and doping with boron. The lowest estimated optical band gap of a-C:B films is approximately around 1.90 eV deposited at different negative biases. For the first time the carbon solar cell from palm oil precursor with the configuration of Au/n-Si/p-C/Au achieved conversion efficiency (η) of 0.1302%. Moreover, the highest η of Au/n-Si/p-C:B/Au achieved is ~1.543% at 350°C and -20 V using grid method. Although the conversion efficiency is considerably low, but Au/n-Si/a-C:B/Au (~1.543%) fabricated by negative bias-CVD using carbon source of palm oil was considered new in this area. It is hope that, the use of palm oil precursors gave reasonable yield for carbon based solar cell in the near future.

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