



UNIVERSITI
TEKNOLOGI
MARA

THE DOCTORAL RESEARCH ABSTRACTS

Volume: 8, Issue 8 November 2015

EIGHTH ISSUE

INSTITUTE of GRADUATE STUDIES

IGS Biannual Publication

5

Name :

Nurfadzilah Ahmad

Title :

Amorphous Carbon Thin Films by Aerosol-Assisted Chemical Vapor Deposition for Carbon-Based Solar Cell Applications

Supervisor :

Prof. Engr. Dr. Mohamad Rusop Mahmood (MS)

Nitrogen doped amorphous carbon (a-C:N) was synthesized using a new custom-made Aerosol-assisted Chemical Vapor Deposition (AACVD) from camphor oil as the precursor. The a-C:N thin films have demonstrated better quality in uniformity, high conductivity, moderate and suitable ID/IG ratio from Raman analysis and optical band gap for solar cell applications. The doping process was successful as proven by the Energy Dispersive X-ray analysis (EDX) spectrum with the presence of Nitrogen (N) peak in a-C:N, and thus this AACVD has proven the suitability to undergo the doping process for nitrogen doped a-C:N. The produced thin films have demonstrated high conductivity with photoresponse effect towards the sun light which is very important in solar cell application. Transmittance spectrum of the nitrogen doped a-C:N exhibit a

large transmittance value (>85%) and high absorption coefficient value of 106 cm⁻¹ and the value was higher than undoped a-C (103-104 cm⁻¹). The optimized optical band gap with the value of 1.4 eV was also close to the optimum optical band gap for the solar cell (1.5 eV) and the thin films yield the smooth surface morphology with very tiny grain size, which has the potential to produce the nanostructured a-C solar cell. The fabrication of new carbon based solar cell by N doped a-C was successfully done by using the AACVD process. The configuration for the fabricated device was Au/a-C:N/p-Si/Au. On the other hand, the rectifying J-V characteristics of Au/a-C:N/p-Si/Au photovoltaic cells resulted from the heterojunction between the n-type a-C film and the p-Si substrate. Since the substrate used was the p-Si substrate, no P-N junction will formed between the undoped a-C with weakly p-type conductivity and p-Si substrate. Thus it was proven that the conductivity of the a-C was tuned from weakly p-type to n-type from the nitrogen doping to form heterojunction with p-Si substrate. The rectifying curve for the device was obvious than the pure a-C, and the efficiency was 0.115% and this value is higher compared to the device fabricated from pure undoped a-C thin film, 0.003%. When the light was incident to the surface of the a-C:N, the photon in the lower wavelength region was strongly absorbed by the Au metal contact which served as the counter electrodes thus giving higher efficiency value. In addition, images captured by the FESEM exhibited small particle size, which is less than 100 nm and in nanostructured scale.