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PIN-all carbon solar cell by microwave surface wave plasma CVD

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We report the optical, electrical, structural, and photovoltaic, properties of all carbon PIN solar cell developed by microwave wave surface wave plasma chemical vapor deposition (MW SWP CVD). Carbon thin films were synthesized by microwave (MW) surface wave plasma (SWP) CVD on quartz, silicon and aluminum substrates. The detail of MW SWP CVD and substrate cleaning process is described elsewhere [1-2]. Helium is used as carrier gas, acetylene is used as carbon source, tri-methyl boron and phosphine were used dopant gases. The CVD chamber was evacuated to a base pressure at about 3×10^{-4} Pa using a turbo pumps. The launched microwave power was typically 1200 W and a constant gas composition pressure is maintained at 35 Pa during film preparation. For film characterization, UV/VIS/NIR spectrophotometer, high resolution transmission electron microscope (HR-TEM), Raman spectroscopy, Halls effect measurements and solar simulator were employed. The preliminary photovoltaic characteristics of the cell in p-type silicon substrate, reveals a short-circuit current density of 44 mA/cm^2, open-circuit voltage of 0.21 V, FF= 0.39 and photoelectrical conversion efficiency of 3.8%, a reproducible result. The spectral photo response characteristic of the device configuration was explained in terms of transmission/absorption characteristics of the two individual carbon layers. The detailed results and some more results of different substrate and layers discussions will be presented during the conference.

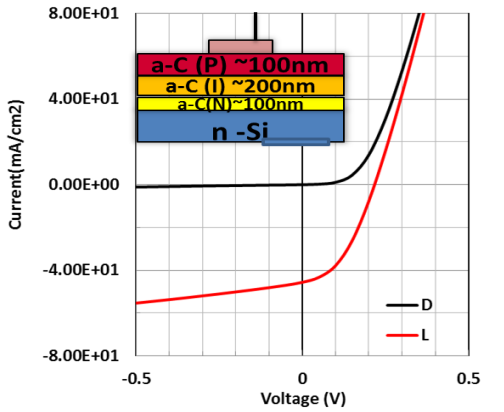

Fig. 1, current voltage characteristics of PIN device under dark and illumination (A.M 1.5 solar simulator).

References:-

[1] K.M. Krishna and M. Umeno et al., Sol. Applied Physics Letters, **77,** 1472 (2000).

[2] Dilip C. Ghimire et. al. Diamond Related Mater. **17,** 1724 (2008).