Fabrication and Characterization of Chitin Nanowires on Doped N/Mn Carbon Nanostructures for Thin Film Solar Cell Applications

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In this study, chitin and N/Mn-doped carbon nanostructures were fabricated and characterized for thin film solar cell (TFSC) applications. Chitin, which has high heat resistivity and UV-Vis absorption peak of 250-750nm (Azofeifa, et al., 2012), was transformed into nanomaterials. These were combined with carbon nanostructures (CNS), which are known for high efficiency in solar cells. Chitin from local crab shells was extracted by deproteinization, demineralization and decolorization. Chitin and N/Mn-doped carbon were fabricated into nanomaterials via Horizontal Vapor Phase Growth Technique (Santos, et al., 2009). Their morphology was determined using SEM imaging software, and their elemental and atomic compositions by EDX Oxford Spectroscopy. Photoconductivity was measured with and without solar illumination using fluke multimeter. The efficiency was calculated based on ? = (Pmax/E x AC) x100. The surface morphology of chitin was observed to be nanowires with physical size of 45nm while N/Mn-doped CNS was observed to be nanoflakes and measured at 84.6nm (N) and 92.73nm (Mn), respectively. Chitin contained 31.55% nitrogen; N-CNS, 31.73% nitrogen and Mn-CNS, 2.13% manganese. I-V characteristics yielded short-circuit current of 0.08mA, open-circuit voltage of 120.1mV, maximum power of 9.61mW and efficiency as high as 16.02%. Chitin nanowires increased the TFSC's efficiency by 6.69% due to its high photoelectric properties. The results showed that chitin nanowires and N/Mn-CNS comprise a promising TFSC that uses an abundant biopolymer and an innovative technique for green production of electrical energy. Organic–inorganic solar thin films with efficiencies up to 9% are practicable devices for sustainable development and energy crisis.

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