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Nanocrystalline Cu₂O/p-Si solar light-responsive Schottky photodiode

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Abstract

Nanocrystalline of Cu₂O thin film was synthesized by sol-gel spin-coating technique. The spectrophotometric characteristics of transmission and reflection were studied for the film deposited on glass substrate. The optical absorption measurements near the absorption edge indicate that the absorption mechanism is due to allowed direct transition with energy gap value of 2.09 eV. The current-voltage characteristics of Al/Cu₂O/p-Si/Al diode were studied under dark and various light intensities in the range 20-100 mW/cm². The main diode parameters such as barrier height, ideality factor, series resistance were calculated from the analysis of current-voltage characteristics and studied under various illumination intensities. Moreover, the results indicate that the diode has a high photoresponsivity and the photocurrent increases with increasing light intensity which supports the availability of the diode for photosensor applications. The capacitance and conductance characteristics indicate that the diode highly depends on both voltage and frequency. Higher increase in the capacitance under low frequency as well as the presence of a characteristic peak in the capacitance-frequency characteristics indicates the presence of interface states. Moreover, the stronger parameters of the diode performance such as series resistance and interface states were extracted from the capacitance-voltage-frequency and conductance-voltage-frequency characteristics.

Keywords

KeyWords Plus: CAPACITANCE-VOLTAGE CHARACTERISTICS; CU₂O THIN-FILMS; OPTICAL-PROPERTIES; ELECTROCHEMICAL DEPOSITION; SERIES RESISTANCE; V CHARACTERISTICS; INTERFACE STATES; TEMPERATURE; MORPHOLOGY; NANOWIRES

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