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I-V, C-V-f and G-V-f Characteristics of Nanocrystalline n-Type FeSi2/p-Type Si Heterojunctions Fabricated Using Pulsed Laser Deposition

In the present study, nanocrystalline n-type FeSi2/p-type Si heterojunctions were fabricated by using pulsed laser deposition technique at room temperature. Their dark current density-voltage (J-V) curves were measured at room temperature. The possible carrier transportation mechanisms were investigated by analyzing the forward J-V curves. The present heterojunctions showed good rectifying behavior with the ideality factor value of 1.45 at the applied bias voltage of less than 0.2 V. This suggested that a recombination process was dominant. At the applied bias voltage of higher than 0.2V, the possible mechanism of carrier transportation was a space-charge-limited current process. Both capacitance-voltage (C-V) and conductance-voltage (G-V) curves were measured and analyzed as a function of frequency (f) ranging from 50 kHz to 2 MHz at room temperature. The density of interface state (Nss) of the heterojunctions was estimated by using the Hill–Coleman method. The value of Nss was 2.72×1013 cm-2eV-1 at 50 kHz and it decreased to 2.38×1012 cm-2eV-1 at 2 MHz. This result demonstrated the existence of a large amount of Nss for our heterojunctions, which should be the cause of a large leakage current and small response under illumination for near-infrared light.

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