The Investigation of Optoelectronic Characteristics with SiGe/Si Heterostructure

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ABSTRACT

In this study, reduction of dark current characteristics in the SiGe-based Metal-Semiconductor-Metal photodetectors (MSM-PD) with and without hydrogenated amorphous silicon (a-Si:H) and/or with silicon dioxide (SiO2) passivation layer will be discussed. The a-Si:H and SiO2 layer were deposited by using plasma-enhanced chemical vapor deposition (PECVD) system. At 6V applied voltage, the measured dark current were 1.27×10-8 A, 2.14×10-3 A and 2.5×10-3 A, respectively, for the samples with a-Si:H passivation, without a-Si:H passivation, and with SiO2 passivation layer, respectively. Compared to the sample without a-Si:H layer, the dark current with a-Si:H passivated one was reduced about five orders. Such a result demonstrates that the a-Si:H exhibits passivation function on SiGe surface. Additionally, we used above result to fabrication a-Si:H/p-SiGe/n-Si heterostructure phototransistor (HPT) having different electrodes (Ni, Ni+ thin Al and ITO). The 850nm infrared laser light source with modulation power was used to irradiate these samples. It was found that the HPT having ITO electrode can achieve high optical- and current-gain.

Keywords : Metal-Semiconductor-Metal(MSM) ; Photodetector ; a-Si:H ; SiGe ; dark current ; Phototransistor

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