Study of Si/SiGe Multiple Quantum Well(MQW) Infrared Photodetector

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ABSTRACT

The SiGe based separate-absorption-multiplication avalanche-photodiode SAMAPD and has been implemented for the first time. The structure of SAMAPD, in our work, is P+-Si/MQW-(SiGe/Si)/ i-SiGe/N+-Si, in which the i-SiGe and quantum well structure of SiGe/Si are deposited by ultra-high-vacuum chemical-vapor-deposition (UHVCVD) system. In this structure the thickness of i-$Si_{0.8}Ge_{0.2}$ layer is about 150nm and quantum structure is of Si (25 nm)/$Si_{0.8}Ge_{0.2}$(5 nm) with five periods. Experiment results shows that the current increases sharply at about 2 V reverse bias, we speculates that the avalanche effect occurred at this voltage. Two structures of dot and net are processed in our studies. We found that the photo-to-dark current ratio of Iphoto/Idark was 15.19 without and 17.9 with covered by Al thin film for dot electrodes at 1 V reverse bias voltage. A higher photo-to-dark current ratio was obtained for net electrodes, the Iphoto/Idark is 52.6 without covered by Al thin film; after covered by Al thin film, the Iphoto/Idark achieved a high value of 134. In addition, the solar cell performance with this structure is measured by using a simulated solar source of 1000W/cm2 and a high conversion efficiency of 8.26% is obtained for dot electrodes with Al thin films.

Keywords : MQW ; SiGe ; photodetector ; evaporation ; solar cells

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