The Study of Silicon Germanium Material on Photodetectors

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ABSTRACT

The requirements of Silicon-based photonic devices in the next generation of chip technologies have caused extensive studied on SiGe devices due to the strained SiGe material exhibits several advantages, such as high electron and hole mobility than those in bulk Si, modulating detection wavelength from 0.8 to 1.8 μm for near-infrared optical detection, and easily integrated with the existing Silicon technology. In the past years, various types of SiGe-based optoelectronic devices have been proposed. In our researches, we demonstrated a wavelength filter of photodetector which was simply carried out by just inserting a 60 nm thick a-Si:H capped layer onto Si0.8Ge0.2 thin film. Then, we employed Ni, Au, and Cr metals on an asymmetry metal-semiconductor-metal (MSM) structure in SiGe/Si heterojunction photodetector, it was successfully achieved to suppress the dark current of conventional symmetry MSM structure, but the photocurrent are about the same for all symmetry and asymmetry structures. Furthermore, we investigated transparent ohmic contacts of indium tin oxide (ITO) to p-type Si0.8Ge0.2 layer with and without a Si-capping layer. It is shown that the ITO/p-type Si0.8Ge0.2 contact structure exhibits a specific contact resistance of 2.26x10-5 Ω-cm2 as compared to that of 2.78x10-2 Ω-cm2 for the ITO/Si/p-type Si0.8Ge0.2 contact structure after annealed at 600 °C. Applying the contact character of ITO and SiGe, a voltage-control dual-band near-infrared photodetectors was achieved by using a MSM (ITO/p-Si/p-Si0.8Ge0.2/ITO) structure.

Keywords : silicon germanium ; heterostructure ; photodetector ; near infrared

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