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Si/CdTe heterojunction fabricated by closed hot wall system

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ABSTRACT

The Si/CdTe heterojunction is fabricated by a Closed Hot Wall (CHW) system. This system has the special feature of a hot wall, which, by introducing a desired temperature profile on the quartz tube that holds the source materials, leads the path of the vapour directly onto the coolest part of the system - the substrate. It is expected that this controlled vapour deposition may lead eventually to epitaxy. Though the expectation is not fulfilled in this research, the CdTe films grown show very high crystallinity and good stoichiometry. From the ratio of grain size to thickness, it is obvious that the system enhances grain growth during deposition, so, electronic properties of the junction can be ensured. The resulting heterojunction obtained is isotype p-Si/p-CdTe, and the carrier concentration in CdTe is as high as 10^{18} cm^{-3}. The acceptor is identified as vacancies of Cadmium and native defects with energy level at about 0.02eV. This high carrier density leads to the near degeneracy in the CdTe layer and the interesting behaviour of backward diode in I-V measurements. From those measurement, carrier transport mechanisms at the interface is believed to be dominated by tunneling and diode emission. In Open-Circuit voltage V_{oc} measurements, the heterojunction shows abnormally high value at incident wavelength between 0.8μm and 1μm, this makes the junction very appropriate for the application as photovoltic material at the near infrared region. Finally, improvements on the CHW system and buffer layer are suggested, so that the fabrication process may be better controlled and may eventually attain epitaxy. On the other hand, the buffer layer may reduce the large lattice mismatch between the two materials so that more perfect interface and better electronic performance of the heterojunction can be obtained.

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