# Fabrication of inverted GaAs solar cells on silicon substrates

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**ABSTRACT**

This study is to investigate the fabrication of inverted GaAs solar cells on silicon substrates by wafer bonding and epitaxial lift-off technique. Conventional InGaP/GaAs/Ge-based triple junction solar cells with high conversion efficiency have been demonstrated. However, Ge junction contributes only 270 mV to open circuit voltage due to 0.66 eV of bandgap energy for Ge. By switching to InGaAs, the bandgap energy of this junction increases to 1.03 eV. Typical voltages of 550~650 mV can be generated, which enables it to be joined to InGaP/GaAs junctions without limiting the cell ’ s current. This approach involves growing InGaP and GaAs junctions that are lattice matched to a Ge or GaAs substrate in an inverted manner. Any dislocations are then confined to the InGaAs junction, which is deposited on top of the InGaP/GaAs dual junctions. Moreover, GaAs substrates removed by epitaxial lift-off technique are recyclable to save resource and prevent form waste. In this study, wafer bonding technique was applied to connect inverted GaAs solar cells and Si substrates by Au/Ag/Au and Au/Sn/Au. Then GaAs substrates were separated from inverted GaAs solar cells by epitaxial lift-off technique. Finally, the fabrication of inverted GaAs solar cells without any antireflection coating (ARC) was finished by photolithography. The measured open circuit voltage (Voc), short circuit current density (Jsc), fill factor (F.F.) and conversion efficiency ( η ) of the thin film GaAs solar cells on silicon substrates were 0.85V, 20.58mA/cm2, 0.74 and 12.8% respectively.

Keywords : GaAs solar cells、Inverted metamorphic structure、Wafer bonding、Epitaxial lift-off

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