GaInP₂/GaAs/Ge

**Ge**

1

### 1

GaInP₂/GaAs/Ge

Ge

### 2

（2×10⁸Pa）MOCVD（Aixtron 200-4）

p-Ge

**Ge**

### 3

#### 3.1

Ge

### 4

**Ge**

*件工艺*
3.2 Geometric Optimization

\[ J_{ph} = 16 \text{mA/cm}^2, \quad S_s \approx 6 \times 10^5 \text{cm/s} \]
\[ V_{oc} \]
\[ X \quad V_{oc} \]

Fig. 1 Calculated curves of \( V_{oc}(X) \) for various values of \( S_s \).

\[ L_e = 1 \mu \text{m}, \quad X_e \quad V_{oc} \quad L \quad X_e \quad V_{oc} \]

Friedman \[ S_s \quad V_{oc} \quad 1 \times 10^5 \text{cm/s}, \quad 0.24 \text{V} \quad 6 \times 10^5 \text{cm/s}, \quad 0.17 \text{V} \quad J_{ph} = 16.00 \text{mA/cm}^2 \quad V_{oc} = 0.246 \text{V}, \quad \text{FF} = 0.634 \]

Fig. 2 Calculated curves of \( V_{oc}(X) \) for various values of \( L_e \).

\[ AM0 \quad J_{ph} \quad E_x \quad 3 \quad Ge \]

GaAs \[ J_{ph} = 41.5 \text{mA/cm}^2. \quad 170 \mu \text{m} \quad Ge \quad J_{ph} = 75.8 \text{mA/cm}^2 \quad GaAs \quad J_{ph} = 37.0 \text{mA/cm}^2 \]

GaAs \[ J_{ph} = 38.8 \text{mA/cm}^2 \]

Fig. 3 Calculated curve of light current density \( J_{ph} \) as a function of energy gap \( E_x \). AM0 spectrum is also shown.

\[ GaInP_2 \quad Ge \quad L_e = 30 \mu \text{m} \]
\[ L_e = 1 \mu \text{m}, \quad S_s = 1 \times 10^5 \text{cm/s}, \quad X_e \quad 0.1, 0.2, 0.5 \mu \text{m} \quad 0.4, 0.2 \mu \text{m} \quad 0.1 \mu \text{m} \quad 30 \mu \text{m} \quad 50.4, 46.9, 37.8 \text{mA/cm}^2 \]

GaAs \[ J_{ph} = 33.4, 32.4, 28.6 \text{mA/cm}^2 \]

Ge \[ \text{MOCVD} \quad V \quad As \quad P \]

\[ \text{Ge} \quad \text{As} \quad \text{P} \quad \text{MOCVD} \quad \text{V} \quad \text{As} \quad \text{P} \quad \text{Ge} \]
3.3 Ge

Fig. 5  

I-V characteristics of Ge cell before and after edge-etched

Fig. 4  

Theoretical internal quantum efficiencies for various values of $X_c$. Calculated reflectance curve is shown as well.
High Efficiency Ge Bottom Cell for GaInP$_2$/GaAs/Ge
Three-Junction Tandem Solar Cell$

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Abstract: Analyze the impacts of structure and device process of Ge solar cell on open-voltage, light current density, and fill factor. By controlling the surface-recombination velocity, reduction of emitter thickness, and improvement of device process, demonstrate Ge solar cell with open-voltage of 287.5mV, short-circuit current density of 75.13mA/cm$^2$, and efficiency of 7.35%.

Key words: Ge solar cell; high efficiency; surface-recombination velocity; improvement of device process
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