Si/Si-B/Si

، ؛ ، ؛ ،

. (MBE) Si/Si-B/Si

.

.

Characterization of Silicon-Boron slab doping in the Si/Si-B/Si structure grown by molecular beam epitaxy

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Abstract

Electrical characterization of Silicon-Boron slab doping in the Si/Si-B/Si structure grown by molecular beam epitaxy (MBE) has been considered in this paper. After growth, the transversal Hal voltage has been measured in the 60 - 300k temperature range and temperature dependence of Hall coefficient has been determined. The volume concentration and binding energy of dopant, Hall factor and lifting coefficient of Fermi level have been determined by theoretical simulation of hole sheet density versus temperature.

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100nm

(5 °A)

(B) .

. MODFET

. p

( ) . ( )

(500 °C) 10^{-10} mbar

. (1 °A/s)

.

VG 90 Si/Si-B/Si

. MBE (1μm)

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Si–n (100)

/ mm

550 °C .

.

) B

(.

(shutter) ( )

Si

Si-B Si B .

B .

( )

Si/Si-B/Si .

n (substrate) .

(buffer)

L= 35nm Si-B 200nm

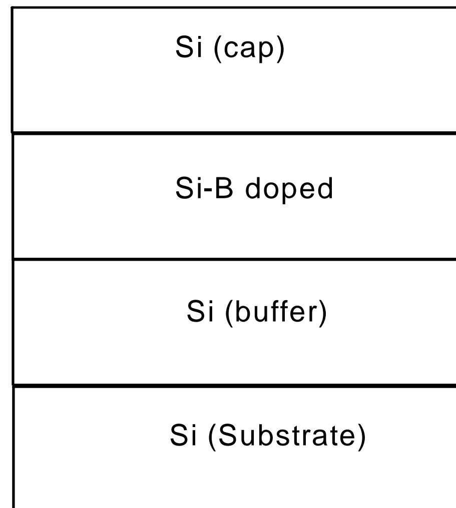
–) $2\times10^{24}\ m^{-3}$ B

Si (cap) ($4.5\times10^{24}\ m^{-3}$

90nm .

MODFET

.[ ]



. Si/Si-B/Si

MBE

1cm×1cm

$(10^{-5}\,mbar$)

1µm 1mm

500 °C

.

HF

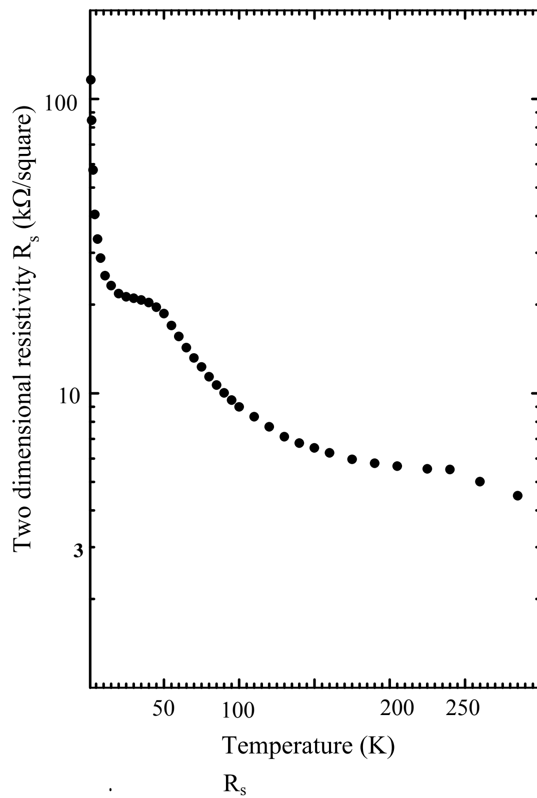
.

. /

V_{xx} / K

R_s V_{xy}

R_H



. R_s

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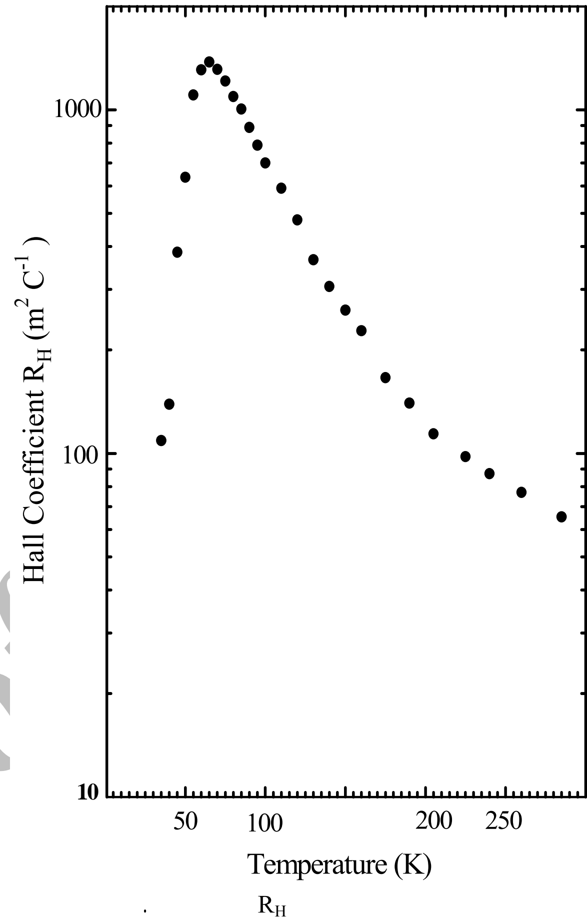

R_H .

k

.

B < T < k

n_s .

:

$$n_s = r_H \left(\frac{1}{e\,R_H}\right) \qquad (\ )$$

r_H e .

N_A^- ( )

(L)

: [ ]

$$n_s = L N_A^- = \frac{L N_A}{1 + g\,(\frac{E_A - E_F}{kT})} \qquad (\ )$$

g N_A

E_A

E_F T k

:

$$E_F = C \times k_B T \ln(\frac{N_v}{N_A}) \qquad (\ )$$

C

N_V

:[ ]

$$N_v \equiv 2[\frac{2\pi m_p kT}{h^2}]^{3/2} \qquad (\ )$$

h m_p .

< T < k

.

.

.

m_p n_s

.

.

E_b

meV E_b –

. [ ]

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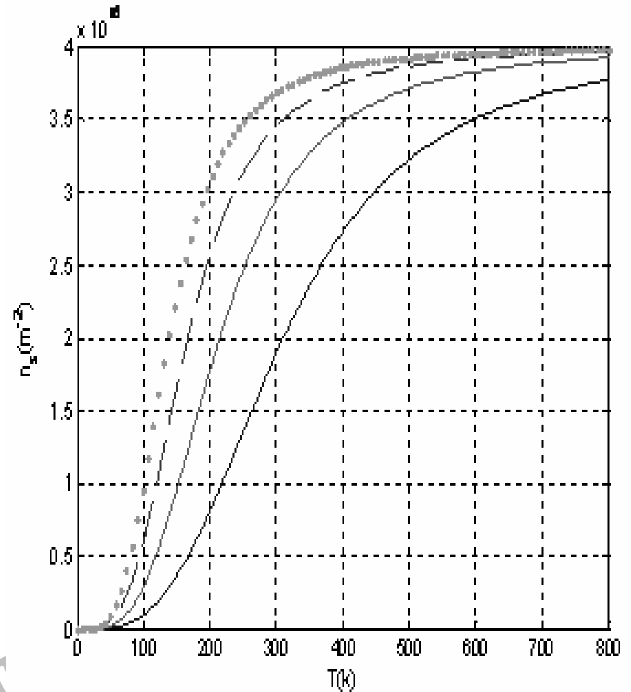
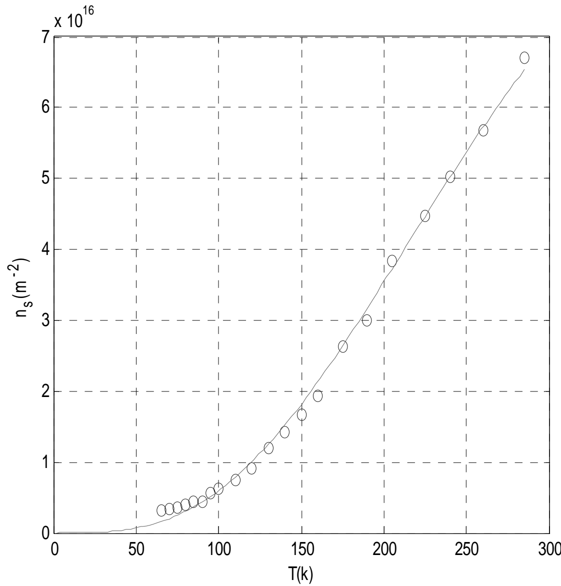


n_s

. m_p $N_A = 1\times 10^{24}\ cm^{-3}$ $E_b = 6meV$

/ m_0 / m_0 / m_0 / m_0

.



n_s ( )

( ) .

.

. MBE

(L $N_A = 10.8\times 10^{16}\ m^{-2}$) %

.

.

( ) C

nm

n Si

C

.

n_s

T .

. n_s

E_b	N_A	m_p	C	r_H
6meV	$3.1\times 10^{24}\ m^{-3}$	$0.5m_0$	1.88	0.7

[ ] Sadeghzadeh, M. A., et al. Appl. Phys Lett. 74 (1999) 579-81.
[ ] Myronov, M., et al. Appl. Phys. Lett. 80 (2002) 3117-9.
[ ] Pearson, G. L. and Bardeen J., Phys. Rev. 75 (1949) 865-883.
[ ] Joelson, K. B., et al. G. J. Appl. Phys. 81 (1997) 1265-9.

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