538.9

Cz-Si

. . . .

The effect of ultrasound load on the concentration of radiation point defects in γ*-irradiated (*[60] *) Czochralski-grown silicon were studied by measuring minority carrier lifetimes. Ultrasonically stimulated annealing of radiation recombination-active point defects was observed at near room temperatures. It was concluded that it was A-centres that were annealed under ultrasound load.*

Keywords*: silicon, radiation defects, ultrasound.*

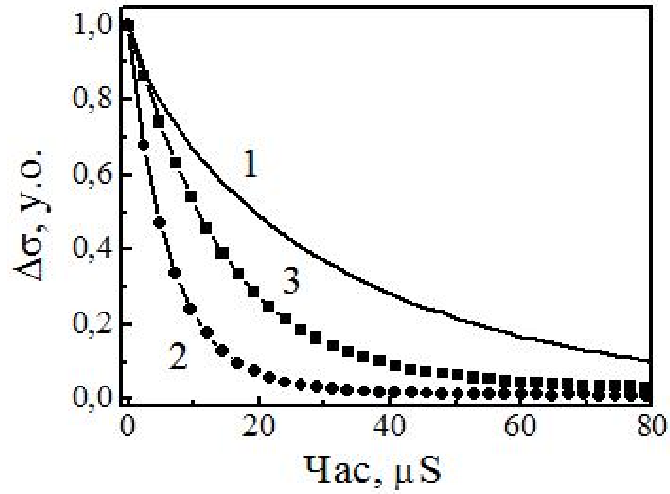
. -
, -
,
LHC- [1-3].
, , [4; 5].
,
, .
[6; 7],
[8; 9] ( ).
, .
-
.

-
- -
( ) , (Cz-Si).
12x7x6 n-Cz-Si = 10 · $_{60}$,
. - ,
$9{,}3\cdot10^{16}$ / ^{2}.
$_b$, [10].
,
(1-2 1,5 / ^{2}),
. 50 ^{0} .

, n-Cz-Si
. -
$_f$, $_b$ [10]. -
$_b$. . 1 -
n-Cz-Si (1), - (2), -
300 (3).

© . ., 2012.

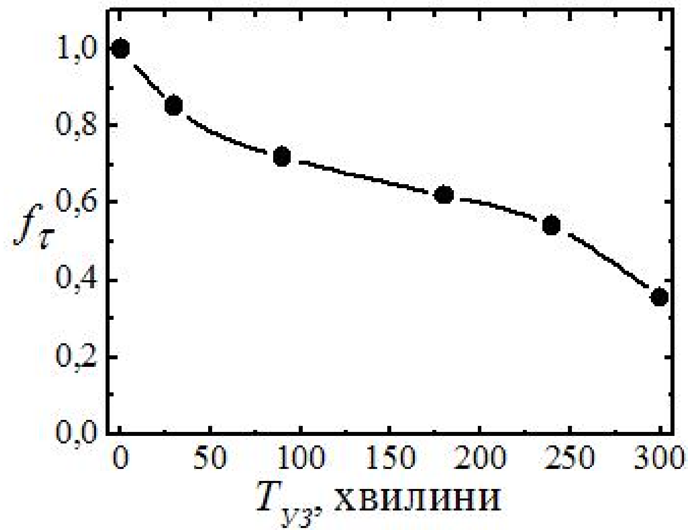
$_b$. 1 $_b$ = 34,4±0,2 (1), $_b$ = 6,32±0,02 (2) $_b$ = 14,70±0,03 (3). , $_b$, - , . $_b$, , . , .



. 1. **n-Cz-Si:**
1 – ; 2 – - ; 3 –
300 .

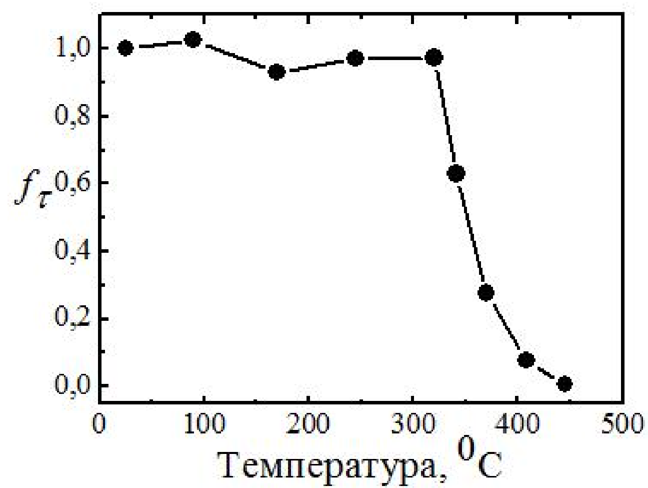
, $_b$ - , ,

$f_\tau = \left(\tau_b^{-1} - \tau_{b0}^{-1}\right) \cdot \left(\tau_{b\Phi}^{-1} - \tau_{b0}^{-1}\right)^{-1}$, $_{b0}$, $_b$ $_b$ – , , , . . 2 f T n-Cz-Si.



. 2. **T**

, -
T . , .
, n-Cz-Si -
60 , - (V-O, E_c-0,17) [11-
12], ~350 ⁰ [13]. 15-
n-Cz-Si (. 3) ,
n-Cz-Si (300-400 ⁰) -
- Si [13].



. 3. n-Cz-Si.
- 15 .

, n-Cz-
Si - . *b* -
, - . , -
- , -
~50 ⁰ - (. 3).
, -
- :
1) , -
- VO_2: VO+O VO_2;
2) [14; 15].
, , ,
- ,
. -
- -
, .

, , -
b, « » -
- 60 n-Cz-Si.
, -
.

:

1. Bruzzi, M. Radiation Damage in Silicon Detectors for High-Energy Physics Experiments / M. Bruzzi // IEEE Trans. Nucl. Sci. – 2001. – V. 48. – 4. – P. 960-971.

2. Lazanu, I., Lazanu, S. Long-term Damage Induced by Hadrons in Silicon Detectors for Uses at the LHC-accelerator and in Space Missions / I. Lazanu, S. Lazanu // Phys. Scr. – 2003. – V. 67. – 5. – P. 388-395.

3. [ ]. – : www.cern.ch/rd50

4. Maekawa, T. Carrier lifetime of silicon wafers doped by neutron transmutation / T. Maekawa, S. Inoue, A. Aiura, A. Usami // Semicond. Sci. Technol. – 1986. – V. 1. – 5. – P. 305-313.

5. Londos, C. A. Complementary infrared and transmission electron microscopy studies of the effect of high temperature – high pressure treatments on oxygen-related defects in irradiated silicon / C. A. Londos, M. S. Potsidi, A. Misiuk, J. Ratajczak, V. V. Emtsev, G. Antonaras // J. Appl. Phys. – 2003. – V. 94. – 7. – P. 4363-4368.

6. Ostapenko, S. S., Bell, R. E. Ultrasound stimulated dissociation of Fe-B pairs in silicon / S. S. Ostapenko, R. E. Bell. // J. Appl. Phys. – 1995. – V. 77. – 10. – P. 5458-5461.

7. , . .
/ . . , . . , . . . // . – 2002. – . 36. – 4. – . 389-391.

8. , . . -
n- / . . , . . , . . // . – 2006. – . 32. – 13. – . 67-73.

9. Podolian, A. O. Charge carrier lifetime recovery in -irradiated silicon under the action of ultrasound / A. O. Podolian, A. B. Nadtochiy, O. A. Korotchenkov // Tech. Phys. Lett. – 2012. – V. 38. – 5. – . 405-408.

10. Schroder, D. K. Semiconductor Material and Device Characterization / D. K. Schroder. – Hoboken, New Jersey : John Wiley & Sons, 2006. – 784 p.

11. , . . / . . , . . , . . . – . : . , 1974. – 200 .

12. , . . n-Si
- / . . , . . -
. // . – 1991. – . 25. – 8. – . 1332-1338.

13. Watkins, G.D. Intrinsic defects in silicon / G. D. Watkins, // Mat. Sci. Sem. Proc. – 2000. – V. 3. – 4. – P. 227-235.

14. Mikelsen, M. Annealing of the divacancy-oxygen and vacancy-oxygen complexes in silicon / M. Mikelsen, J. H. Bleka, J. S. Christensen, E. V. Monakhov, B. G. Svensson, J. Härkönen, B. S. Avset // Phys. Rev. B. – 2007. – V. 75. – 15. – P. 155202 (8 pages).

15. Furuhashi, M., Taniguchi, K. Diffusion and dissociation mechanisms of vacancy-oxygen complex in silicon / M. Furuhashi, K. Taniguchi // Appl. Phys. Lett. – 2005. – V. 86. – 14. – P. 142107 (3 pages).

22.09.2012 .

, . .- . ., ., .
. . . -mail: gogi@univ.kiev.ua