Atomic Diffusion Mechanism in BF2+ Implanted and Annealed n-Fz Si junction using Analytical Approach: Comparison with 2-D TCAD Process Simulation Result

Puspita Chatterjee1, Ajay Kumar Srivastava1\*

1Department of Physics, University Institute of Sciences, Chandigarh University, Gharuan, Mohali, Punjab, India.

1\*Corresponding author: kumar.uis@cumail.in

**Abstract**. Ion implantation controls the diffusion of the dopants inside the n-Fz Si bulk of the p+n Si microstrip detector. In order to understand about the diffusion of BF2+ molecules/dopants in the n-Fz Si bulk of DSSSD (front side) (Double Sided Silicon Strip Detector) for the R3B Silicon Tracker, it is essential to know the precise information of the microscopic defect inside the Si lattice of the detector for the next phase upgrade of the R3B experiment. The purpose of this paper is to present the atomic transportation and electrical activation behaviour of BF2+ molecules/dopants implanted, n-Fz DSSSD for the R3B Silicon Tracker at an energy of 80 KeV and a dose of 1015 ion/cm2 after annealing at 400-1350 0C.

The result shows the amorphous-crystalline interface position and recrystallization temperature using the results revealed from the 2-D TCAD process simulation of the Si microstrip detector.

References:

[1] S. M. Sze, *VLSI TECHNOLOGY* (McGraw-Hill Companies, New York, 1988), pp.340-361.

[2] Nieh C W and Chen L J 1986 Cross-sectional transmission electron microscope study of residual defects in

 BF+2-implanted (001)Si *J. Appl. Phys.* **60** 3114–9

[3] Chatterji S, Bhardwaj A, Ranjan K, Srivastava A K and Shivpuri R K 2002 Annealing behaviour of boron implanted defects in Si detector : *The European Physical Journal Applied Physics* **232** 223–32

[4] N.E.B. Cowern et al., Mater. Sci. Semicond. Proc. 2,369 (1999).

[5] Stolk P A, Gossmann H J, Eaglesham D J, Jacobson D C, Rafferty C S, Gilmer G H, Jaraíz M, Poate J M,

 Luftman H S and Haynes T E 1997 Physical mechanisms of transient enhanced dopant diffusion in ion-

 implanted silicon *J. Appl. Phys.* **81** 6031–50

[6] Claverie A 1999 Nucleation , growth and dissolution of extended defects in implanted Si : impact on dopant diffusion *Nuclear Instruments and Methods in Physics Research B* **147** 1–12

[7] Eaglesham D J, Stolk P A, Gossmann H J and Poate J M 2010 Implantation and transient B diffusion in Si :

 The source of the interstitials Implantation and transient B diffusion in Si : The source of the interstitials

 *Applied Physics Letter* **2305** 18–21

[8] H. Muller, et al., *Ion Implantation in semiconductors* (Springer, Berlin, 1971), Eds. I.ruge and J. Graul,

 pp.85.

[9] D.G.Beanland, *Fifth International Conference on Ion Implantation Proceedings, Plenum, New York*,

 edited by Chernow F, et al. (1976), pp.31-38.

[10] R.B.Fair, et al., 144 (2), 708-717 (1997).

[11] TMA, TSUPREM-4 V., User manual (1999.2.).

[12] Srivastava A K, Bhardwaj A, Ranjan K, Namrata, Chatterji S and Shivpuri R K 2003 Comparison of p+-n

 junction formed by BF2+ and B+ implantation in silicon microstrip detector with low and high thermal

 budget: Impact of fluorine on electrical characteristics *Mater. Sci. Semicond. Process.* **6** 555–9