AN 434

Characterizing Annealed ULE B Implants using **PCOR-SIMS**^{SM}

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Introduction

Development and improvement of Ultra Low Energy (ULE) boron ion implantation is an area of intense interest as device dimensions continually shrink. Characterization of these implants requires accurate profile shape and oxide layer thickness within the upper several nanometers of the wafer surface. **PCOR-SIMS**^{SM} represents the latest improvements in ULE B characterization that incorporates point-by-point data corrections for all regions of the profile. This method avoids near-surface profile distortions introduced by the older oxygen flooding and normal incidence techniques and yields the most accurate junction depth measurements due to precise measurement of surface oxide thickness.

Discussion

The difference between old and new protocols is dramatically shown in the profiles above of a 250eV as-implanted and annealed Si wafer. Near surface artifacts in the old O_2-flood and normal incidence protocols severely distort the B profile shape of both the as-implanted and annealed profiles. In contrast, the **PCOR-SIMS**^{SM} protocol shows that the as-implanted sample has a Gaussian-shaped peak only 1.3nm below the surface. The annealed sample shows redistribution of B to the interface between the surface oxide layer and the Si substrate, in agreement with existing thermodynamic diffusion models at the Si/SiO_2 interface[1]. In addition, the **PCOR-SIMS**^{SM} profile also gives a quantitative measure of the surface oxide thickness, a feature that is lacking entirely from the O_2-flood and normal incidence profiles. Note that there has been little change in the oxide thickness due to annealing despite significant diffusion of B.

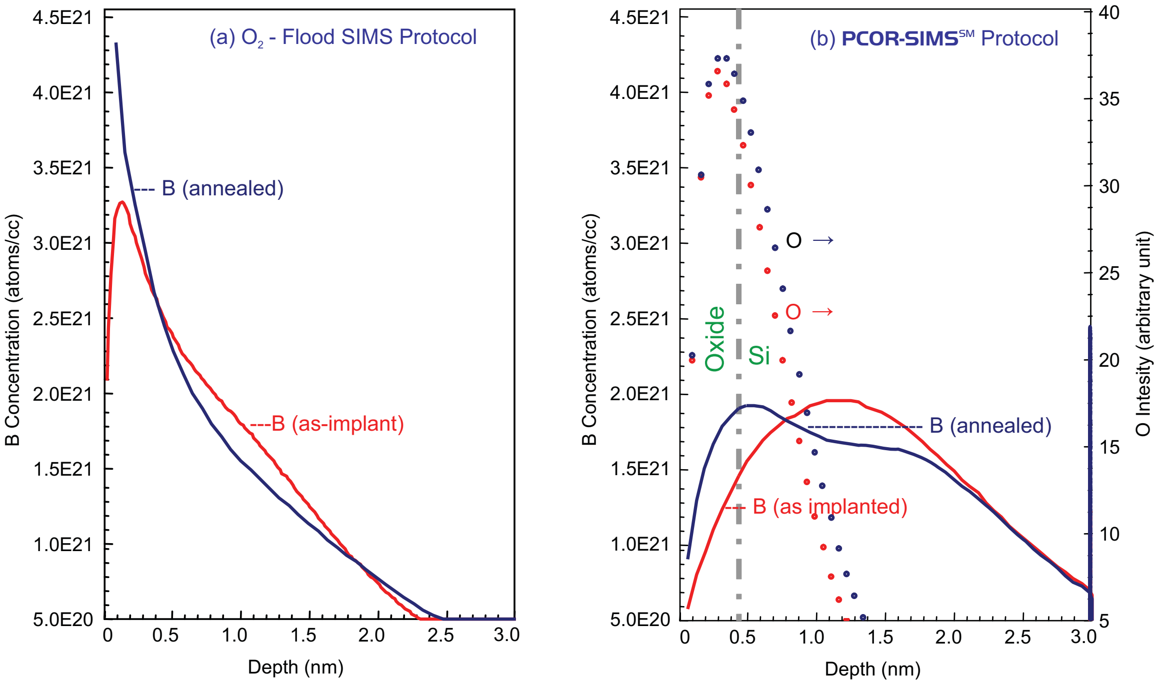

Figure 1. Comparison of two SIMS analysis protocols for 250eV boron implant characterization before and after anneal. Please note that concentration axes are linear unlike the usual log scales. **PCOR-SIMS**^{SM} analysis of annealed B implantation detects accumulation at oxide/Si interface as expected (b). Whereas O_2-flood SIMS protocol results in un-realistic profile shapes (a).

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[1] Phys. Rev. B 68, 195311 (2003)

* The new PCOR-SIMS^{SM} for ULE B protocol is the result of extensive development efforts by EAG. The “PCOR-SIMS^{SM}” name describes, in part, EAG’s proprietary methodology that includes point-to-point correction resulting in the most accurate SIMS profiling yet for ultra shallow implants.

United States Locations

Tempe, Arizona
+1 480 239 0602 info.az@eaglabs.com
+1 602 470 2655 fax

Sunnyvale, California
810 Kifer Road
+1 408 530 3500 info.ca@eaglabs.com
+1 408 530 3501 fax

1135 E Arques Avenue
+1 408 738 3033
+1 408 530 3035 fax

785 Lucerne Drive
+1 408 737 3892
+1 408 737 3916 fax

Peabody, Massachusetts
+1 978 278 9500 info.ma@eaglabs.com
+1 978 278 9501 fax

Chanhassen, Minnesota
+1 952 828 6411 info.mn@eaglabs.com
+1 952 828 6449 fax

East Windsor, New Jersey
+1 609 371 4800 info.nj@eaglabs.com
+1 609 371 5666 fax

Syracuse, New York
+1 315 431 9900 info.ny@eaglabs.com
+1 315 431 9800 fax

Raleigh, North Carolina
+1 919 829 7041 info.nc@eaglabs.com
+1 919 829 5518 fax

Round Rock, Texas
+1 512 671 9500 info.tx@eaglabs.com
+1 512 671 9501 fax

International Locations

Shanghai, China
+ 86 21 6879 6088 info.cn@eaglabs.com
+ 86 21 6879 9086 fax

Tournefeuille, France
+ 33 5 61 73 15 29 info.fr@eaglabs.com
+ 33 5 61 73 15 67 fax

Frankfurt, Germany
+ 49 (0) 693053213 info.de@eaglabs.com
+ 49 (0) 69307941 fax

Tokyo, Japan
+ 81 3 5396 0531 info.jp@eaglabs.com
+ 81 3 5396 1930 fax

HsinChu, Taiwan
+ 886 3 5632303 info.tw@eaglabs.com
+ 886 3 5632306 fax

Uxbridge, United Kingdom
+ 44 (0) 1895 811194 info.uk@eaglabs.com
+ 44 (0) 1895 810350 fax