

HOW DO YOU COMPLY WITH <USP 232/233>? HOW DO YOU KNOW WHEN TO CONDUCT E/L STUDIES? HOW DO YOU FULLY CHARACTERIZE AN ANTIBODY DRUG CONJUGATE? HOW DO YOU MONITOR CHARGE VARIANTS AND DEGRADATIONS? HOW DO YOU DETECT POST-TRANSLATIONAL MODIFICATIONS? HOW DO YOU RE-OPTIMIZE AN ELISA METHOD WHEN A REAGENT LOT CHANGES? HOW DO YOU IDENTIFY UNKNOWN METABOLITES? HOW DO YOU OPTIMIZE AN ANALYTICAL METHOD UNDER GMP? HOW DO YOU KNOW IF A BIOSIMILAR IS SIMILAR TO THE REFERENCE? HOW DO YOU KNOW RAW MATERIALS ARE PURE? HOW DO YOU EVALUATE PRODUCT PACKAGING? HOW DO YOU IDENTIFY THE SOURCE OF CONTAMINATION? HOW DO YOU KNOW WHEN TO RECALL? HOW DO YOU DETECT SURFACE CHEMICAL CHANGES? MULTANEOUSLY TEST FOR TWO ANALYTES? HOW DO YOU ADJUST A FORMULATION FOR TIMED RELEASE? HOW DO YOU MAKE A DRUG ABUSE-DETERRENT? HOW DO YOU MAKE A METHOD MORE ROBUST? HOW DO YOU ENSURE A LINKER WON'T BECOME TOXIC? HOW DO YOU GET A CLEARER SUPERNATANT? HOW DO YOU MONITOR ANALYTE CONCENTRATION OVER TIME? HOW DO YOU ADDRESS AN FDA RESPONSE LETTER ASAP? HOW DO YOU KEEP UP WITH CHANGING REGULATIONS? HOW DO YOU PREDICT EFFECTS OF POST-TRANSLATIONAL MODIFICATIONS? HOW DO YOU EVALUATE CONTAINER/CLOSURE SYSTEMS? HOW DO WE MAKE PACKAGING SAFER? HOW DO WE SPEED UP INNOVATION?

**APPLICATION NOTE**

**Characterizing Annealed ULE B Implants using PCOR-SIMS®**

**INTRODUCTION**

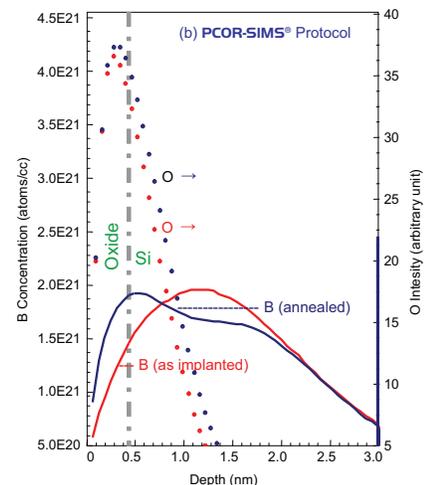
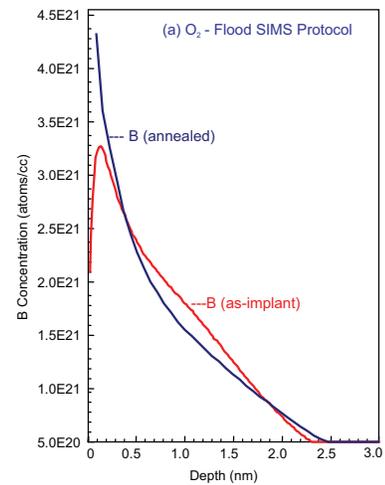
Development and improvement of Ultra Low Energy (ULE) boron ion implantation is an area of intense interest as device dimensions continually shrink. Characterization of these implants requires accurate profile shape and oxide layer thickness within the upper several nanometers of the wafer surface.

PCOR-SIMS® 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<sub>2</sub>-flood and normal incidence protocols severely distort the B profile shape of both the as-implanted and annealed profiles. In contrast, the PCOR-SIMS® 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<sub>2</sub> interface<sup>1</sup>. In addition, the PCOR-SIMS® profile also gives a quantitative measure of the surface oxide thickness, a feature that is lacking entirely from the O<sub>2</sub>-flood and normal incidence profiles. Note that there has been little change in the oxide thickness due to annealing despite significant diffusion of B.

\* PCOR-SIMS® for ULE B protocol is the result of extensive development efforts by EAG. The “PCOR-SIMS®” 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.



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® analysis of annealed B implantation detects accumulation at oxide/Si interface as expected (b). Whereas O<sub>2</sub>-flood SIMS protocol results in un-realistic profile shapes (a).

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