ASSESSMENT OF ADVANCED X-RAY GIXRF METHODOLOGY APPLIED TO THE CHARACTERIZATION OF ULTRA SHALLOW JUNCTIONS

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Grazing Incidence X-Ray Fluorescence (GIXRF) analysis in the soft X-ray range provides excellent conditions for exciting B-K and As-$L_{iii,ii}$ shells. The X-ray Standing Wave (XSW) field associated with GIXRF on very flat samples is used as a tunable sensor for the implantation profile in the nanometer range due to the in-depth changes of the XSW intensity dependent on the angle between the sample surface and the primary beam. This technique is therefore well suited for the study of ultra shallow dopant distributions.
Well-characterized synchrotron radiation induced GIXRF analysis was used to characterize ultra shallow junctions on arsenic implanted 300 mm (100) Si Wafers with a nominal fluence between $1x10^{14}$ cm^{-2} and $5x10^{15}$ cm^{-2} and implantation energies between 0.5 keV and 5 keV as well as boron implanted 200 mm (100) Si wafers with identical nominal fluence and implantation energies between 0.2 keV and 3 keV. The measurements have been performed in the PTB laboratory at the electron storage ring BESSY using calibrated instrumentation [1,2]. This allows for the absolute determination of the total retained dose. An estimate of the concentration profiles is obtained by fitting the X-ray fluorescence angular scans with profiles derived by SRIM simulations of the respective implantation process [3]. The determined implantation depth profiles have been compared to Secondary Ion Mass Spectrometry (SIMS) as well as Medium Energy Ion Scattering (MEIS) [4].

References:

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