

Detection of Nitrogen at Ultra Low Concentration in SiC by SIMS

With the development of high voltage termination technology of SiC devices, detection of nitrogen at ultra low concentration has become important. Recently, the detection limit of N in SiC materials at our company have been greatly decreased from 10^{15}cm^{-3} to 10^{14}cm^{-3} through improvement of instrumentation, measurement conditions, and data-analysis methods. Since variation of signal intensity is decreased, it is also possible to evaluate minute changes in the nitrogen concentration.

SIMS analysis of nitrogen in SiC epi films

Fig.1 shows the SIMS depth profiles of nitrogen in 2 of the SiC epi films.

By using the method of raster change*1 specifically developed for bulk analysis, nitrogen concentrations that agree with the designed valued are obtained.

*1 Details are shown below

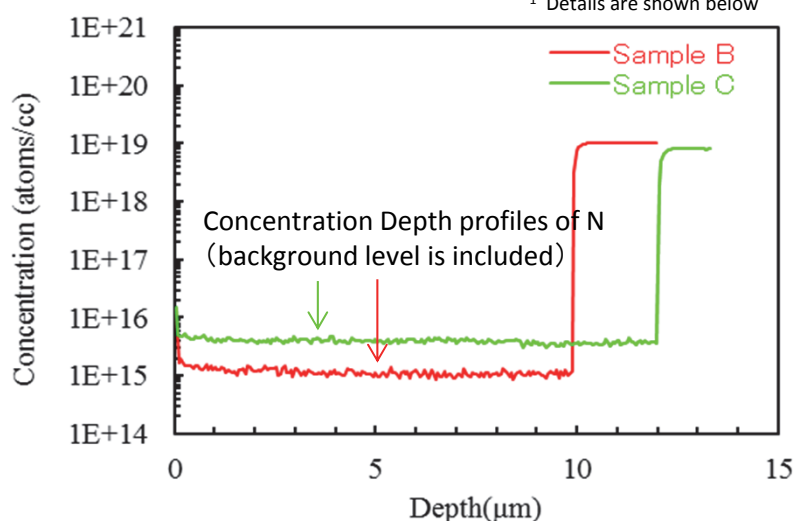


Fig.1 Depth Profiles of Nitrogen in SiC

Table 1 N concentrations in SiC epi films

Sample	SIMS	Hg-CV
B	2E14	1.9E14
C	3.1E15	1.99E15

✕The background contribution has been removed from the SIMS results.

- ✓ Possible to quantify ultra low N concentration
- ✓ Possible to evaluate minute changes in N concentration between samples
- ✓ SIMS results agree with the results obtained by Hg-CV method

The method of raster change *2

By varying the raster area, primary ion density is changed which leads to changes in signal intensity. This allows for separation of the background contribution (from the apparatus) and the contribution from the sample.

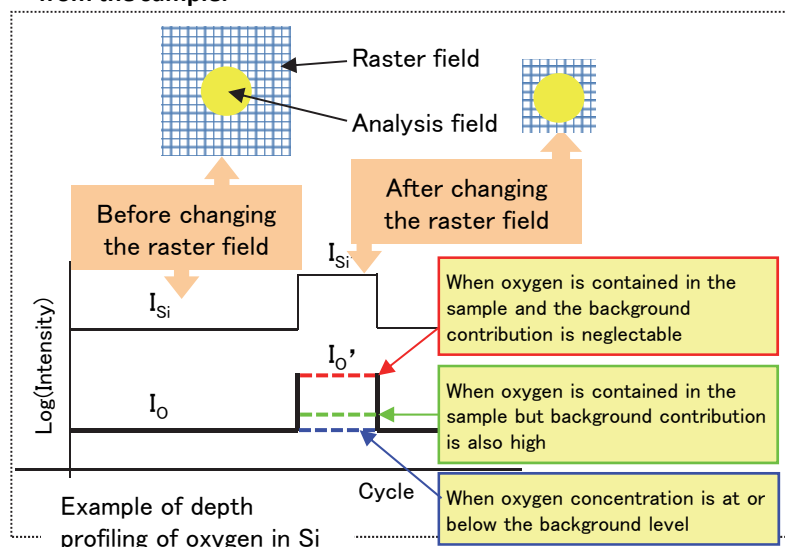


Fig.2 The principle of raster change method (Oxygen in Si)

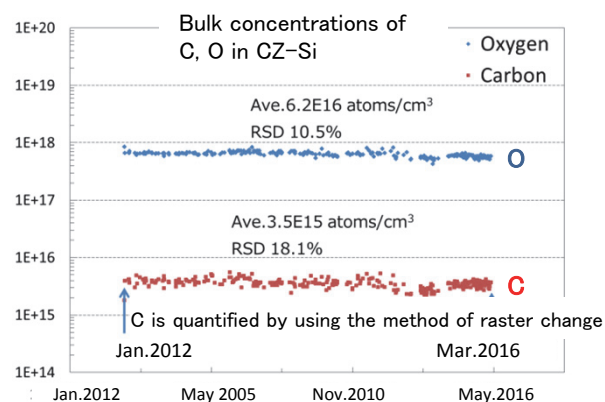


Fig.3 Result of C, O concentrations in the same sample of (CZ-Si) (Verification of the accuracy of SIMS measurements by time)

More than 10 years of highly accurate bulk elemental analysis by SIMS

*2 A.Ishitani, K.Okuno, A.Karen, S.Karen, F.Soeda, Proceedings of Materials and Process Characterization for VLSI(ICMPC '88), edited by X.-F.Zong, Y.-Y.Wang, J. Chen, pp.123, World Scientific