AN 401
Proper SIMS Quantification of Boron in SiGe structures: Comparison of Cs and O Ion Beam Bombardment

May 7, 2007 (Version 3.0)

Discussion

The analysis of SiGe structures by SIMS using Cs ion bombardment does not provide an accurate profile shape for Boron. Known limitations of this analysis include significant tailing of the boron profile from Cs knock-on and chemical segregation effects. In order to obtain the most accurate data for these SiGe structures, EAG recommends that two separate SIMS analyses be performed.

To meet current market financial needs, and when the most accurate B profile shape is not needed, EAG offers the analysis of SiGe structures using Cs bombardment at a basic cost of one unit per sample. For this unit charge Ge composition, dopant concentrations and low background levels of atmospheric contaminants are provided using a quadrupole based SIMS instrument. As illustrated below, if the shape of the boron profile is critical to the analysis, a second profile using O ion bombardment is necessary.

SiGe structures are analyzed using Cs ion bombardment to obtain accurate compositional information and low background levels of atmospheric contaminants. Figure 1 shows the typical negative ion profile acquired using Cs ion bombardment. B, C, O, P, As and Ge were acquired simultaneously and quantified in one analysis at minimal cost. The Ge composition is obtained with ±3-5% accuracy up to 80% Ge, together with very low detection limits for C and O. However, the known limitations of analyzing boron with Cs ion bombardment results in a distorted tail shape. Figure 2 shows a typical positive ion profile acquired using O ion bombardment. This analysis accurately shows the true boron concentration profile shape. Using this analysis, it is easily observed that the boron dopant is entirely contained within the SiGe layer and that two spikes are observed at the Si/SiGe and SiGe/Si interfaces. Based on these data, EAG strongly recommends that two analyses be performed for the proper quantification of B, C, O, P, As and Ge in SiGe structures.

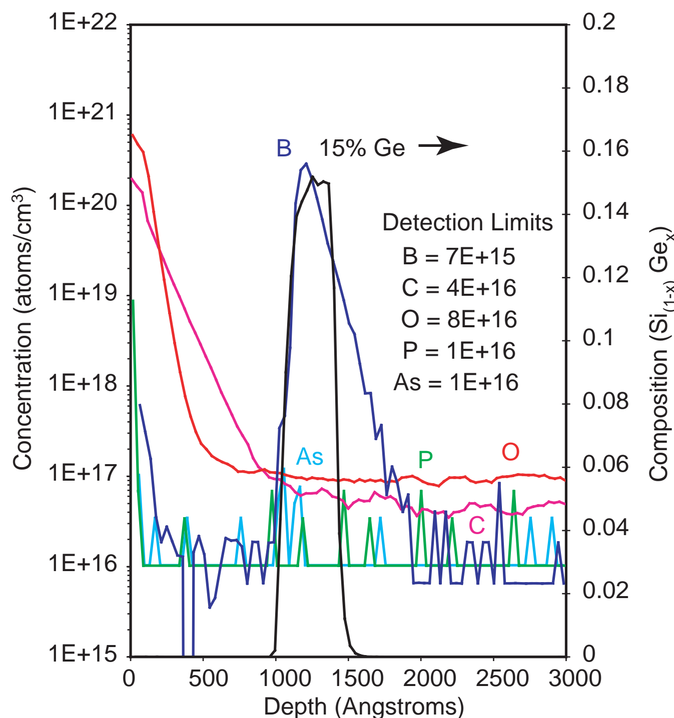

Figure 1. SiGe Analysis Using 2keV Cs

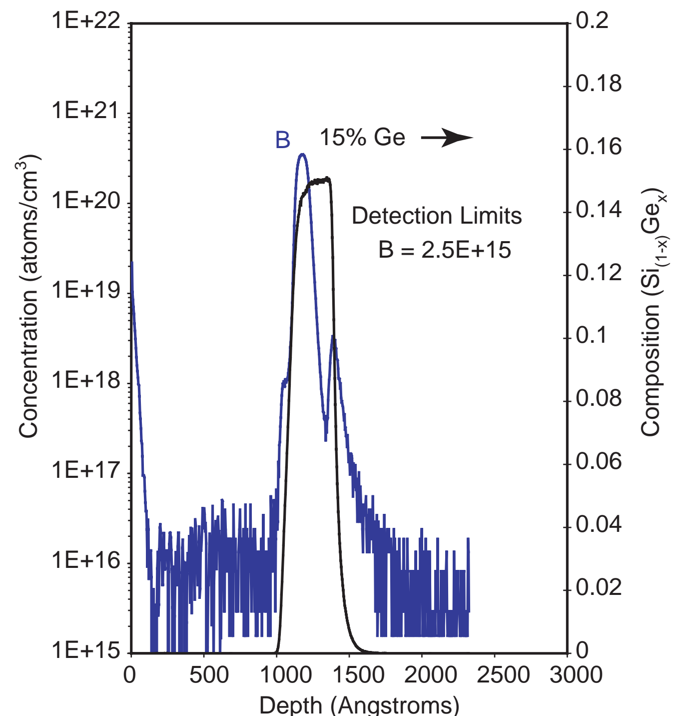

Figure 2. SiGe Analysis Using 1keV O2 w/O-leak

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