S-04

Calibration of SIMS Depth Scale using a B-doped Si Multiple Delta-Layer CRM

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Secondary ion mass spectrometry (SIMS) is the most popular technique for determining the in-depth distribution of doping elements within 20 nm shallow junctions. Therefore the calibration of SIMS depth scale is required for the depth analysis of minor impurities in the shallow depth region.The measurement of crater depth is a common method to calibrate the depth scale of SIMS profiling as shown in Figure 1. ISO/TR-15969 describes some methods for measuring the sputtered depth. Measurement of the crater depth by a mechanical stylus profilometer is one of the general methods for the calibration of sputter depth. The crater depth is defined as the average distance between the original surface and the crater bottom from which the measured signal is derived. SIMS depth scale can be also calibrated using a thin film reference material with a certified thickness.

In this presentation, we will show how to establish the traceability in the calibration of SIMS depth scale using a multiple deltalayer certified reference material (CRM). A B-doped Si multipledelta-layer (MDL) CRM was used for the calibration of SIMS depth scale. The total thicknesses of the films were certified by high resolution transmission electron microscopy. The feature depths determined from the crater depths measured by a stylus profilometer showed a good linear relationship with the same feature depths measured from SIMS profiling using the calibrated film thickness for depth scale calibration. These results indicate that an MDL with a certified thickness can be used as a reference to calibrate the depth scale of a stylus profilometer for measurement of sputter depth.

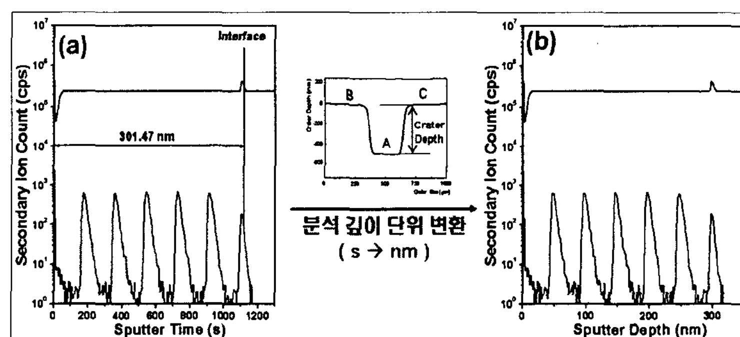

Figure 1. (a) An original SIMS depth profile and (b) a conversion of depth profile from s to nm.