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Determination of Layer Thickness of A/B Type Multilayer Films in SIMS Depth Profiling Analysis

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Correct determination of the interface locations is critical for the calibration of the depth scale and measurement of layer thickness in SIMS depth profiling analysis of multilayer films. However, the interface locations are difficult to determine due to the unwanted distortion from the real ones by the several effects due to sputtering with energetic ions.

In this study, the layer thicknesses of Si/Ge and Si/Ti multilayer films were measured by SIMS depth profiling analysis using the oxygen and cesium primary ion beam. The interface locations in the multilayer films could be determined by two methods. The interfaces can be determined by the 50 at% definition where the atomic fractions of the constituent layer elements drop or rise to 50 at% at the interfaces. In this method, the raw depth profiles were converted to compositional depth profiles through the two-step conversion process using the alloy reference relative sensitivity factors (AR-RSF) determined by the alloy reference films with well-known compositions determined by Rutherford backscattering spectroscopy (RBS).

The interface locations of the Si/Ge and Si/Ti multilayer films were also determined from the intensities of the interfacial composited ions (SiGe+, SiTi+). The determination of the interface locations from the composited ions was found to be difficult to apply due to the small intensity and the unclear variation at the interfaces.

Keywords: SIMS, Mutilayer, interface, composited ion