AN 417
Determination of SiGe Stoichiometry

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Discussion

Quantitative analysis in Auger Electron Spectroscopy (AES) has traditionally been limited to elemental composition based upon normalization of derivative spectra using sensitivity factors derived from pure materials. Problems using this approach, such as nonlinear energy resolution and peak shape changes due to chemistry have contributed to a degree of uncertainty in quantitative AES data.

There are many materials, however, that do not exhibit significant change in the Auger electron yield due to chemical binding effects. These materials include most alloys, some compounds and many semiconductors. An example of a semiconductor that can be accurately characterized using Auger Electron Spectroscopy is silicon-germanium, a promising material for faster electronic devices. Quantification of this material by SIMS has been shown to be nonlinear at high Ge concentrations.

Figure 1 is an Auger ion-sputtered depth profile of a multilayer silicon-germanium sample (calibrated by RBS) with regions of 74%, 49% and 24% germanium, respectively. The Auger profile is normalized using elemental sensitivity factors and clearly reflects the correct germanium content in each layer (±2% at.). Figure 2 is the SIMS profile of the same sample, exhibiting similar changes in composition for each layer shown in the AES profile. Note that the error in the SIMS data increases with Ge concentration. These analyses illustrate the application of Auger spectroscopy in quantitative materials characterization and also the advantages of using various techniques to accurately define the elemental composition of electronic materials.

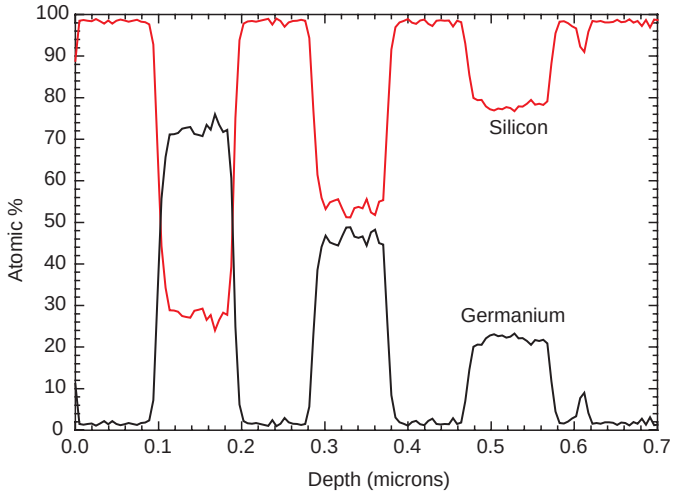

Figure 1. AES depth profile of a multi-layer SiGe sample. SiGe is one of the many alloys that can be quantitatively characterized by AES.

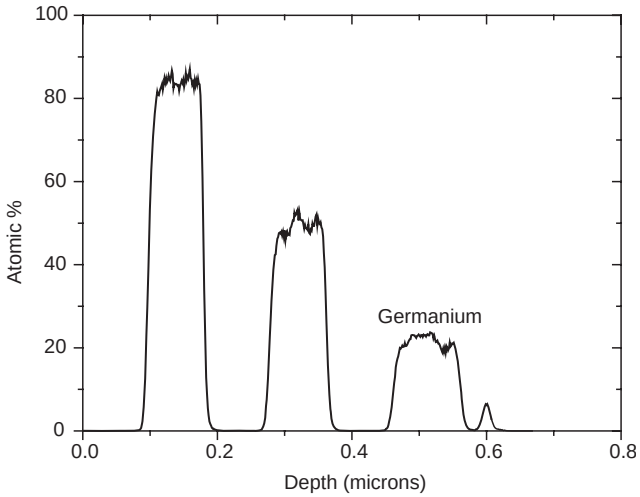

Figure 2. SIMS depth profile of the same sample. You can use various techniques in concert to more fully understand the properties of electronic materials.

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