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Experimental and Theoretical Depth Resolution Functions in AES Depth Profiling

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An outline of the current state of depth profiling by ion sputtering is presented. The main factors causing profile broadening have to be considered in order to optimize sputter profiling experiments. These factors can be divided in three categories, namely change of surface topography (roughness), change of surface composition (mixing and preferential sputtering etc.) and information depth of the analysis method (e.g., Auger electron escape depth).

The sputter profile of a very thin layer ("delta-layer") represents the depth resolution function, which is composed of all the relevant broadening factors. Particularly useful in AES depth profiling is the acquisition of the sputter profile of a bilayer A/B with infinitesimal thin interface. Differentiation of this measured profile yields the experimentally determined depth resolution function. On the other hand, the depth resolution function can be established theoretically by modeling the physical mechanisms of e.g. atomic mixing, surface roughness and information depth (MRI-model)/1/. These three parameters are obtained by fitting the calculated depth resolution function to the experimentally determined one. As shown for GaAs/AlAs interfaces, variations of the profiling conditions and of the electron escape depth can be distinguished by their different effect on the depth resolution function. Within the margin of experimental errors, the determined depth resolution function can be used for deconvolution and/or reconstruction of the original in depth distribution.

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