[IV~6]

A Practical and Simplified Interpretation of Auger Electron and X-ray Photoelectron Spectra for Surface Layered Structures

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1. Introduction Sputter depth profile and angle dependent analysis of Auger electron and/or photoelectron peaks are major analytical ways to get depth information. However, these techniques also have big difficulties of analysis. One is the sputter damage. Sputtering sometimes changes surface chemistry completely. Organic materials are typical examples of this. The other is a big difficulty to keep a small sample at the analysis area, exactly, when tilting the sample. Tougaard[1] has reported a semi-quantitative way of analysis, and Seah also showed a typical figure of plasmon loss shapes[2]. These semi-quantitative ways showed some spectral line shape examples. However, these expressions look like to require us to use mathematical calculations including a complex(?) convolutions, or using some sorts of software[3]. This report tries to explain a very simplified, qualitative, and practical understanding to interpret measured electron spectra.

2. An example of measurements Fig.1 is an example of XPS spectrum acquired with PHI-5600 which has an almost flat transmission function. The sample is a high purity iron. A big difference is observed at the background (so called peak-background). The sputtered sample shows smaller background. When comparing backgrounds below C 1s and O 1s of the contaminated sample, C 1s has smaller one than O 1s.

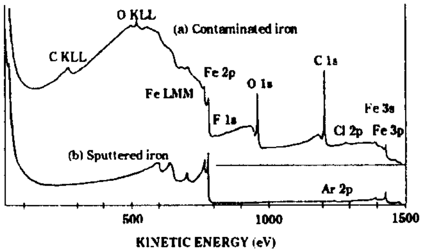

Fig.1 XPS Spectra of high purity Fe (a) contaminated (b)sputtered

3. Simplified Interpretation and conclusion Peak backgrounds are generated when photoelectrons or Auger electrons are passing through the materials over the electron emitted point. If the number of inelastic scattering are increased, generated background should be larger. Also, the intensity of no-loss electrons is exponentially decreased. A relation between the number of inelastic scattering, emitted depth and signal intensity can be simplified and modeled like Fig.2, as a Poisson's distribution.

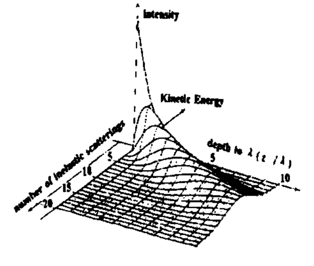

Fig.2 Peak background model

A kind of depth information is reflected on a wide spectrum of XPS and AES. Deeper emission makes larger peak background, and shallower emission makes smaller one to peak intensity. According to this effect and simplified background line shape[2], we can roughly estimate thickness of some overlayers.

References [1] S.Tougaard, J.Vac.Sci.Technol.A8, 2197(1990) etc., [2] M.P.Seah, Chap.5 of *Practical Surface Analysis* 2nd. ed., p.249 (Figure 5.32),Wiley (1990), [3] S.Tougaard, *QUASES* (1994)

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