The Reliability of Quantitative Surface Chemical Analysis with Electron Spectroscopy

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VAMAS Project (Versailles Project on Advanced Materials and Standards) was set up at the economic summit of Versailles in June 1982. A number of technical working parties have been organized, one of which is Surface Chemical Analysis (SCA). In the VAMAS-SCA party, there are 31 projects involving AES, XPS, depth profiling, SIMS, etc. In Japan, the Japanese VAMAS-SCA working group, in which 50 institutes are involved, has been in existence since 1985.

The main theme of this group is to improve the performance of AES and XPS. We have prepared Au-Cu alloys and Co-Ni alloys for round robin AES and XPS and distributed to the participants of these projects, then carried out round robin tests on the reliability of quantitative surface chemical analysis.

Since 1990, under the VAMAS umbrella, the projects have been started to construct software in Quick Basic for IBM PC or NEC PC with MS-DOS to translate spectral data acquired on different machines to the VAMAS-SCA Standard Data Transfer Format and construct software to manipulate AES and XPS spectra in a standard manner. We call this system COMMON DATA PROCESSING SYSTEM.

The COMMON DATA PROCESSING SYSTEM is a software to assess the data processing procedures proposed by scientists, to check a spectrum, to utilize a spectra database and correction factor database. In this system, the spectral data taken on different machines can be shared. At present, Ver.2.4 has been already distributed.

Main results on round robin tests are summarized as follows:

(1) AES round robin by using Au-Cu alloys
The error of the surface concentration calculated with peak intensities of pure Au and pure Cu as the standard materials lies between about 3% and 10%, and that with the relative sensitivity factors lies between about 7% and 20%.

(2) XPS round robin by using Au-Cu alloys
The error of the surface concentration calculated with peak intensities of pure Au and pure Cu as the standard materials lies between about 2% and 6%. However, the scattering of data became very large, when the relative sensitivity factors were used.

(3) AES round robin by using Co-Ni alloys
The surface concentrations were calculated by the curve fitting procedure and obtained within the errors of about 2%.