

## **XPS applications in the analysis of Alloys'**

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Electronic structure of alloys has been studied for long time due to its application in everyday life. From the results of x-ray photoelectron spectroscopy, we can estimate the composition and its chemical state. Core level shift is the basis of the understanding the electronic structure of alloys. To get the quantitative information of alloy, the sample preparation and the data analysis process are quite important. Using conventional method like core level shift and resonant photoemission, we are going to present the detailed information on the electronic structure of Au-Cu alloys. Also we will show another alloy system which shows the needs for high resolution to make the analysis be meaningful. If the same treatment as in Au-Cu alloy is applied to this system, we can get quite a strange results.

The electronic structure of an alloy is not explained by the unique theory. And it is not easy to separate the effect of each component of alloy in the analysis of experimental results. Among the many binary alloy systems, the Au-Cu system is one of the most frequently studied alloy system. Mossbauer Isomer shift and photoelectron spectroscopy show different direction of the charge redistribution. And the order-disorder transition in single crystal has been studied as a model system of the surface segregation. In previous reports, it is generally believed that the interatomic charge redistribution in metallic alloy is negligible due to its itinerant band character in metals. Egelhoff<sup>1</sup> showed that in the core level binding energy shift problem, all the possible effects including final state effect should be considered to estimate the amount of charge redistributed more accurately. Another controversy in this Au-Cu system is on the density of

states of each component near the valence level upon alloying. The overlapping of d-bands between Au and Cu is relatively small. On the basis of the d-d repulsion model, Eberhardt<sup>2</sup> showed that the partial density of each d band in Cu and Au is separated well. But from the results of DiCenzo et al.<sup>3</sup> and Wertheim et al.<sup>4</sup>, the gold 5d band is crossed well through the entire spectral region. To get the clear understanding of this system, the core level shift of the Au-Cu alloy has been studied including final state effect which is neglected in many previous studies. Second, the resonant photoemission including valence band spectra has been applied for the controversial problems of partial density of states in Au-Cu alloys. Figure 1 shows the core level shift of this alloy, on which the detailed information on charge redistribution is dependent. Left side is the spectrum of Au 4f state while right side is that of Cu 2p<sub>3/2</sub>. We will give the explanation on our experiment results including the resonant photoemission results also.<sup>5</sup>

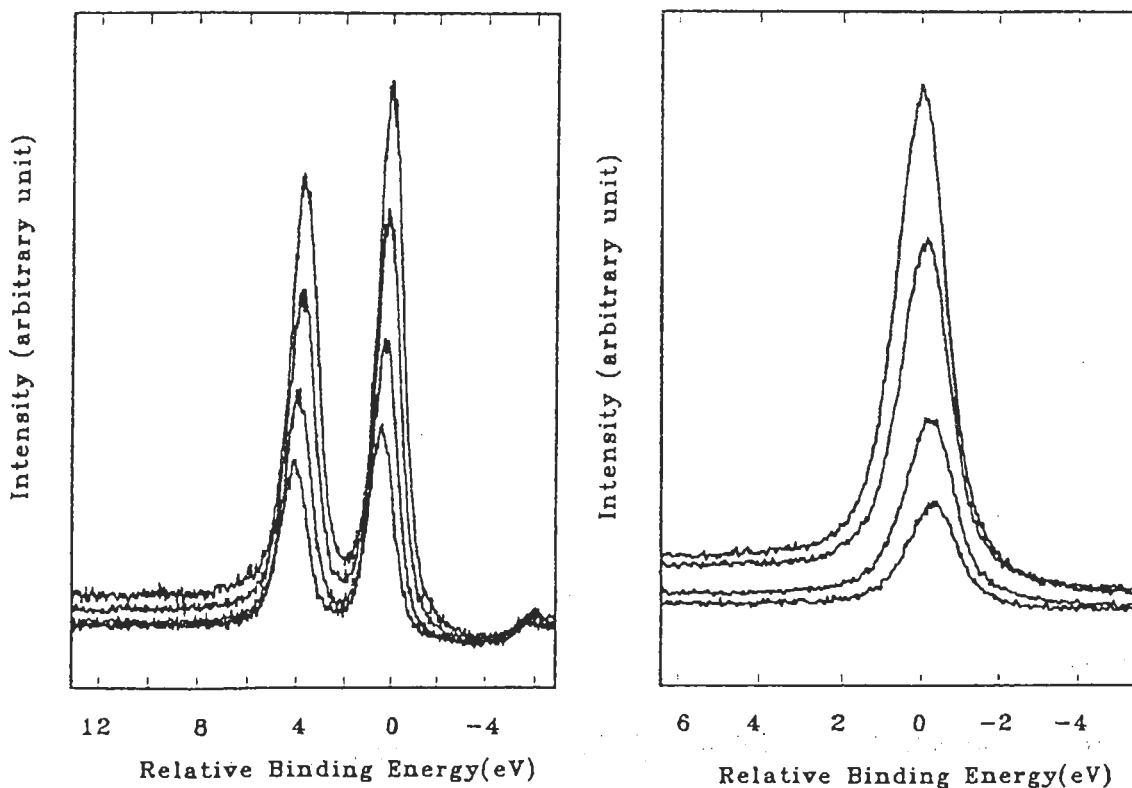


Fig. 1

Some alloy systems need more accurate measurement to get the clear understanding on the electronic structure of alloys. This is related to the light source and electron optics. Figure 2 shows Pd 3d core level spectra in  $\text{Ag}_{25}\text{Pd}_{75}$  alloy using both mono and twin anode source. It is quite interesting that using mono source, Pd 3d core level shows obvious two components.

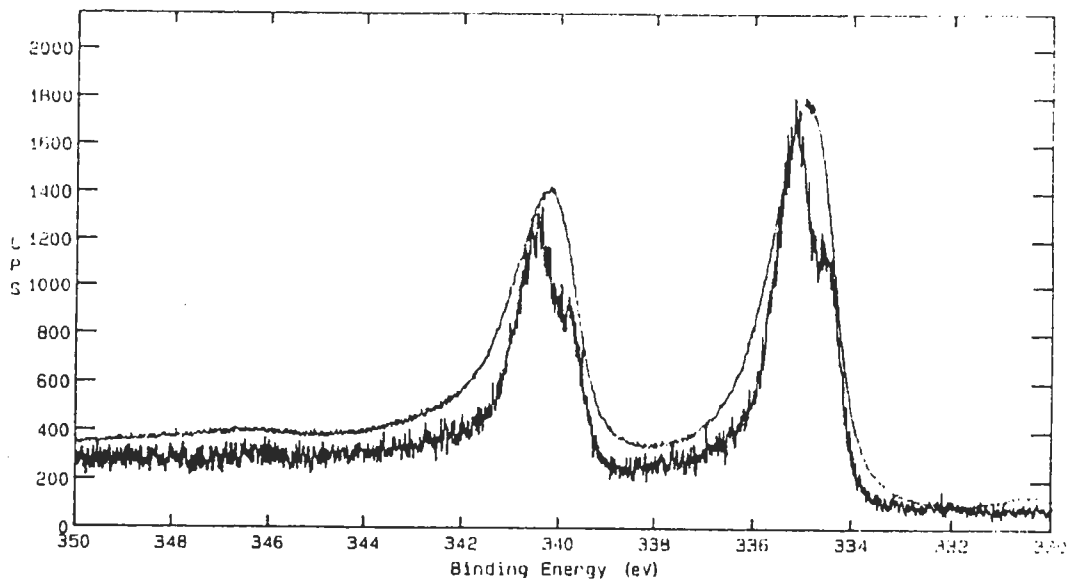


Fig. 2

Here we are going to stress the importance of the mono source in accurate analysis of the XPS spectrum. Using angle resolved x-ray photoelectron spectroscopy, we could expect the origin of the peak which has relatively lower binding energy. It is due to the Pd clusters surrounded by Ag environment. The detailed origin of this kind of decomposition is not still clear. But we will show many different aspects of this system as a standard system of composition analysis in binary alloys.

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