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X-RAY PHOTOELECTRON SPECTROSCOPY OF SOME INDIUM COMPOUNDS

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X-ray photoelectron spectroscopy of some indium compounds was studied. Chemical shifts were found among the InM_4 or M_5 electrons emitted from metallic indium, indium oxide, indium EDTA·OH and indium EDTA. It was shown that the simple charge-binding energy relationship did not always hold good for the complex compounds studied.

In this paper we report X-ray photoelectron spectroscopy of several indium compounds which have not been extensively investigated so far.

X-ray photoelectron spectra were measured by an AEI ES-100 spectrometer, using the M_g-K_α line (1253.6 eV). Charge up of the samples by the X-ray irradiation was avoided by a careful preparation of the specimen as thin as possible,[1] especially in metal complexes. This was confirmed by checking electron spectra of N1s electrons or C1s electrons. Instability of the peak position is within about 0.3 eV.

The samples of sodium ethylenediaminetetraacetatoindate (III) Na[In(EDTA)$(H_2O)]2H_2O$ and N-2-hydroxyethylethylenediamine-N,N',N'-triacetatoindate (III) [In(EDTA·OH)$(H_2O)_2$] were synthesized according to the literatures[2,3] Metallic indium was a reagent of 99.99 % purity which was purchased from Mitsuwa Co. Indium oxide was air oxidized from the fresh surface of metallic indium.

The results obtained for metallic indium, its oxide, indium EDTA·OH and EDTA complex are shown in Table 1. The binding energies of InM_4 and InM_5 electrons show the clear chemical shifts from metallic indium to the indium EDTA complex, even taking the unstability (±0.3 eV) into consideration. It is interesting to see that the indium complexes show higher binding energies (~2 eV) compared to metallic indium, and even higher than that of indium oxide. These data seem to show the complexity for which the simple charge-binding energy relationship cannot be applied as in the case of the palladium complexes.[4]

Indium EDTA is known to be more stable than indium EDTA·OH as expected from the view point of their structural relationship (i.e. one of four oxygen ligands in indium EDTA is out of bondage in indium EDTA·OH due to the replacement of CH_2COO by CH_2CH_2OH). This reflected upon isotopic exchange phenomena,[5,6] and recently upon

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Table 1. Photoelectrons emitted from the inner shells of indium in some indium compounds.

	Binding Energy(eV)		Chemical Shift(eV)	
	InM_4	InM_5	InM_4	InM_5
In metal	450.8	443.1	—	—
In oxide	451.9	444.2	1.1	1.1
In EDTA·OH	452.4	444.9	1.6	1.8
In EDTA	453.1	445.5	2.3	2.3

threshold energy determination of the hot atom effects.[7] That is, an isotopic exchange in the indium EDTA·OH complex is more rapid than in the indium EDTA complex and the appearance energy of the hot atom effect is lower in the former than in the latter. However, the exact meaning of the inner-shell electron binding energy shift between these complexes is not clear at present.

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