Masterarbeit

Application of XPS for studies of the composition of organized Langmuir-Blodgett films

X-ray photoelectron spectroscopy (XPS) belongs to one of the most powerful methods used for the qualitative and quantitative analysis of species present at surfaces of solids. In XP spectroscopy an X-ray beam of light with a known energy is focused on a solid sample. The energy of the incoming light is sufficient to remove an inner core electron from an atom present in a solid. The free electrons travel with a certain kinetic energy, which is measured, to the electron analyzed and detector. The binding energy of an electron on a given orbital is specific to each element and is determined during the measurement. Clearly, XPS is an excellent technique to identify elements present in an analyzed sample. Obviously, the binding energy of an electron in an atom depends on its oxidation state and chemical environment of the sample. In XP-spectrum is it reflected as so called chemical shift allowing the determination of the oxidation state and chemical environment of the analyzed sample. Moreover, the quantitative analysis of the composition of different elements in the analyzed sample can be done.

In this study qualitative and quantitative analysis of the composition of a hybrid organic-inorganic amphiphilic molecule (Figure 1) in Langmuir-Blodgett mono- and multilayers will be studied.

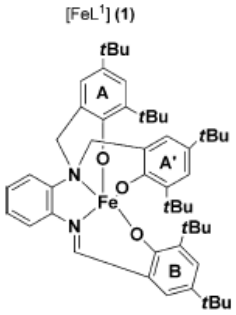

Figure 1. Structure of the $Fe^{(III)}L$ complex molecule.

First a monolayer of the amphiphilic compound will be prepared at the air|water interface and transferred on the surface of gold. Langmuir-Blodgett technique will be used to transfer molecular films of $Fe^{(III)}L$ onto the gold substrate surface. In this study monolayers as well as multilayers containing 2,3, 5 and 10 layers will be prepared. Survey XPS spectra as well as signals from C, N, O, Fe atoms of the analyzed molecule in LB films as well as of Au from the substrate will be measured. Angle dependent analysis will be performed in order to analyze the composition and chemical environment of the amphiphilic molecules in different layers.

In addition, the molecule shown in figure 1 is redox-active, the $Fe^{(III)}$ center may be reduced to $Fe^{(II)}$. Electrochemistry will be used to reduce the $Fe^{(III)}$ metal centers in mono- and multilayers assemblies. Using XPS an approach will be done to identify signals from Fe and describe them corresponding oxidation states.

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