**Photoemission at**
**Semiconductor / Electrolyte Interfaces**

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In order to elucidate wet chemical reactions on an atomic scale Gerischer initiated the application of modern surface science techniques to semiconductor electrolyte interfaces. Ultraviolet and x-ray photoemission have proven to be amongst the most powerful methods for the investigation of chemical and physical interface properties. A prerequisite for the acquisition of meaningful measurements is the integration of processing and analysis in a integrated ultra high vacuum system to avoid contamination by ambient atmosphere. For the solid liquid interface adsorption and coadsorption experiments of electrolyte species on cooled samples, modeling the solid liquid interface may be carried out. Several attempts have also been undertaken to couple an electrochemical cell to a UHV system. Thus the electrode surface may be processed under inert gas atmosphere and analyzed after emersion under potential control and transfer into the UHV system, without contact to ambient air.

Adsorption experiments on non-reactive monocristalline semiconductors allow for a detailed understanding of elementary charge transfer processes and solute-solvent interactions. Physical properties as band bending and photopotentials are readily available from photoemission measurements. Also occupied electronic states in the model electrolyte are accessible. Adsorption of model electrolytes on reacative semiconductor surfaces allow for a detailed understanding of adsorption mechanisms and intermediate reaction steps of complex wet etching processes. On the other hand emersion experiments show the final surface composition as produced by technologically relevant processing steps as e.g. etching, passivating, anodizing or plating.

We have built up an integrated adsorption and emersion system into an UHV spectrometer called SOLIAS (Solid Liquid Analysis System) at BESSY. The possible applications of SOLIAS will be shown by the hydration of sodium ions[1], by a combination of coadsorption and emersion experiments on GaAs (110) / $Br_2$ / $H_2O$ interfaces[2][3], by etching of GaAs (100) wafers with aqueous HCl and $NH_3$ solutions, by anodizing of GaAs in $H_2O$[4], and by sulfur passivation of GaAs (100) in dependence of different solvents. Also CVD and PVD processes my be performed in the system in order to analyze e.g. in situ wet chemical engineering of the band alignment of semiconductor hetero-junctions.

[1] Th. Mayer and W. Jaegermann
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[2] M. Beerbom, O. Henrion, A. Klein, Th. Mayer and W. Jaegermann
*XPS analysis of wet chemical etching of GaAs by $Br_2/H_2O$: Comparison of emersion and model experiments*
Electrochimica Acta 45 (2000) 4663

[3] M. Beerbom, Th. Mayer and W. Jaegermann
*Synchrotron Induced Photoemission of Emersed GaAs Electrodes After Electrochemical Etching in $Br_2/H_2O$ Solutions*
J. Phys. Chem. B 104 (2000) 8503

[4] M. Beerbom, Th. Mayer, W. Jaegermann, D. R. Batchelor and D. Schmeißer
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