07. X–1 PHOTOEMISSION OF ADSORBED XENON: A PROBE FOR ATOMIC-SCALE SURFACE STRUCTURE

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The sensitivity of Photoemission of Adsorbed Xenon (PAX) towards the atomic-scale structure of surfaces is based on the fact, that the electron binding energies of adsorbed Xe atoms E_B^F (with respect to the Fermi level F) reflect the local work function φ(local) of the respective adsorption site [1]. As a consequence on heterogeneous surfaces adsorption states of xenon coexisting on surface sites of different local work function φ(local) may be distinguished by their shift in E_B^F(local) with respect to each other. While E_B^F(local) is a measure of φ(local), the photoemission intensity of each Xe state is a measure of the concentration of each specific kind of surface site of given φ(local). The lateral resolution between sites of different φ(local) is better than 10 Å.

In the present context PAX together with other surface sensitive techniques as Low energy electron diffraction (LEED), Auger electron spectroscopy (AES) etc. will be used to study the atomic-scale topography of thin adsorbed metal layers as a function of temperature and layer thickness. Also using PAX, the first direct experimental verification of a "Roughening transition" in an adsorbed film, namely Xe multilayers, will be presented.

[1] K. Wandelt, J. Vac. Sci. Technol. (1984) in press.

07. X–2 MOLECULAR SIEVES AND ZEOLITE CATALYSTS. By

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Zeolite molecular sieves, porous tektosilicates originally developed for use in separation processes, have become of prime importance in heterogeneous catalysis. Numerous organic reactions can be carried out using acidic and/or metal loaded zeolite catalysts. The latter comprise many zeolite structure types, differing considerably in pore size and tortuosity of the intracrystalline channels which impose configurational and diffusional constraints for the reactant molecules, transition states and reaction products.

Faujasite-type zeolite catalysts revolutionized catalytic cracking and brought about enormous changes in petroleum processing. The new generation of 'high silica zeolites', notably those of the pentasil series (ZSM-5 etc.) display extraordinary shape selectivity in catalytic reactions. Examples will be presented illustrating the controlling factors and structure-related catalytic properties of these porous crystals which have been referred to as inorganic analogues of enzymes in view of their remarkable activity and selectivity.

07. X–3 TAILORING OF METALLIC ALLOYS: IS IT POSSIBLE ?

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It is a fact that the alloys which have conditionned the advances of the technics have been found empirically by metallurgists from the prehistoric ages up to the twentieth century.
The properties of alloys like bronze, quenched steels and age-hardened light alloys have been explained, afterwards, by the metal physicist. A decisive advance came from the determination of the atomic structures of the crystal at first, then of the crystalline defects. The development and the deepening of our theoretical knowledges of the metallic state allows now in some cases to predict a priori the influences of changes of composition and of thermal or mechanical treatments. So improvments of existing alloys have been realised as consequences of theoretical ideas. Often indications are only qualitative; experiments are still necessary, but, what is important for industry, useless trials are avoided. Examples rather rare of partial tailoring will be given in the domain of light alloys.

07. X–4 DIELECTRIC AND PIEZOELECTRIC CERAMICS.

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In modern electronics many components utilize ceramic materials because of their unique properties, their low-cost fabrication and their wide range of modifications. In the field of dielectric and piezoelectric ceramics which are widely used in ceramic capacitors and electromechanical transducers, the interest is primarily directed to ferroelectric materials, such as $BaTiO_3$ and $Pb(Ti_{1-x}Zr_x)O_3$, because these fulfill the basic requirements of high permittivities and high electromechanical coupling factors. In general, however, the plain ferroelectric compounds are not directly suited for the stringent requirements of industrial applications, so that they often demand a more or less sophisticated modification of their properties. Intensive research and development work has made available a number of "tools" which are well suited to manipulate these materials in such a way that many of the requirements can be fulfilled adequately. Such tayloring of materials and devices can be performed in different ways, as for example by:
- compositional optimization (doping, solid solutions, stoichiometry)
- controlled heterogeneity on micro and macroscales
- composites or special arrangements of the device.

In some cases the physical and chemical mechanisms are quite well understood, whereas in others the basic principles are still under investigation. The different possibilities to manipulate the properties of these components are briefly reviewed and some recent investigations in this field will be presented.