

Physics of metal/electrolyte interfaces

Prof. Dr. Klaus Wandelt

List of contents

1. Why are surfaces and interfaces interesting?

- 1.1 Technological relevance of surfaces
- 1.2 Specific properties of surfaces: An intuitive approach

2. The “surface science approach”: State-of-the-art

- 2.1 Experimental conditions and methods
 - 2.1.1 UHV-requirement, single-crystals
 - 2.1.2 Surface analytical methods based on electron-, ion-, photon-beams and scanning probes
- 2.2 Our understanding of surface properties and processes
 - 2.2.1 Surface structure: Relaxation, reconstruction
 - 2.2.2 Electronic properties of surfaces
 - 2.2.3 Dynamics at surfaces
 - 2.2.4 Chemical composition: Segregation
 - 2.2.5 Defects at surfaces
 - 2.2.6 Adsorption, reaction, catalysis
 - 2.2.7 Film growth

3. Metal/electrolyte interfaces

- 3.1 The “electrochemical double layer”
- 3.2 Classical electrochemical methods
- 3.3 Modern solid/liquid interface methods
 - 3.3.1 Photon-based methods: X-ray-diffraction, X-ray-fluorescence spectroscopy, IR-Spectroscopy
 - 3.3.2 Scanning-Tunneling- and Scanning-Force-Microscopy
 - 3.3.3 Sample preparation
- 3.4 Our understanding of properties and processes at metal/electrolyte interfaces
 - 3.4.1 Anion-adsorption/- desorption: Structures, morphologies, charge state
 - 3.4.1.1 Halogenides: Chloride, Bromide, Iodide
 - 3.4.1.2 Pseudohalogenides
 - 3.4.1.3 Sulfide
 - 3.4.1.4 Sulfate
 - 3.4.2 Film-, phase-formation

3.4.2.1 Reaction with substrate: Cu/Iodide-, Cu-Sulfide-phases

3.4.2.2 Deposition, Electrochemical Atomic Layer Epitaxy (ECALE): Cd/Chloride, Cd/Sulfide, Cu/Au, Cd-S/Cu etc

.

3.4.3 Organic layers, selfassembly

3.4.3.1 Porphyrin-, Phthalocyanine-Layers

3.4.3.2 Viologen-Layers

3.4.4 Electrocatalysis