Modulbezeichnung:	**Korrosion und Oberflächentechnik (M1-WW4)**	**30 ECTS**
Modulverantwortliche/r:	Patrik Schmuki	
Lehrende:	Patrik Schmuki	

Startsemester: WS 2014/2015	Dauer: 2 Semester	Turnus: jährlich (WS)
Präsenzzeit: 330 Std.	Eigenstudium: 570 Std.	Sprache: Deutsch

Lehrveranstaltungen:

UNIVIS-MODUL IM AUFBAU!!

Basics Electrochemistry I + II:

Electrochemistry plays important role in scientific and technological fields. Nowadays, the research areas are centered, but not limited, on nanotechnology and energy devices i.e. fuel cells, battery systems and solar cells. In principle, the electrochemistry involves the study of relationship between electricity and chemical reactions, such that chemical free energy associated with a reaction is converted into electrical energy (e.g. fuel cells) or conversely, electricity is used to decompose stable chemical systems (e.g. production of chlorine). The course program provides an opportunity for students to understand the basics of electrochemistry and provide the fundamental tools for understanding electrochemical-reactions and electrochemical-devices.

Topics covered in this course: Thermodynamics: enthalpy, entropy, free energy, chemical equilibrium, Electrolytes, aqueous solutions, organic solutions, solid ionic conductors, Electrodes: types of electrodes, electrode potential, Nernst equation, Electrochemical systems: electrolytic cells and galvanic cells, The electrode-solution interface: The electric double layer, Relationship between electrochemical reaction rate and current, Electrode kinetics: mass transport control, charge transfer control, reaction control, Butler-Volmer equation, Instrumental techniques in electrochemistry, Technology: fuel cells, battery systems, electrochemical devices.

Surface Analysis I + II:

The generation of nanostructured materials gained relevance in the recent years and efficient characterization methods were developed, permitting insight into the topographical and chemical nanostructure of materials. The scope of this course covers a range of surface analytical instruments, discussing their principle mode of operation, application and data interpretation. All discussed instruments are also available at the chair and tutorials at the machines are a part of the lecture. The generation of nanostructured materials from particles to complex 3 dimensional structures is the topic of the second part of this lecture.

Topics covered in this course: Basics in crystallography, surface characterization techniques, STM/AFM, SEM/EDX, XPS/Auger, XRD, ToF-SIMS, Generation of nanostructures, nanostructured CVD, sol-gel process, application of nanostructured surfaces.

Surface Modification techniques:

The tailored modification of surfaces plays an important role in material science. Besides improving e.g. the corrosion and tribological properties of materials surfaces by specific methods and approaches, also completely new properties can be achieved. In this course common methods of surface modification and surface functionalization are covered. The theoretical background and examples, indicating the relevance of these methods in everyday life and industry, are presented. In addition to the common methods new highly promising approaches are introduced and discussed.

Topics covered in this course: Mechanical, thermomechanical and thermal methods (e.g. blasting, nitriding, induction hardening), Plasma aided methods, Laser and electron beam methods, Ion implantation, Lithography, Chemical conversion layers (phosphatization, chromating), Electrochemical conversion layers (anodizing), CVD/PVD techniques, Organic coatings (paints and lacquers), Self assembled monolayers, Self-organized anodic oxide layers (Nanopores, Nanotubes).

Kernfachpraktikum Vertiefung der Kenntnisse zur Korrosion und Oberflächenanalyse und -technik

Basics Electrochemistry I (WS 2014/2015, Vorlesung, 2 SWS, Ning Liu)

Übungen zu Korrosion und Oberflächentechnik (WS 2014/2015, Übung, 1 SWS, Martin Weiser)

Surface Modification techniques (WS 2014/2015, Vorlesung, 2 SWS, Robert Hahn)

Surface Analysis I (WS 2014/2015, Vorlesung, 2 SWS, Manuela Killian)

Seminar Surface Science and Corrosion (WS 2014/2015, Seminar, 2 SWS, Patrik Schmuki)

Basics Electrochemistry II (SS 2015, Vorlesung, 2 SWS, N.N.)

Kernfachpraktikum (SS 2015, Praktikum, 6 SWS, Assistenten WW IV)

Surface Analysis I/II (SS 2015, Vorlesung, 2 SWS, N.N.)

Corrosion and Corrosion Protection (SS 2015, Vorlesung, 1 SWS, Sannakaisa Virtanen)

Seminar Surface Science and Corrosion (SS 2015, Seminar, 2 SWS, Patrik Schmuki)

Werkstoffoberflächen in der Medizin/Material surfaces in medicine (SS 2015, Vorlesung, Aldo R. Boccaccini et al.)

Lernziele und Kompetenzen:

- Die Studenten erwerben fundierte Kenntnisse und ein grundlegendes Verständnis für chemische und physikalische Oberflächen- und Grenzflächenreaktionen, inklusive Korrosionsreaktionen, sowie Funktionalisierung und Strukturierung von Oberflächen.

- Kennenlernen von elektrochemischen und oberflächenanalytischen Methoden in den Werkstoffwissenschaften.

Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:

Das Modul ist im Kontext der folgenden Studienfächer/Vertiefungsrichtungen verwendbar:

[1] **Materialwissenschaft und Werkstofftechnik (Master of Science)**
(Po-Vers. 2010 | Module M1 - M3 (gegliedert nach Kernfächern) | Kernfach Korrosion und Oberflächentechnik | 1. Werkstoffwissenschaftliches Modul (M1) | Korrosion und Oberflächentechnik)

Studien-/Prüfungsleistungen:

Korrosion und Oberflächentechnik (Prüfungsnummer: 62702)
Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 40
Anteil an der Berechnung der Modulnote: 100%

Erstablegung: WS 2014/2015, 1. Wdh.: SS 2015
1. Prüfer: Sannakaisa Virtanen

Praktikum zu Korrosion und Oberflächentechnik (Prüfungsnummer: 62701)
Prüfungsleistung, Praktikumsleistung

Erstablegung: WS 2014/2015, 1. Wdh.: SS 2015
1. Prüfer: Patrik Schmuki
