3.4.5 Bio- Chemo- und Radiation Sensors

Module title: Bio-, Chemo-, and Radiation Sensors

Module summary
Module code: EITM 210S
Module coordinator: Prof. Dr. Karsten Pinkwart
Credits (ECTS): 5 CP workload: in lecture 60 h, independent study time 90 h
Semester: 1st or 2nd semester
Pre-requisites with regards to content: Physics, Chemistry, Physical Chemistry, Electronics, Physical Sensors, Chemosensorics
Pre-requisites according to the examination regulations: none
Competencies: Students who have successfully completed the module • know and understand the various non-optical sensor principles for the determination of chemical and biochemical quantities in different fields of application • have an in-depth knowledge regarding the materials on which sensor technologies are based, which enables them to continue their scientific development later with doctoral studies • are able to independently select a suitable sensor principle according to the requirements of the task • are able to weigh up the strengths and weaknesses of different, possibly alternative sensor concepts on the basis of scientific considerations and can make a scientifically sound selection in this way. • are able to describe the interaction of sensor properties and conditions of use on the basis of specialised scientific knowledge
Assessment: Assessment is done by a written exam (120 minutes)
Usability: *General:* This module teaches students theoretical models for a variety of sensor concepts for the detection of (bio)chemical and radiation variables that have become established in recent years. In addition to the sensor principles, the materials are also introduced and their special properties are discussed with regard to the sensory measurement principle. Newer technology trends and research results in this still young, rapidly developing field of technology will also be addressed. *Connection with other modules:* This module draws on a broad scientific and engineering foundation of knowledge and skills. It builds on knowledge and skills from the Master's lectures EITM111S, EITM112S, EITM121S and EITM131S and is to be seen as a supplement to the courses in the module EITM230S.

Course: Bio- and Chemosensorics
Module code: EITM211S
Lecturer: Prof. Dr. Marcus Graf and Prof. Dr. Karsten Pinkwart
Contact hours: by arrangement
Semester of delivery: yearly, summer semester
Type/mode: Lecture 2h/week; mandatory in the study field Sensor Systems Technology, optional in the other study fields of the program

Language of instruction: English
Content: The lecture continues the lecture EITM112S with the contents • Theory for calibration and determination of the chemical measurands of dissolved oxygen sensors • Deepening of the lectures on metal oxide gas sensing with regard to material issues and theoretical understanding • Deepening the theoretical knowledge for understanding the properties of gas sensors that work according to the heat tone principle • Imparting special knowledge about the structure, mode of operation and properties of electrochemical gas measuring cells • Theoretical knowledge of the disinfection of water and the associated sensor technology for setting the disinfection effect. and is followed in the second half of the semester by lectures on biosensors with the contents of • Elaboration of the special features of biochemical sensors as a subclass of chemical sensors and the transduction processes required with them • Comparison of biocatalytic and bioaffinity sensors and development of specific knowledge on antibodies and enzymes • Communicate the possibilities of binding biomolecules to a sensor surface using self-assembly monolayers (SAM) and Langmuir-Blodgett layers (LBL). • Illustration of the routine steps for the complete construction of a biosensor using the example of nitroaromatic sensor technology • Examination of the various transduction processes using the example of biosensory detection of β–Δ–Glucose as the most common biosensor worldwide continued and brought to a conclusion.
Recommended reading: Lecture presentations (templates) P. Atkins: *Physical Chemistry,* VCH Schanz: *Sensor technology* Schiessle: *Sensor technology and measured value recording* An adequate textbook with the necessary in-depth character for the lecture EITM211S is not available internationally. The course content is largely taken from the primary literature. English-language specialist literature on selected topics: Mirsky; Ultrthin: *Electrochemical Chemo- and Biosensors*
Comments: -

Lehrveranstaltung: Strahlungssensorik
EDV-Bezeichnung: EITM 212S
Dozent/in: Dr. Holger Hessdorfer
Umfang (SWS): 2
Turnus: jährlich, Sommersemester
Art und Modus: Vorlesung; Pflichtmodul für Studienrichtung Sensorsystemtechnik, Wahlmodul für die anderen Studienrichtungen des Masterstudiengangs Elektrotechnik
Lehrsprache: Deutsch
Inhalte: • Theoretische Modelle zum Atomaufbau und zur Struktur des Atomkerns • Vertiefung der theoretischen Kenntnisse zur Entstehung von Strahlung aus verschiedenen Quellen, Laser

- Struktur der Nukleonen, Quarks und Leptonen, fundamentale Wechselwirkungen
- Einführung der Dunklen Energie und Materie - theoretische Begründung von deren Notwendigkeit
- Strahlung aus Kernzerfällen - α,β,γ, n-Strahlung, Energiegewinnung
- Vertiefung der Kenntnisse über die Wechselwirkung von α,β,γ, n-Strahlung mit Materie
- Vermittlung von Spezialkenntnissen zum Aufbau und zur Arbeitsweise von Sensoren zur Messung von Strahlung:
    - Gassensoren:
        - Ionisationskammer
        - Proportionalzählrohr
        - Geiger-Müller Zählrohr
    - Szintillationsdetektoren:
        - Szintillatoren
        - Photodioden
        - Photomultiplier
    - Halbleiterdetektoren:
        - Si-Sperrschichtdetektor
        - Ge – Detektor, γ-Spektroskopie
        - Ortsauflösende Si (Streifen-)Detektoren
    - Multichannelplate, Bildverstärker
- Sensorkombinationen zur Messung hochenergetischer Teilchen

Empfohlene Literatur:
Vorlesungspräsentationen (Vorlagen)
K. Kleinknecht: *Detektoren für Teilchenstrahlung*, Springer
G.F. Knoll: *Radiation Detection and Measurement*, Wiley

Anmerkungen: -