

3.4.2 Microsystems

Module title: Microsystems

Module summary
Module code: EITM 120S
Module coordinator: Prof. Dr.-Ing. Christian Karnutsch
Credits (ECTS): 5 CP workload: in lecture 60 h, independent study time 90 h
Semester: 1 st or 2 nd semester
Pre-requisites with regards to content: Basic knowledge in (Solid state) Physics, Chemistry and Biology
Pre-requisites according to the examination regulations: none
Competencies: Upon successful completion, the students <ul style="list-style-type: none"> • can independently assess which effects can be used for the realization of micro-, nano- and optofluidic systems • can evaluate under economic and technological constraints and decide, whether the manufacturing should be done by volume or surface micromechanical concepts • are able to independently develop an adequate manufacturing process • master technological challenges in the fabrication of micro-, nano- and optofluidic systems • analyze macroscopic optofluidic analysis systems and independently plan a process for the miniaturization of these systems • can propose a measurement instrument to be used on the basis of the structure size and geometry of a component • critically evaluate the degree of miniaturization of an analysis system and create suggestions for improvement from it
Assessment: Assessment is done by a written exam (120 minutes).
Usability: <i>General:</i> Microsystems technology is considered a key technology of the 21 st century. It is relevant for microelectronic devices as well as in the emerging field of optofluidic microsystems. The module enables students to acquire competencies in the development and production of general microsystems and specializes them using optofluidic microsystems as an example. <i>Connection with other modules:</i> The knowledge and skills acquired in the module are required in the modules Physical and Chemical Sensors, Bio- Chemo- and Radiation Sensors, Optical Sensors and Environmental Technologies. Only in the module Microsystems, the technologies for the production of sensors and micro- and nanosystems are dealt with.

Course: Micro- and Nanotechnology
Module code: EITM 121S
Lecturer: Prof. Dr. Markus Graf
Contact hours: by arrangement
Semester of delivery: yearly, winter 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

<p>Content:</p> <ul style="list-style-type: none"> • Introduction to microsystem technology • Scaling effect in a micro and nano world • Typical microtechnological process sequence • Photolithography • Silicon & silicon-base processes • Thin Film Deposition • Etching • Process examples & packaging • Microfluidics • Fundamentals on nanotechnology
<p>Recommended reading: Madou, M.: <i>Manufacturing Techniques for Microfabrication and Nanotechnology</i>, CRC Press, 2012 Globisch, S. et al.: <i>Lehrbuch Mikrotechnologie</i>, Fachbuchverlag Leipzig im Carl Hanser Verlag (German edition only) Gerlach & W. Dötzel: <i>Introduction to Microsystem Technology - A Guide for Students</i>, Wiley, 2008 Ramsden, J.: <i>Nanotechnology</i>. Elsevier, 2011</p>
<p>Comments: Lecture notes are available on ILIAS</p>

<p>Course: Optofluidic Microsystems</p>
<p>Module code: EITM 122S</p>
<p>Lecturer: Prof. Dr.-Ing. Christian Karnutsch</p>
<p>Contact hours: by arrangement</p>
<p>Semester of delivery: yearly, winter semester</p>
<p>Type/mode: lecture 2h/week; mandatory in the study field Sensor Systems Technology, optional in the other study fields of the program</p>
<p>Language of instruction: English</p>
<p>Content: Micro- and nanofabrication technologies for optofluidic sensors and instruments for micro- and nanomeasurements are discussed. Subsequently, applications of Optofluidics (some of them under active research) in the fields of biology, medicine and chemical detection systems are introduced by studying selected analysis systems and their miniaturization.</p>
<p>Recommended reading: [1] Fabrication Engineering at the Micro- and Nanoscale; Stephen A. Campbell; Oxford University Press [2] MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering; Tai-Ran Hsu; John Wiley & Sons [3] Optofluidics: Fundamentals, Devices, and Applications; Yeshaiahu Fainman, Luke Lee, Demetri Psaltis, Changhuei Yang; McGraw Hill Professional [4] Scanning Electron Microscopy and X-Ray Microanalysis; Joseph Goldstein, Dale Newbury, David Joy, Charles Lyman, Patrick Echlin, Eric Lifshin, Linda Sawyer, and Joseph Michael; Springer</p>
<p>Comments: Lecture notes and all other course materials are available on ILIAS.</p>