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| **Modulbezeichnung:** | **Scanning Electron Microscopy in Materials Science and Nanotechnology (IMN_M3/4/5/10/11-MWT_M10/11-NT_SEM)** (Scanning Electron Microscopy in Materials Science and Nanotechnology) | **5 ECTS** |
| Modulverantwortliche/r: | Erdmann Spiecker | |
| Lehrende: | Erdmann Spiecker, Thomas Przybilla | |

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| Startsemester: WS 2021/2022 | Dauer: 1 Semester | Turnus: jährlich (WS) |
| Präsenzzeit: 60 Std. | Eigenstudium: 90 Std. | Sprache: Deutsch und Englisch |

**Lehrveranstaltungen:**

Rasterelektronenmikroskopie in Materialforschung und Nanotechnologie (WS 2021/2022, Vorlesung, 2 SWS, Erdmann Spiecker et al.)
Übungen zur Rasterelektronenmikroskopie (WS 2021/2022, Übung, 2 SWS, Erdmann Spiecker et al.)

**Inhalt:**

The module focuses on the introduction to and application of Scanning Electron Microscopy (SEM) in Materials Science and Nanotechnology and comprises a lecture with corresponding exercises. Amongst others, the following topics are addressed:

- Components of an SEM instrument
- Elastic/inelastic electron-probe/sample interactions, interaction volume, generation of secondary and backscattered electrons
- Contrast mechanisms of different detector systems
- Topographic und chemically-sensitive imaging
- Electron diffraction and its application in SEM
- Scanning Transmission Electron Microscopy (STEM)
- Quantitative X-ray spectroscopy
- Focused ion beams (Dual-Beam FIB, He-ion microscopy)
- Preparation-specific challenges
- Application examples

Specific topics are accompanied with suitable exercises (e.g. Monte-Carlo simulations to simulate electron trajectories).

**Lernziele und Kompetenzen:**

Die Studierenden

*Fachkompetenz*

*Wissen*

- Introduction to the basic concepts of and physics behind SEM

*Verstehen*

- Overview over applications and deeper understanding of SEM and FIB techniques in materials science on the micro- and nanoscale
- Enhancement of knowledge through teaching of current SEM applications and state-of-the-art developments in research

*Anwenden*

- Application and consolidation of taught contents by SEM-related exercises

**Literatur:**


- Reimer, Scanning Electron Microscopy, Springer Verlag.
- Goodhews, Humphreys and Beanland: Electron Microscopy and Analysis
- Goldstein et al., Scanning Electron Microscopy and X-Ray Microanalysis (2003)
- N. Yao, Focused Ion Beam Systems, Basics and Applications, Cambridge University Press, 2010.
- L.A. Gianuzzi, F.A. Stevie, Introduction to Focused Ion Beams. Instrumentation, Theory, Techniques and Practice, Springer, 2005.

- J. Orloff, M. Utlaut, L. Swanson, High Resolution Focused Ion Beams: FIB and its Applications, Springer, 2003
- Lecture notes.

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**Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:**

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

[1] **Nanotechnologie (Master of Science)**

(Po-Vers. 2020w | TechFak | Nanotechnologie (Master of Science) | Gesamtkonto | 1. und 2. Naturwissenschaftlich-technisches Wahlmodul | Scanning Electron Microscopy in Materials Science and Nanotechnology)

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**Studien-/Prüfungsleistungen:**

Scanning Electron Microscopy in Materials Science and Nanotechnology (Prüfungsnummer: 62831)
(englische Bezeichnung: Scanning Electron Microscopy in Materials Science and Nanotechnology)

Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 15
Anteil an der Berechnung der Modulnote: 100%
weitere Erläuterungen:
Prüfungssprache nach Wahl der Studierenden
Prüfungssprache: Deutsch oder Englisch

Erstablegung: WS 2021/2022, 1. Wdh.: SS 2022
1. Prüfer: Erdmann Spiecker

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