Modulbezeichnung:	**Molecular materials (CME5)** (Molecular materials)	**15 ECTS**
Modulverantwortliche/r:	Andreas Hirsch	
Lehrende:	Franziska Gröhn, Dirk Guldi, Julien Bachmann, Andreas Hirsch	

Startsemester: SS 2019	Dauer: 2 Semester	Turnus: halbjährlich (WS+SS)
Präsenzzeit: 195 Std.	Eigenstudium: 255 Std.	Sprache: Englisch

Lehrveranstaltungen:

A. Molekulare Materialien I - Supramoleculare Chemie I (2L - WS)

Supramolecular Chemistry I / Molekulare Materialien I, Supramolekulare Chemie I (WS 2019/2020, Vorlesung, 2 SWS, Andreas Hirsch)

B. Choose one lecture from Molecular Materials B1 - B4 (2L):

B1. Molecular Materials II - Supramolecular Chemistry II (SS)

Supramolecular Chemistry - Molecular Materials II (SS 2019, Vorlesung, 2 SWS, Andreas Hirsch)

B2. Nanoparticles & nanostructured thin films (WS)

Nanoparticles and Nanostructured Thin Films / Nanopartikel und nanostrukturierte dünne Schichten (WS 2019/2020, Vorlesung, 2 SWS, Julien Bachmann)

B3. Characterization of nanosized systems (WS)

Characterization of Nanosized Systems (WS 2019/2020, Vorlesung, 2 SWS, Dirk Guldi)

B4. Alternative elective lecture, see UnivIS (WS/SS)

vgl. UnivIS

C. Seminar Molecular Nanoscience (2S - WS)

Seminar Molecular Nanoscience II (SS 2019, Seminar, 2 SWS, Franziska Gröhn et al.)
Seminar Molecular Nanoscience I (WS 2019/2020, Seminar, 2 SWS, Franziska Gröhn et al.)

D. Lab-course Molecular Materials (7 LAB - SS)

Attendance in lab course is compulsory!

Lab Course Molecular Materials (SS 2019, Praktikum, 7 SWS, Andreas Hirsch)

Inhalt:

Based on

- Modern concepts of molecular and supramolecular organic chemistry
- Host-guest-systems
- Basic principles of molecular recognition
- Formation of molecular superstructures
- Syntheses and characterization of inorganic nanoparticles
- Formation of thin films
- Molecular functionalisation of surfaces
- and examination of the functioning of nanostructures (e.g. with mikroscopic, steady state and time resolved measurements)

the student shall be introduced to a pronounced interdisciplinary access to actual problems and research-issues in the field of molecular materials.

A. Analysis of non-covalent interactions in molecular materials; systematic representation of host-guest-chemistry and molecular recognition, experimental quantification of association-processes; molecular templates for efficient preparation of complex and functional molecular superstructures

B1. Principals of molecular switching via external stimuli; possibilities of "molecular computing", electrical conductivity of molecular materials; molecular electronics and electronical active hybrid materials; Introduction to supramolecular catalysis.

B2. Synthesis of 1-, 2-, and 3-dimensional inorganic nanomaterials. Systematic approaches towards nanoparticles of defined size and structure and with tailored properties. Optical, electrical, and mechanical properties. Sensing, biomedical, and semiconductor device applications.

B3. Properties of low-dimensional carbon allotropes (fullerenes, carbon nanotubes and graphene); fundamental physico-chemical aspect of nanoscale-carbon-allotropes (spectroscopy and microscopy), optoelectronical applications of carbon-Allotropes

C. Seminar: presentation and discussion of current topics in the field of molecular materials. The teachers provide support for the students during preparation of their presentation. Performance style and content should be discussed intensively. **D.** Lab-course (5 experiments, see docket): syntheses, modifications and funktionalisations of molecular nanostructures (e.g. fullerenes, nanotubes, graphene, inorganic nanoparticles, ultrathin molecular films). Characterization of the structural and functional properties of these materials (NMR-, MS-, UV/Vis/NIR-, emission-, Raman-spectroscopy, XPS, conductivity, HR microscopy (TEM, AFM, STM))

Lernziele und Kompetenzen:

Students

- acquire knowledge and expertise required for theoretical evaluation and practical handling of novel organic and inorganic compounds
- prepare and characterize compounds not previously introduced in mandatory practical courses
- apply and evaluate the guiding principles of "molecular materials" to practical-preparative problems
- manage and apply the fundamental safety regulations important to handling hazardous compounds and instruct other co-workers in relevant safety topic
- aquire the guiding principles of "molecular electronics" and evaluate the application-potential of different materials

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Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:

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

[1] **Chemie (Master of Science): 1-2. Semester**

(Po-Vers. 2009 | NatFak | Chemie (Master of Science) | Wahlpflichtmodul | Molekulare Materialien)

Studien-/Prüfungsleistungen:

Molekulare Materialien (Prüfungsnummer: 65701)

(englische Bezeichnung: Oral Examination or Examination (Klausur) on Molecular Materials)

Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 45
Anteil an der Berechnung der Modulnote: 100%
weitere Erläuterungen:
O45, 2 examiners (PL)
EX (SL)
EX (SL)
LAB (SL)
Grading procedure: Result of the oral examination (100%)
Prüfungssprache: Englisch

Erstablegung: WS 2019/2020, 1. Wdh.: SS 2020
1. Prüfer: Andreas Hirsch

Bemerkungen:

Module compatibility: M.Sc. Chemie / M.Sc. Molecular Science (Elective module)