

<b>Heterogeneous Catalysis</b>						
<b>Modulnummer (Modulnummer)</b>	<b>Workload</b>	<b>Präsenzzeit (Attendance)</b>	<b>Selbststudium (Self-study)</b>	<b>Studiensemester (Study semester)</b>	<b>Angebot im (Offered in)</b>	<b>Dauer (Duration)</b>
40231	180 h	60 h	120 h	1./2. Semester	WS	1 Semester
<b>Lehrveranstaltungen (Courses)</b>		<b>Credits</b>	<b>Zuordnung zu den Curricula (Allocation to the curricula)</b>			
a) Lecture 2 SWS b) Seminar 2 SWS		6 CP	Master SET, IWI (UPT/EUT)			
1	<b>Lernergebnisse (Learning outcomes) / Kompetenzen (Competences)</b>					
	<p>Heterogeneous catalysis plays a decisive role for more than 80% of large-scale processes in the chemical industry.</p> <p>In this module, the students have gained sound insight into the fundamentals of heterogeneous catalysis. They know all essential aspects of the selection, preparation and characterisation of catalysts, their application in important industrial reactions and the evaluation of kinetic measurement data for further process optimisation.</p> <p>During the accompanying seminar, the students have</p> <ul style="list-style-type: none"> <li>transferred the acquired contents to selected sample processes independently and</li> <li>discussed them based on the current state of research.</li> </ul> <p>This module has enabled students to</p> <ul style="list-style-type: none"> <li>study the highly interdisciplinary field of heterogeneous catalysis thoroughly and</li> <li>pursue their own research activities in this field.</li> </ul>					
2	<b>Inhalte (Contents)</b>					
	<ul style="list-style-type: none"> <li>Introduction to heterogeneous catalysis: beginnings of catalysis research; industrial significance; concepts and definitions in heterogeneous catalysis</li> <li>Fundamentals of heterogeneous catalysis: reaction course; physisorption and chemisorption; adsorption equilibria; elementary steps</li> <li>Catalysts: classification, preselection and preparation; methods of catalyst synthesis; promoters and catalyst poisons</li> <li>Characterisation: methods to determine catalyst parameters; texture, porosity and surface; volume methods; surface methods</li> <li>Catalyst performance: selection of reactors; experimental design and optimisation; evaluation of kinetic measurement data; catalyst testing</li> <li>Kinetics and reaction mechanisms: a. microkinetics (surface reaction, structure-activity relationship, kinetic approaches); b. macrokinetics (film diffusion, pore diffusion)</li> <li>Consideration of important heterogeneously catalysed reactions: hydrogenation reactions; oxidation reactions; acid-base catalysis; bifunctional catalysis</li> <li>Concepts for laboratory-scale and industrial-scale reactors</li> <li><i>Seminar</i>: oral presentation of selected industrial processes including current research activities and patent applications</li> </ul>					
3	<b>Lehrformen (Forms of teaching)</b>					
	<ul style="list-style-type: none"> <li>Lectures (a)</li> <li>Oral presentations and discussions (b)</li> </ul>					

4	<p><b>Empfohlene Voraussetzungen (Recommended prerequisites)</b></p> <p>(recommended but not mandatory)</p> <ul style="list-style-type: none"> <li>• Chemistry; mechanical, thermal, and chemical process engineering</li> </ul>
5	<p><b>Prüfungsformen (Types of examination)</b></p> <ul style="list-style-type: none"> <li>• Combined examination: oral examination (30 min, 50%) and oral presentation during seminar (45 min, 50%)</li> </ul>
6	<p><b>Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)</b></p> <ul style="list-style-type: none"> <li>• Passed examination</li> </ul>
7	<p><b>Modulverantwortliche(r) (Person responsible for the module)</b></p> <p>Prof. Dr. Stefan Kaluza</p>
8	<p><b>Sprache (Language of instruction)</b></p> <p>English or German (depending on participants)</p>
9	<p><b>Sonstige Informationen / Literaturempfehlungen (Further information and references)</b></p> <ul style="list-style-type: none"> <li>• All presentations and lecture notes in MOODLE</li> <li>• W. Reschetilowski, „Einführung in die Heterogene Katalyse“, 2015, Springer Verlag</li> </ul>