《Surface and Interface》Syllabus

Course Number: NANA2018
Course Name: Surface and Interface
Course Category: Compulsory Course (Nano Devices Stream)
Credits/Contact Hours: 2/36
Evaluation Method: First version term paper, Final version term paper, Final exam
Semester: 6th
Prerequisites: NANA2069; NANA3012; NANA2068
Follow-Up: Graduation thesis
Lecturer: Steffen Duhm
Syllabus Author: Steffen Duhm
Syllabus Reviewer: Kuizhao Wang
Text Book: Script to the lecture

1. Specific Goals for the Course

Fundamental concepts of surfaces and interfaces are introduced with special regard to their interfaces in organic electronic devices. The course equips students with knowledge on material surfaces and interfaces that are at the core of the transport processes of charge carriers and operational principles of (opto-)electronic devices. In this context, the course comprises theories on surfaces in real and in reciprocal space, adsorption processes, electronic structures, and energy-level alignment. The framework of surface and interfacial theories is in synergy of practical analysis involving different analytical methods, such as x-surface scattering techniques and photoelectron spectroscopy.

By the end of the course, students should be able to:

(i) Discuss and interpret theories on surfaces and interfaces. (Support Graduation Requirements Indicator 1-1)

(ii) Discuss novel contemporary concepts of interfaces that are only available in recently published review articles and anthologies. (Support Graduation Requirements Indicator 1-2)

(iii) Understand analytical data and apply the basic concepts of manuscript writing. (Support Graduation Requirements Indicator 2-1)

2. Topics for the Course

- Interfaces in organic electronic devices.
- Surfaces in real and in reciprocal space.
- Defects, grain boundaries etc.
- Low energy-electron diffraction, scanning probe and other methods.
- Work function and electron emission.
- Thin film growth.
- Adsorption processes.
- Thermal desorption spectroscopy.

- Surface X-ray scattering techniques and the X-ray standing wave technique.
- van der Waals forces at interfaces.
- Electronic structure at interfaces.
- Photoelectron spectroscopy.
- Surface states.
- X-ray absorption spectroscopy and inverse photoemission.
- Energy levels in molecular semiconductor thin films.
- Interface energetics.
- Chemical bonding at interfaces.
- Charge transport properties.
- Surface transfer doping.

3. Topics for the Course

(1). Evaluation mode

Course Goal	Evaluation content	Evaluation mode
Discuss and interpret theories on surfaces and interfaces (1-1)	To understand comprehensive knowledge related to surfaces and interfaces	First version term paper, Final version term paper, Final exam
Discuss novel contemporary concepts of interfaces that are only available in recently published review articles and anthologies (1-2)	To address complex problems related to surfaces and interfaces.	First version term paper, Final version term paper, Final exam
Understand analytical data and apply the basic concepts of manuscript writing (2-1)	To analyse XPS and UPS data	First version term paper, Final version term paper, Final exam

(2). Assessments for the Course

	First version term paper weight	Final version term paper weight	Final exam weight
First Course Goal	0.5	0.5	0.5
Second Course Goal	0.3	0.3	0.3
Third Course Goal	0.2	0.2	0.2

(3). Assessments for the Course Goal and Achievement Degree Evaluation

- **Course Score = First version term paper (20%) + Final version term paper (40%) + Final Exam (40%)**
- **Achievement of Course Goal = (First version term paper mean score*0.2*0.5 + Final version term paper mean score*0.4*0.3 + Final exam*0.4*0.2) / (100*0.2*0.5 + 100*0.4*0.3+ 1100*0.4*0.2)**

(4). Rubrics for the Course:

Course Goal	90-100 (Excellent)	75-89 (Good)	60-74 (Pass)	0-59 (Fail)
Discuss and interpret	Students	Students	Students	Students are lack

theories on surfaces and interfaces. (Support Graduation Requirements Indicator 1-1)	understand comprehensive knowledge related to surfaces and interfaces and are able to find innovative ways to analyze and calculate related complex problems.	understand comprehensive knowledge related to surfaces and interfaces and are able to use the knowledge to efficiently analyze and calculate related complex problems.	understand key knowledge related to surfaces and interfaces and are able to use the knowledge to correctly analyze and calculate related complex problems.	of key knowledge related to surfaces and interfaces, and/or are not able to use the knowledge to analyze and calculate related complex problems.
(ii) Discuss novel contemporary concepts of interfaces that are only available in recently published review articles and anthologies. (Support Graduation Requirements Indicator 1-2)	Students are able offer their viewpoints on literature to address complex problems related to surfaces and interfaces.	Students are able to conduct thorough literature review to address complex problems related to surfaces and interfaces.	Students are able to conduct appropriate literature review to address complex problems related to surfaces and interfaces.	Students are not able to conduct literature review to address complex problems related to surfaces and interfaces.
(iii) Understand analytical data and apply the basic concepts of manuscript writing. (Support Graduation Requirements Indicator 2-1)	Students are able to conduct analysis in innovative ways and offer their viewpoints to address complex problems related to surfaces and interfaces.	Students are able to conduct comprehensive analysis to address complex problems related to surfaces and interfaces.	Students are able to conduct correct analysis to address complex problems related to surfaces and interfaces.	Students are not able to conduct analysis to address complex problems related to surfaces and interfaces.