《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: Term paper, Midterm exam, Final exam
Semester: 6th
Prerequisites: NANA2069; NANA3012; NANA2068
Follow-Up: Graduation thesis
Lecturer: Steffen Duhm
Syllabus Author: Steffen Duhm
Syllabus Reviewer:
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) Assessments for the Course

- **Course Score = Term Paper (TP, 50%) + Midterm Exam (MP, 20%) + Final Exam (FE, 30%)**
- **Achievement of Course Goal = (TP Mean Score*TP Weight*0.5 + ME Mean Score*ME Weight*0.2 + FE Mean Score*FE Weight*0.3) / (100*TP Weight*0.5 + 100*ME Weight*0.2 + 100*FE Weight*0.3)**

Course Goal	Term paper Weight	Midterm exam Weight	Final Exam Weight
Discuss and interpret theories on surfaces and interfaces. (Support Graduation Requirements Indicator 1-1)	0	0.4	0.4
(ii) Discuss novel contemporary concepts of interfaces that are only available in recently published review articles and anthologies. (Support Graduation Requirements Indicator 1-2)	0.2	0.4	0.3
(iii) Understand analytical data and apply the basic concepts of manuscript writing. (Support Graduation Requirements Indicator 2-1)	0.8	0.2	0.3

Rubrics for the Course:

Course Goal	90-100 (Excellent)	75-89 (Good)	60-74 (Pass)	0-59 (Fail)
Discuss and interpret theories on surfaces and interfaces. (Support	Students understand comprehensive	Students understand comprehensive	Students understand key knowledge related	Students are lack of key knowledge

Graduation Requirements Indicator 1-1)	knowledge related to surfaces and interfaces and are able to find innovative ways to analyze and calculate related complex problems.	knowledge related to surfaces and interfaces and are able to use the knowledge to efficiently analyze and calculate related complex problems.	to surfaces and interfaces and are able to use the knowledge to correctly analyze and calculate related complex problems.	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.