AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Introduction to Dislocation Theory

Academic year: 2019/2020 Code: ZSDA-3-0156-s ECTS credits: 3

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: prof. Hamilton Carter (hamiltbc@miamioh.edu)

Module summary

This course presents advanced concepts in the mechanical behavior of materials with a focus on dislocations in structural metals, including Shockley partial dislocations, Frank partial dislocations and Lomer/Cottrell dislocations. The course discusses the elastic properties of dislocations, their motion in crystal lattices and their interaction with crystallographic and microstructural features. The influence of dislocations on material, mechanical and fracture properties is emphasized. Mechanisms for the origin and multiplication of dislocations are also studied with an overview on the characterization methods, e.g. transmission electron microscopy, employed to analyze them

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	Student	SDA3A_K01	
Skills: he can			
M_U001	Student can derive the stress/strain fields associated with dislocations and assess their influence on mechanical and fracture behavior	SDA3A_U01	
M_U002	Student can model the motion of dislocations as they interact with crystallographic features, e.g. stacking faults and twins, that promote dislocation jogs and climb	SDA3A_U01	
Knowledge: he knows and understands			
M_W001	Student has a basic knowledge on crystal structures	SDA3A_W01	Examination

M_W002	Student knows how to derive the stress/strain fields associated with dislocations and assess their influence on mechanical and fracture behavior	SDA3A_W01	

Number of hours for each form of classes

	Form of classes										
Suma	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
30	15	15	0	0	0	0	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	Student	+	+	-	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	Student can derive the stress/strain fields associated with dislocations and assess their influence on mechanical and fracture behavior	-	+	-	-	-	-	-	-	-	-	-
M_U002	Student can model the motion of dislocations as they interact with crystallographic features, e.g. stacking faults and twins, that promote dislocation jogs and climb	-	+	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Student has a basic knowledge on crystal structures	+	+	-	-	-	-	-	-	-	-	-
M_W002	Student knows how to derive the stress/strain fields associated with dislocations and assess their influence on mechanical and fracture behavior	-	+	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	30 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	20 h
Realization of independently performed tasks	20 h
Examination or Final test	2 h
Contact hours	5 h
Summary student workload	107 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

This course presents advanced concepts in the mechanical behavior of materials with a focus on dislocations in structural metals, including Shockley partial dislocations, Frank partial dislocations and Lomer/Cottrell dislocations. The course discusses the elastic properties of dislocations, their motion in crystal lattices and their interaction with crystallographic and microstructural features. The influence of dislocations on material, mechanical and fracture properties is emphasized. Mechanisms for the origin and multiplication of dislocations are also studied with an overview on the characterization methods, e.g. transmission electron microscopy, employed to analyze them.

Auditorium classes

-

Teaching methods and techniques:

Lectures: Presentation, discussion
Auditorium classes: Presentation,

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

According to the Student Handbook, a student may withdraw from a full-semester course through the ninth calendar week of the semester. After the end of the ninth week, a student may not withdraw from a course unless the Interdivisional Committee of Advisers approves a petition.

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:
– Attendance is mandatory: Yes
– Participation rules in classes: 1.Lecture attendance is required.

2.Lecture will begin promptly at the scheduled time.
3.On time attendance counts as 100%; late attendance as 50%; absence as 0%.
4.More than 15 minutes late counts as an absence.
5.No make-up tests will be given for unexcused absences.
6.University policy concerning academic honesty will be strictly enforced.

Auditorium classes:
– Attendance is mandatory: Yes
– Participation rules in classes: 1.Lecture attendance is required.
2.Lecture will begin promptly at the scheduled time.
3.On time attendance counts as 100%; late attendance as 50%; absence as 0%.
4.More than 15 minutes late counts as an absence.
5.No make-up tests will be given for unexcused absences.
6.University policy concerning academic honesty will be strictly enforced.

Method of calculating the final grade

Grade Composition and Range
Exam 120%
Exam 220%
Final20%
Homework/Projects35%
Attendance5%

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

According to the Student Handbook, a student may withdraw from a full-semester course through the ninth calendar week of the semester. After the end of the ninth week, a student may not withdraw from a course unless the Interdivisional Committee of Advisers approves a petition.

Prerequisites and additional requirements

Basic materials science

Recommended literature and teaching resources

Reference Texts
•Essentials of Materials Science and Engineering, Donald R. Askeland and Wendelin J. Wright, 3rd Edition, Cengage Learning, 2014
•Mechanical Behavior of Materials, Thomas H. Courtney, Waveland Press, Inc., 2nd Edition, 2000
•Elementary Dislocation Theory, Johannes Weertman and Julia Weertman, Oxford University Press, 2nd edition, 1992

Scientific publications of module course instructors related to the topic of the module

Additional scientific publications not specified

Additional information

None