

**AGH**AGH UNIVERSITY OF SCIENCE  
AND TECHNOLOGY

Module name: Chemical and thermal treatment of metallic materials

Academic year: 2019/2020 Code: ZSDA-3-0174-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: dr hab, prof. AGH Żabiński Piotr (zabinski@agh.edu.pl)

### Module summary

Brief and complete review over different methods of thermal and chemical treatment of metals.

### 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)
Skills: he can			
M_U001	Student is able to propose different methods of chemical and thermal treatment and surface modification techniques of metallic materials	SDA3A_U03, SDA3A_U02, SDA3A_U01	Presentation
M_U002	Student can select the right method for material improvement for the specified application.	SDA3A_U07, SDA3A_U06, SDA3A_U04	Case study
Knowledge: he knows and understands			
M_W001	Student knows different types of thermal treatments of materials, their application and manufacturing techniques	SDA3A_W01	Project
M_W002	Student knows the mechanical, structural, tribological and chemical requirements for metallic materials in certain application	SDA3A_W03	Project
M_W003	Students knows the corrosion improvement of chemically and thermal treated materials	SDA3A_W05	Case study
M_W004	Students knows new trends in surface science and engineering	SDA3A_W03, SDA3A_W07	Execution of a project

**Number of hours for each form of classes**

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
30	15	0	0	15	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
Skills: he can												
M_U001	Student is able to propose different methods of chemical and thermal treatment and surface modification techniques of metallic materials	+	-	-	+	-	-	-	-	-	-	-
M_U002	Student can select the right method for material improvement for the specified application.	+	-	-	+	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Student knows different types of thermal treatments of materials, their application and manufacturing techniques	+	-	-	+	-	-	-	-	-	-	-
M_W002	Student knows the mechanical, structural, tribological and chemical requirements for metallic materials in certain application	+	-	-	+	-	-	-	-	-	-	-
M_W003	Students knows the corrosion improvement of chemically and thermal treated materials	+	-	-	+	-	-	-	-	-	-	-
M_W004	Students knows new trends in surface science and engineering	+	-	-	+	-	-	-	-	-	-	-

**Student workload (ECTS credits balance)**

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	15 h
Realization of independently performed tasks	30 h
Examination or Final test	2 h
Contact hours	5 h
Summary student workload	82 h
Module ECTS credits	3 ECTS

**Additional information****Module content****Lectures**

## Lecture

Introduction to processes during thermal and chemical treatment of metals. Diffusion evaporation of metals and non-metals at surface layer. Evaporation from gas, liquid and solid phase. Physical Vapor Deposition (PVD), Thermal PVD, Sputter Deposition, Ion plating. Surface Heat Treatment, Diffusion Coating, Hot-Dip Coatings, Weld Overlay Coatings.

**Project classes**

## Project classes

A term project will be assigned consisting of an oral presentation and written report. The presentation will be ~20 minute lecture presented by students. Active participation of students - discussion, brain storm.

**Teaching methods and techniques:**

Lectures: Nie określono

Project classes: Nie określono

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

presence on all lectures and project classes

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

Lectures:

- Attendance is mandatory: No
- Participation rules in classes: Nie określono

Project classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Nie określono

## Method of calculating the final grade

0.5 examination grade + 0.5 project grade

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

extra project

## Prerequisites and additional requirements

Prerequisites and additional requirements not specified

## Recommended literature and teaching resources

- 1.T. Pełczyński, Obróbka cieplno-chemiczna metali i półprzewodników, Wyd. Politechniki Lubelskiej, Lublin 2000.
- 2.K. Przybyłowicz, Metaloznawstwo teoretyczne, Wyd. AGH, Kraków 1975.
- 3.L.A.Dobrzański, Metaloznawstwo z podstawami nauki o materiałach, WNT, Warszawa 1996.
- 4.L.A.Dobrzański, Metaloznawstwo i obróbka cieplna, Wydawnictwa Szkolne i Pedagogiczne, Warszawa 1997.
- 5.Poradnik inżyniera, Obróbka cieplna stopów żelaza, WNT, Warszawa 1977.
- 6.M. Blicharski, Wstęp do inżynierii materiałowej, WNT, Warszawa, 1998.
- 7.M.F. Ashby, D.R.H. Jones, Materiały inżynierskie, WNT, Warszawa 1995.
- 8.T. Burakowski, T. Wierzchoń, Inżynieria powierzchni metali, WNT Warszawa, 1995.
- 9.L.L. Shreir , Ochrona przed korozją (t.II), WNT, Warszawa 1966.

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

- R. Kowalik, D. Kutyla, K. Mech, P. Żabiński, M. Wróbel, T. Tokarski, Electrochemical deposition of Mo-Se thin films, ECS Trans. 2015 volume 64, issue 29, 23-32
- A. M. Białostocka, P. Żabiński Modification of Electrodeposited FeNi Alloys by Applying External Magnetic Field New Materials and Processing Technologies, Key Engineering Materials Vol. 641, (2014), 157-163
- R. Kowalik, P. Żabiński, K. Mech; "Electrochemical studies of Cd UPD on polycrystalline silver", Electrochemistry Communications , Vol. 31, (June 2013), 49-51
- K. Mech, R. Kowalik, P. Żabiński "Cu thin films deposited by DC magnetron sputtering for contact surfaces on electronic components" Arch. Met. and Mat., 4 (vol 56) (2011) 903-908
- S. Chouchane, A. Levesque, P. Zabinski, R. Rehamnia, J.-P. Chopart; "Behaviour in NaCl media of zinc-nickel alloys electrodeposited under applied magnetic field." J. Alloys Compd., Vol. 506, Is. 2, (2010), p. 575-580

## Additional information

None