

**AGH**AGH UNIVERSITY OF SCIENCE  
AND TECHNOLOGY

Module name: Modern glass and glass-ceramic materials

Academic year: 2019/2020 Code: ZSDA-3-0050-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. inż. Stoch Paweł (pstoch@agh.edu.pl)

### Module summary

The course presents fundamentals of modern glass and glass - ceramic materials which are used in environmental protection, electronic and optoelectronic devices or as biomaterials. The fundamentals of glass structure, microstructure and selected properties will be also presented and discussed.

### 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 understands importance of development of new materials.	SDA3A_K01	Activity during classes
Skills: he can			
M_U001	Is able to predict selected properties based on glass and glass-ceramics composition.	SDA3A_U02, SDA3A_U01	Presentation, Activity during classes
M_U002	Is able to choose proper material composition to selected application.	SDA3A_U02, SDA3A_U01	Presentation, Oral answer, Activity during classes
Knowledge: he knows and understands			
M_W001	Knowledge of fundamentals of glass and glass - ceramics structural properties.	SDA3A_W03, SDA3A_W01	
M_W002	Knowledge of selected properties of glass and glass-ceramic materials.	SDA3A_W03, SDA3A_W01	Presentation, Activity during classes
M_W003	Knows relations between structure and selected properties.	SDA3A_W03, SDA3A_W01	Presentation, Oral answer, Activity during classes

**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	0	0	15	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 understands importance of development of new materials.	+	-	-	-	-	+	-	-	-	-	-
Skills: he can												
M_U001	Is able to predict selected properties based on glass and glass-ceramics composition.	+	-	-	-	-	+	-	-	-	-	-
M_U002	Is able to choose proper material composition to selected application.	+	-	-	-	-	+	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Knowledge of fundamentals of glass and glass - ceramics structural properties.	+	-	-	-	-	+	-	-	-	-	-
M_W002	Knowledge of selected properties of glass and glass-ceramic materials.	+	-	-	-	-	+	-	-	-	-	-
M_W003	Knows relations between structure and selected properties.	+	-	-	-	-	+	-	-	-	-	-

## Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	5 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	5 h
Contact hours	1 h
Summary student workload	41 h
Module ECTS credits	3 ECTS

## Additional information

### Module content

#### Lectures

The lectures will cover the following topics:

1. Fundamentals of glass science.
2. Thermal properties of glasses.
3. Glasses in environmental protection,
4. Biomaterials and bioglass.
5. Glasses for optoelectronic and electronic devices.

#### Seminar classes

The presentations given by the students will follow the subjects presented during the lectures. Exemplary presentations topics can be as follow:

1. Glass crystallization.
2. Obtaining glass - ceramic materials.
3. Materials for waste vitrification.
4. Glass fibers.
5. Glasses in electronics.

### Teaching methods and techniques:

Lectures: The content of the lecture is presented in the form of a multimedia presentation in combination with a classic blackboard lecture enriched with shows related to the issues presented.

Seminar classes: The basis for seminar classes is the multimedia and oral presentation led by students. Another important element of education are the answers to the questions raised, as well as the students' discussion of the presented content.

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

In order to complete the seminar class, a presentation on a chosen subject must be given and the student must take part in a discussion, which will be positively graded. Additionally the student need to be present on at least 75 % of classes.

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

Lectures:

- Attendance is mandatory: No
- Participation rules in classes: Students participate in lectures learning the next teaching content according to the subject syllabus. Students should keep asking questions and clarifying doubts. Audiovisual registration of the lecture requires the teacher's consent.

Seminar classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Students present in the group forum the topic indicated by the lecturer and participate in the discussion on this topic. Both the substantive value of the presentation and the so-called soft skills.

## **Method of calculating the final grade**

The final grade is the seminar classes grade.

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

Each case will be discussed individually.

## **Prerequisites and additional requirements**

Basic knowledge of materials science, solid state physics/chemistry.

## **Recommended literature and teaching resources**

1. James E. Shelby, Introduction to Glass Science and Technology, RSC, 2005.
2. Arun K. Varshneya, Fundamentals of Inorganic Glasses, Academic Press, Inc., 1994.
3. Frederick T. Wallenberger, Paul A. Bingham, Fiberglass and Glass Technology, Springer, 2010.
4. Hans Bach, Dieter Krause, Low Thermal Expansion Glass Ceramics, Springer, 2005.
5. Wolfram Holand, George Beall, Glass-Ceramic Technology, The American Ceramic Society, 2002.
6. Ian W. Donald, Waste Immobilization in Glass and Ceramic Based Hosts, Wiley, 2010.

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

Publications are available at: <https://www.bpp.agh.edu.pl>

## **Additional information**

None