AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Materials Science in Space Technologies

Academic year: 2018/2019 Code: CIM-2-317-BK-s ECTS credits: 3

Faculty of: Materials Science and Ceramics

Field of study: Materials Science Specialty: Biomateriały i kompozyty

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

Lecture language: English Profile of education: Academic (A) Semester: 3

Course homepage: http://home.agh.edu.pl/~zbgrzesik

Responsible teacher: prof. dr hab. inż. Grzesik Zbigniew (grzesik@agh.edu.pl)

Academic teachers: prof. dr hab. inż. Grzesik Zbigniew (grzesik@agh.edu.pl)

Module summary

Students obtain essential information about materials applied in space technologies. They will gain knowledge on threats in universe and protection methods.

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			
M_K001	has basic knowledge on space in relation to the application possibilities of novel materials		Presentation, Participation in a discussion, Activity during classes
M_K002	is creative in solving of problems		Presentation, Participation in a discussion, Activity during classes
Skills			
M_U001	is able to select appropriate materials for specific application in space		Presentation, Participation in a discussion, Activity during classes
Knowledge			
M_W001	has knowledge on current trends in development of new space technologies		Presentation, Participation in a discussion, Activity during classes

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	Others	E-learning
Social competence												
M_K001	has basic knowledge on space in relation to the application possibilities of novel materials	-	-	-	-	-	+	-	-	-	-	-
M_K002	is creative in solving of problems	-	-	-	-	-	+	-	-	-	-	-
Skills												
M_U001	is able to select appropriate materials for specific application in space	-	-	-	-	-	+	-	-	-	-	-
Knowledge												
M_W001	has knowledge on current trends in development of new space technologies	-	-	-	-	-	+	-	-	-	-	-

Module content

Seminar classes

•Outline of space science
•Outline of space exploration
•History of satellite technology
•Present satellite technology
•Space flight technology
•Space exploration technology
•Future space technologies
•Aerospace and space materials
•Advanced materials in future space applications
•Commercialization and colonization of space

Method of calculating the final grade

Final grade = 0.7 x grade from oral presentation +0.3 x grade from participation in discussions

Prerequisites and additional requirements

None

Recommended literature and teaching resources

ASM Handbook, vol. 13, Corrosion: Fundamentals, Testing and Protection. Ed. ASM International,

Materials Park, Ohio USA, 2003.
High temperature materials and mechanisms. Ed. Yoseph Bar-Cohen. CRC Press, Boca Raton, London, New York, 2014.
http://www.spaceflight.esa.int/users/materials/
http://www.esa.int/Our_Activities/Space_Engineering_Technology/Materials_and_Processes
https://www.nasa.gov/audience/foreducators/postsecondary/features/nasa-material.html

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

Z. Grzesik, M. B. Dickerson, K. Sandhage, “Incongruent reduction of tungsten carbide by a zirconium-copper melt”, Journal of Materials Research, 18, 2135-2140 (2003).
Z. Grzesik, T. Bak, J. Nowotny and B. Henry, “Chemical diffusion in amphoteric oxide semiconductors”, Advances in Applied Ceramics, 106, 77-81 (2007).
M. Danielewski, Z. Grzesik, S. Mrowec, „On the oxidation mechanism of Ni-Pt alloys at high temperatures”, Corrosion Science, 53, 2785-2792 (2011).
Z. Grzesik, S. Mrowec, „High temperature corrosion of metallic materials in composed oxidizing environments”, High Temperature Materials and Processes, 31, 539-551 (2012).
K. Kyzioł, Ł. Kaczmarek, M. Klich, Z. Grzesik, “Dependence of structure and mechanical properties of Si-DLC coatings on methane content applied in plasma modification of Al-Zn and Al-Cu T6I6 alloys”, Proceedings of 12th International Conference „Local mechanical properties 2015”, p. 30, November 04–06, 2015, Liberec, Czech Republic.

Additional information

None

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in conversation seminars	30 h
Preparation of a report, presentation, written work, etc.	5 h
Realization of independently performed tasks	15 h
Preparation for classes	30 h
Summary student workload	80 h
Module ECTS credits	3 ECTS