

**AGH**AGH UNIVERSITY OF SCIENCE  
AND TECHNOLOGY

Module name: Chemistry of organosilicon compounds

Academic year: 2018/2019 Code: CTC-1-511-s ECTS credits: 3

Faculty of: Materials Science and Ceramics

Field of study: Chemical Technology Specialty: —

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

Lecture language: English Profile of education: Academic (A) Semester: 5

Course homepage: —

Responsible teacher: prof. dr hab. inż. Hasik Magdalena (mhasik@agh.edu.pl)

Academic teachers: prof. dr hab. inż. Hasik Magdalena (mhasik@agh.edu.pl)

### Module summary

During the course students get acquainted with the main classes of organosilicon compounds. The course can be treated as the one expanding the knowledge of chemistry acquired during previous studies.

### 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	is aware of the consequences of application of organosilicon compounds in everyday life and in chemical technology	TC1A_K01, TC1A_K12, TC1A_K09	Activity during classes
Skills			
M_U002	is able to select an organosilicon compound for a given application	TC1A_U12, TC1A_U05, TC1A_U02	Presentation
M_U003	can give a proper name to an organosilicon compound, can identify it based on IR and NMR spectra	TC1A_U01	Presentation
Knowledge			
M_W003	is familiar with the main classes of organosilicon compounds, knows how to name them	TC1A_W01	Activity during classes

M_W004	knows the methods of preparation of various organosilicon compounds, knows their physical and chemical properties	TC1A_W01	Presentation
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## 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	is aware of the consequences of application of organosilicon compounds in everyday life and in chemical technology	-	-	-	-	-	+	-	-	-	-	-
Skills												
M_U002	is able to select an organosilicon compound for a given application	-	-	-	-	-	+	-	-	-	-	-
M_U003	can give a proper name to an organosilicon compound, can identify it based on IR and NMR spectra	-	-	-	-	-	+	-	-	-	-	-
Knowledge												
M_W003	is familiar with the main classes of organosilicon compounds, knows how to name them	-	-	-	-	-	+	-	-	-	-	-
M_W004	knows the methods of preparation of various organosilicon compounds, knows their physical and chemical properties	-	-	-	-	-	+	-	-	-	-	-

## Module content

### Seminar classes

Topics of the seminar classes include:

1. Silicon – its atomic properties, bonds formed with other elements in the Periodic Table.
2. Main organosilicon compounds and their nomenclature. General synthetic routes to organosilicon compounds.
3. Principles of IR spectroscopy. Characterization of organosilicon compounds by IR spectroscopy.

4. Principles of NMR spectroscopy. Characterization of organosilicon compounds by NMR spectroscopy.
5. Compounds containing Si-H bonds (organohydrosilanes, organohydrosiloxanes). Hydrosilylation.
6. Organosilanes and polyorganosilanes – chemical structure, synthesis, properties and applications.
7. Ladder and polyhedral oligomeric silsesquioxanes.
8. Organosilanes and polyorganosilanes – chemical structure, synthesis, properties and applications.
9. Carbo- and Polycarbosilanes – chemical structure, synthesis, properties and applications.
10. Silane coupling agents.
11. Organosilicon compounds in biological environment.

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

Final grade is based on activity during the classes, homework and presentations on selected topics in organosilicon chemistry prepared by the student.

### **Prerequisites and additional requirements**

During the course, each student has to make an oral presentation on a selected topic in organosilicon chemistry.

### **Recommended literature and teaching resources**

1. M.A. Brook, "Silicon in Organic, Organometallic and Polymer Chemistry", Wiley, NY 2000
2. R.G. Jones, W. Ando, J. Chojnowski (editors) "Silicon-containing polymers", Kluwer Academic Press, Dordrecht 2000
3. scientific papers devoted to organosilicon compounds

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

1. A. Nyczyk, C. Paluszkiwicz, A. Pyda, M. Hasik "Pre-ceramic polysiloxane networks obtained by hydrosilylation of 1,3,5,7-tetravinyl-1,3,5,7-tetramethylcyclotetrasiloxane", *Spectrochimica Acta* 79 (2011) 801-808.
2. A. Nyczyk, C. Paluszkiwicz, M. Hasik, M. Cypryk, P. Pospiech "Cross-linking of linear vinylpolysiloxanes by hydrosilylation – FTIR spectroscopic studies", *Vibrational Spectroscopy* 59 (2012) 1-8.
3. M. Hasik, M. Wójcik-Bania, A. Nyczyk, T. Gumuła "Polysiloxane-POSS systems as precursors to SiCO ceramics", *Reactive & Functional Polymers* 73 (2013) 779-788.
4. A. Nyczyk-Malinowska, E. Dryzek, M. Hasik, J. Dryzek "Various types of polysiloxanes studied by positron annihilation lifetime spectroscopy" *Journal of Molecular Structure* 1065-1066 (2014) 254-261.
5. A. Nyczyk-Malinowska, M. Wójcik-Bania, T. Gumuła, M. Hasik, M. Cypryk, Z. Olejniczak "New precursors to SiCO ceramics derived from linear poly(vinylsiloxanes) of regular chain composition" *Journal of the European Ceramic Society* 34 (2014) 889-902.
6. M. Wójcik-Bania, J. Olejarka, T. Gumuła, A. Łącz, M. Hasik "Influence of metallic palladium on thermal properties of polysiloxane networks" *Polymer Degradation and Stability* 109 (2014) 249-260.
7. M. Wójcik-Bania, A. Krowiak, J. Strzeżik, M. Hasik "Pt supported on cross-linked poly(vinylsiloxanes) and SiCO ceramics – new materials for catalytic applications" *Materials & Design* 96 (2016) 171-179.
8. M. Wójcik-Bania, A. Łącz, A. Nyczyk-Malinowska, M. Hasik "Poly(methylhydrosiloxane) networks of different structure and content of Si-H groups: Physicochemical properties and transformation into silicon oxycarbide ceramics", *Polymer* 130 (2017) 170-181.
9. J. Olejarka, A. Łącz, Z. Olejniczak, M. Hasik "Non-porous and porous materials prepared by cross-linking of polyhydrothylsiloxane with silazane compounds", *European Polymer Journal* 97 (2018) 150-164.

### Additional information

None

### Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in seminar classes	30 h
Preparation for classes	15 h
Preparation of a report, presentation, written work, etc.	15 h
Realization of independently performed tasks	15 h
Summary student workload	75 h
Module ECTS credits	3 ECTS