Załącznik nr 1 do zarządzenia nr 11 Rektora UW z dnia 19 lutego 2010 r.
w sprawie opisu przedmiotu w Uniwersyteckim Katalogu Przedmiotów zamieszczonym
w Uniwersyteckim Systemie Obsługi Studiów (USOS)
i zgodnym ze standardami Europejskiego Systemu Transferu i Akumulacji Punktów (ECTS)

Formularz opisu przedmiotu (formularz sylabusa) – dotyczy studiów I i II stopnia

A. Informacje ogólne (wypełnia koordynator przedmiotu z wyjątkiem pól *Kod przedmiotu*, *Przyporządkowanie do grupy przedmiotów*).

Nazwa pola	
Course title	Mechanism of classic and controlled radical polymerization
Faculty/Institute	Faculty of Chemistry /Department of Chemical Technology
Programme for which the course is offered	
Course ID	
Erasmus code	13304
Course group	
Didactic cycle	2M/4M
Type/form of class	Lecture
Brief course description	Lecture is devoted to the characteristics and comparison of classic and controlled radical polymerization. Polymerizability of monomers. Initiators and initiation mechanisms.Propagation reactions. Molecular weight synthezised with both mechanisms. Polydispersity index. Transfer of the kinetic and physical chain. Trommsdorf effect. Temperature influence on polymerization rate and molecular weight. Architecture of polymer chain from both mechanisms. Copolymerization. Alfrey-Price „Q- e" kinetic model: Perspective for classic and controlled radical polymerization.
Full course description	Topics of the lecture: 1. Polymerizability of monomers according to polymerization mechanism 1.1. Influence of substituents on double bond reactivity 1.2. Electron effects 1.3. Steric effects 2. Conditions for radical polymerization 2.1. Creation of primary radicals (chemical, physical methods) 2.2. Mechanism of thermal polymerization 2.3. Efficiency of initiation ("cage effect") 2.4. Methods for investigation of radical polymerization 2.5. Solvents 2.6. Temperatura 3. Radical polymerization 3.1. Kinetic equations 3.1.1. Initiation 3.1.2. Propagation (efekt żelowy) 3.1.3. Termination (chain length and kinetic chain length) 3.1.4. Transfer reaction, 3.1.5. Inhibition and retardation 4. Copolymerization in radical polymerization 4.1. Alfrey-Price Scheme "Q-e" 4.2. Copolymerization kinetics models 4.3. Terminal model 4.4. Penultimate model 5. Radical polymerization today and tomorrow 6. Characteristics of controlled/living radical polymerization (criteria: time of radical live, Ri vs. Rp, kinetic curves, molecular mass) 7. Living anionic polymerization concept by Szwarc 7.1. Stable free radical polymerization (SFRP) 7.1.1. I generation radical mediators 7.1.2. II generation radical mediators 7.1.3. Bimolecular mechanism of NMRP 7.1.4. Monomolecular mechanism of NMRP 7.1.5. Polymerization "outside-in" and "inside-out" 7.2. Atom transfer radical polymerization (ATRP) 7.2.1. Initiators and monomers in ATRP 7.2.2. Homogeneity of polymerization system 7.2.3. Polymerization product: functional polymers, block grafting copolymers, comb and star polymers and others. 7.3. Reversible addition-fragmentation chain transfer polymerization (RAFT) Main living groups in RAFT Architecture of polymer chains (brushes, stars, combs) 8. Classical vs. controlled radical polymerization

Prerquisites	Formal prerquisites	Licentiate in chemistry
	other prerquisites	Before the course the student should: – demonstrate basic knowledge of polymer chemistry, – demonstrate skills in scientific literature search and study – demonstrate understanding principles of research work in chemistry – demonstrate understanding relations between experiment and conclusions – demonstrate skills in understanding scientific papers in English
Learning outcomes		After the course the student should: – demonstrate skills in forecasting possible methods of synthesis for given polymers – is able to determine conditions for planned synthesis of given polymer - - - demonstrate skills in analysis of applicability of a given polymer and its relations with the method of synthesis
ECTS credits		2 weeks of work (and presence at the lecture) is sufficient to get 1,5 ECTS points
Assessment methods and criteria		Exam
Type of examination		Skills sufficient to pass the exam. To proof the acquired skills the student is obligated to answer questions connected to the main topics of the lecture. Passing the exam means to get > 50% of max. number of points There are approximately 6 open questions of varying difficulty expressed in points of a settled scale (scale 0-20 pts).
Type of course		According to the program of the study the lecture is an optional course in the Ist year of the 2nd level (M) specially for those who use polymer materials or/and polymer chemistry methods during specialization
Mode of delivery		Multimedia aided lecture. Stimulation to active participation (questions, discussion, digressions to research and scientific problems)
Language of instruction		Polish
Bibliography		Supplementary bibliography: - „Chemia polimerów", tom I,II,III, praca zbiorowa pod red. Z. Florjańczyka i S. Penczka, Oficyna Wyd. Pol. Warszawskiej, 1995-98. - Nicholson J. W., Chemia polimerów WNT, Warszawa 1996. - G. Odian, Principles of Polymerization, John Wiley & Sons, 2004 - K. Matyjaszewski, T. P. Davis, Handbook of radical polymerization, John Wiley & Sons Inc., Hoboken, 2002
Work placement(s)		Lecture room
Course coordinator		dr hab. Inż. Andrzej Kaim
Academic teachers		dr hab. Inż. Andrzej Kaim
Remarks		

B. Informacje szczegółowe (wypełnia prowadzący zajęcia, z wyjątkiem pól: *Limit miejsc w grupie, Terminy odbywania zajęć*, *Miejsce odbywania zajęć* – pola te prowadzący zajęcia wypełnia w porozumieniu z administracją).

Nazwa pola	
Name of the academic teacher	**Andrzej Kaim**
Academic degree	PhD, Ing.
Form of the class	Lecture
Learning outcomes	After the course the student should: – demonstrate skills in forecasting possible methods of synthesis for given polymers – is able to determine conditions for planned synthesis of given polymer - - - demonstrate skills in analysis of applicability of a given polymer and its relations with the method of synthesis
Assessment methods and criteria for this course	Skills sufficient to pass the exam. To proof the acquired skills the student is obligated to answer questions connected to the main topics of the lecture. Passing the exam means to get > 50% of max. number of points There are approximately 6 open questions of varying difficulty expressed in points of a settled scale (scale 0-20 pts).
Type of examination	Written exam
A list of topics	1. Polymerizability of monomers according to polymerization mechanism 1.1. Influence of substituents on double bond reactivity 1.2. Electron effects 1.3. Steric effects 2. Conditions for radical polymerization 2.1. Creation of primary radicals (chemical, physical methods) 2.2. Mechanism of thermal polymerization 2.3. Efficiency of initiation ("cage effect") 2.4. Methods for investigation of radical polymerization

	2.5. Solvents 2.6. Temperatura 3. Radical polymerization 3.1. Kinetic equations 3.1.1. Initiation 3.1.2. Propagation (efekt żelowy) 3.1.3. Termination (chain length and kinetic chain length) 3.1.4. Transfer reaction, 3.1.5. Inhibition and retardation 4. Copolymerization in radical polymerization 4.1. Alfrey-Price Scheme “Q-e” 4.2. Copolymerization kinetics models 4.3. Terminal model 4.4. Penultimate model 5. Radical polymerization today and tomorrow 6. Characteristics of controlled/living radical polymerization (criteria: time of radical live, Ri vs. Rp, kinetic curves, molecular mass) 7. Living anionic polymerization concept by Szwarc 7.1. Stable free radical polymerization (SFRP) 7.1.1. I generation radical mediators 7.1.2. II generation radical mediators 7.1.3. Bimolecular mechanism of NMRP 7.1.4. Monomolecular mechanism of NMRP 7.1.5. Polymerization ”outside-in” and ”inside-out” 7.2. Atom transfer radical polymerization (ATRP) 7.2.1. Initiators and monomers in ATRP 7.2.2. Homogeneity of polymerization system 7.2.3. Polymerization product: functional polymers, block grafting copolymers, comb and star polymers and others. 7.3. Reversible addition-fragmentation chain transfer polymerization (RAFT) 7.3.1. Main living groups in RAFT 7.3.2. Architecture of polymer chains (brushes, stars, combs) 8. Classical vs. controlled radical polymerization
Learning activities and teaching methods	Multimedia aided lecture. Stimulation to active participation (questions, discussion, digressions to research and scientific problems)
Bibliography	Supplementary bibliography: - „Chemia polimerów”, tom I,II,III, praca zbiorowa pod red. Z. Florjańczyka i S. Penczka, Oficyna Wyd. Pol. Warszawskiej, 1995-98. - Nicholson J. W., Chemia polimerów WNT, Warszawa 1996. - G. Odian, Principles of Polymerization, John Wiley & Sons, 2004 - K. Matyjaszewski, T. P. Davis, Handbook of radical polymerization, John Wiley & Sons Inc., Hoboken, 2002
Limit of places available	
Time	
Place	