



Course syllabus – FKF3090 Polymer Chemistry

The graduate course in polymer chemistry aims to compare and discuss different polymerization processes with respect to chemical mechanisms and different steps, by-reactions and modifications that can occur. The course aims at giving knowledge and tools for designing new polymers. This is an advanced course in polymer chemistry which will give deepening and general knowledge in the chemistry, structure, production, and modification processes of polymers. This is not a continuous course like the polymer chemistry course for undergraduate students, which aims at giving a comprehensive picture, but more of a methodology course which will supplement and deepen the knowledge acquired from the basic course. The course will stimulate to critical examination and discussion about actual synthesis routes in the field, existing as well as new ones. Each topic will be discussed in direct relation to the forefront research exploring the chemical pathways with ample examples from contemporary scientific advances.

Course aims

After passed course the student shall be able to:

- From a desired macromolecular chemical structure draw a suitable synthesis path (a mechanism) and suggest appropriate process parameters for its modification and when possible chemical recycling.
- From a given monomer draw up a suitable synthesis path (a mechanism), describe the associated kinetics, suggest appropriate process parameters and understand the relationship between polymerization conditions and the polymer product characteristics.
- Value, understand and apply the concepts of green chemistry in the development of the field of polymer chemistry.
- Identify a current research question within the field of polymer chemistry and orally present a suggested solution of how to approach it.

Prerequisites

Eligible for studies at the third-cycle level as well as a basic course in polymer chemistry.

Course literature

G. Odian, Principles of polymerization 4th Ed., Wiley-Interscience, 2004. The book is available online via: <http://onlinelibrary.wiley.com/book/10.1002/047147875X>

e-learning platform

Information and all documents in this course will be available via Canvas. This is also where you hand in all home assignments for grading.

The course activity name is: FKF3090 H24 (50924) Polymer Chemistry



Schedule

Lectures are given on Zoom and/or in the Rånby room, Teknikringen 56, 2nd floor, 100 44 Stockholm.

Topics included:

- Anionic polymerization
- Step-growth polymerization
- Radical polymerization; Controlled radical polymerization
- Cationic polymerization, Thiol-ene chemistry
- Cationic photopolymerization
- Coordination polymerization, Ziegler-Natta systems
- Biocatalytic reactions/polymerization
- Ring-opening polymerization
- Polymerization and chemical processes – an industrial perspective
- Click chemistry and dendrimers
- Chemical recycling
- Green chemistry principles

Course examination

INL1 – Home assignments, 4.0 credits

SEM1 – Seminar, 2.0 credits

Total credits: 6,0 hp, Grade scale: Pass or Fail

Examination is done as a series of consecutive home assignments handed out at the lectures addressing the topics of each assignment, respectively, as well as seminars where the students present orally current research questions within the field of polymer chemistry. Each home assignment should be completed in writing and uploaded to the course Canvas page no later than two weeks after the corresponding lecture. Please note that the home assignment exercises are to be submitted by each student individually. All assignments will be checked for plagiarism. The oral presentation for the seminars is to be in total 20 min long (15 min presentation and 5 min for questions). The student chooses the topic individually and presents the forefront of research within the field, highlighting the research question investigated.

Requirements to pass: Mandatory presence at $\geq 80\%$ of all lectures + Pass on all home assignments.



Contract information

Department of Fibre and Polymer technology, Teknikringen 56

Ulrica Edlund (edlund@kth.se, tel: 08-7907634)

Karin Odellius (hoem@kth.se, tel: 08-7908076)

Guest lecturers

Apostolos Avgeropoulos is professor at the department of materials science and engineering at the University of Ioannina in Greece and he is also Director of the Polymeric Materials Laboratory. His research interests comprise synthesis of novel polymers via anionic polymerization with high vacuum techniques, copolymers with two and three segments, star copolymers with 3, 4, 16 arms and bridged copolymers of the H and Super-H type, synthesis of copolymers containing silicon, copolymers with new dienes, synthesis of copolymers with styrene - isoprene, isoprene - butadiene, styrene - dimethylsiloxane and other combinations exhibiting high molecular weights for the preparation of photonic materials, synthesis of dendritic homo and copolymers with dienic arms for applications as viscosity modifiers and studying of the microphase separation, synthesis of biopolymers and biodegradable polymers, and synthesis of linear, non-linear and cyclic oligopeptides and polypeptides for applications of hosting anticancer drugs.

Michael A. R. Meier studied chemistry in Regensburg (Germany) and received his Ph.D. from the Eindhoven University of Technology (The Netherlands) in 2006 under the supervision of Prof. Ulrich S. Schubert. After further stays in Emden and Potsdam, he was appointed as full professor at the Karlsruhe Institute of Technology (KIT) in 2010. He has received several awards and is associate editor of ACS Sustainable Chemistry & Engineering. His research interests include the sustainable use and derivatization of renewable resources for polymer chemistry as well as the design of novel highly defined macromolecular architectures.

Daniela Pappalardo is an associate professor of Inorganic Chemistry at the Università del Sannio (Italy) and from September 2014 part-time guest researcher at KTH as a leader of a VINNOVA project. She did her PhD in Chemistry in 1998 at the Università di Salerno, under the supervision of Prof. Zambelli, a former co-worker of the Nobel Laureate Giulio Natta. Her expertise is in the field of polymer chemistry and polymerization catalysis, with special focus on poly(olefins) and aliphatic polyesters.

Marco Sangermano is associate professor at Politecnico di Torino in Italy. His main activities are in the field of photopolymerization, structure-properties relationships studies, tailoring formulations for achieving specific properties, surface modifications by employing fluorinated or silicone additives and preparation of nanostructured polymeric coatings. He is co-author of 150 papers on International journals of about 60 Conference participation and 6 patents.