

Course title: **Recycling of polymer and inorganic waste (I-221)**

Nositelji kolegija: **Assoc. Prof. Ljerka Kratofil Krehula, Ph.D.** (1st part of the course)

Assoc. Prof. Vilko Mandić, Ph.D. (2nd part of the course)

Teaching hours: 20

ECTS: 6

Teaching hours:

1st part of the course, recycling of polymer waste: Ljerka Kratofil Krehula: Introduction to polymer chemistry. Polymerizations by mechanism: chain and step polymerizations. The most important types of polymer materials. Use of polymer materials. Influence of application conditions and environment on the properties of polymer materials. Sources of polymer waste. Homogeneous and heterogeneous polymer waste. Polymer waste collection and separation technologies. Technologies for preparation of polymer materials for recycling: washing, shredding and drying. Primary and secondary recycling. Polymer waste recycling procedures: mechanical recycling, chemical recycling, energy recycling, solvent recovery. Advantages and disadvantages of polymer waste disposal procedures. Important examples of recycling of polymer materials: mechanical and chemical recycling of waste polyethylene terephthalate, mechanical recycling of waste polyethylene, recycling of waste tires. Characterization of recycled materials. Legal regulations, strategy and plan for polymer waste management.

2nd part of the course, recycling of inorganic waste: Vilko Mandić

Basics of inorganic materials. Basics of composition, structure and morphology. Basics of preparing and production of inorganic materials. The use of inorganic materials. Environmental influence of inorganic materials. Life cycle of inorganic materials. Sources of inorganic materials concerning production. Classification of inorganic materials waste. Economic opportunities and possibilities concerning inorganic materials waste. Separation and conditioning for removal, recycling, remediation and reuse of inorganic materials waste. Options and procedures for inorganic materials waste; advantages and problems. Characterisation of inorganic materials waste and products; quality control. Historic evolution of inorganic materials waste recycling. Relevant examples. Relevant problems. Quantification and economic aspect. Projections and innovation. Legislative.

Learning outcomes: To systematize and present the literature survey on the recycling techniques of polymer and inorganic waste.

To assess the suitability of recycling techniques of polymer and inorganic waste for the specific purpose.

To select the appropriate characterization technique of potentially suitable waste materials for recycling.

To demonstrate the ability to select an adequate route for recycling waste and characterizing the recycled product.

To interpret as well as to correlate related phenomenology.

Teaching methods: Lectures, consultations

Examination methods: Preparation of a seminar, written/oral exam

Monitoring of the course quality and successfulness: Student Survey

List of recommended readings:

1. C. E. Carraher, Introduction to Polymer Chemistry, Taylor & Francis, Boca Raton, 2017.
2. Z. Janović, Polimerizacije i polimeri, Hrvatsko društvo kemijskih inženjera i tehnologa, Zagreb, 1997.
3. J. Scheirs, Polymer Recycling: Science, Technology and Applications, J. Wiley & Sons, Chichester, 1998.
4. E. Worrell, M. A. Reuter, Handbook of Recycling, Elsevier, 2014.
5. D. W. Bruce, Dermot O'Hare, Inorganic Materials, 2nd Edition, Wiley, 1997.
6. J. W. Evans, L. C. de Jonghe, The production & Processing of Inorganic Materials, Wiley, 2010.