



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

|                      |                     |
|----------------------|---------------------|
| <b>Predmet:</b>      | POLIMERNI MATERIALI |
| <b>Course title:</b> | Polymer materials   |

| Študijski program in stopnja<br>Study programme and level        | Študijska smer<br>Study field | Letnik<br>Academic year | Semester<br>Semester |
|------------------------------------------------------------------|-------------------------------|-------------------------|----------------------|
| Enovit magistrski študijski program Predmetni učitelj 2. stopnje | Izobraževalna tehnika         | 3                       | 6                    |
| Five-year master's degree program Subject teacher                | Technical education           | 3                       | 6                    |

Vrsta predmeta / Course type

Izbirni / elective

Univerzitetna koda predmeta / University course code:

| Predavanja<br>Lectures | Seminar<br>Seminar | Vaje<br>Tutorial | Klinične vaje<br>work | Druge oblike<br>študija | Samost. delo<br>Individ.<br>work | ECTS |
|------------------------|--------------------|------------------|-----------------------|-------------------------|----------------------------------|------|
| 30                     |                    | 15               |                       |                         | 45                               | 3    |

Nosilec predmeta / Lecturer:

Klementina Pušnik Črešnar

Jeziki /

Languages:

Predavanja / Lectures:

Vaje / Tutorial:

slovenski / slovene

slovenski / slovene

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Potrebno je znanje srednješolske kemije in matematike.

**Prerequisites:**

A knowledge of high school chemistry and mathematics is necessary.

**Vsebina:**

**Content (Syllabus outline):**

|                                                                                                                                               |                                                                                                                                              |
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| Splošno o polimerih. Osnovni pojmi. Nomenklatura polimerov. Sestava. Strukturne značilnosti polimerov.                                        | General about polymers. Basic concepts. Nomenclature of polymers. Composition. Structural properties of polymers.                            |
| Prostorska razporeditev makromolekul. Konfiguracija. Konformacija.                                                                            | Spatial arrangement of macromolecules. Configuration. Conformation.                                                                          |
| Povprečja in porazdelitev molske mase. Stopnja polimerizacije. Viskoznost polimernih raztopin.                                                | Average molecular weight and molecular weight distribution. Degree of polymerisation. Viscosity of polymer solutions.                        |
| Fizikalna stanja in urejenost polimernih verig. Toplotni prehodi. Diferenčna dinamična kalorimetrija (DSC). Termogravimetrična analiza (TGA). | Physical states and order of polymer chains. Thermal transitions. Differential Scanning Calorimetry (DSC). Thermogravimetric analysis (TGA). |
| Reakcije polimerizacije. Stopenjska polimerizacija. Verižna polimerizacija. Inicijatorji. Inhibitorji. Radikalna polimerizacija.              | Polymerisation reactions. Stepwise polymerisation. Chain polymerisation. Initiators. Inhibitors. Radical polymerisation.                     |
| Kemijska sestava polimerov. Infrardeča (IR) spektroskopija. Jedrska magnetna resonančna spektroskopija (NMR).                                 | Chemical Composition of Polymers. Infrared (IR) spectroscopy. Nuclear Magnetic Resonance (NMR) Spectroscopy.                                 |
| Degradacija polimerov. Dodatki polimerov.                                                                                                     | Degradation of polymers. Polymer additives.                                                                                                  |
| Delitev polimerov. Verižni plastomeri. Termoplasti. Stopenjski plastomeri. Duomeri. Elastomeri.                                               | Partitioning of polymers. Chain plastomers. Thermoplastics. Plastomers. Duomers. Elastomers.                                                 |
| Predelava polimerov. Ekstruzija. Reakcijska ekstruzija.                                                                                       | Polymer Processing. Extrusion. Reaction Extrusion.                                                                                           |

### Temeljni literatura in viri / Readings:

Dodatna literatura:

R. O. Ebewele: POLYMER SCIENCE AND TECHNOLOGY, CRC Press LLC, Boca Raton, 2000.

M. Žigon: UVOD V POLIMERE, Zapiski predavanj, Kemijski inštitut, Ljubljana, 2004

F. Rodriges: PRINCIPLES OF POLYMERS SYSTEMS, 4th Ed., Taylor and Francis, 1996.

### Cilji in kompetence:

Predmetno specifični cilji in kompetence:

- Študente seznaniti z atomarno in molekularno zgradbo polimerov glede na osnovno delitev polimernih materialov.,
- Študente seznaniti s principi reakcij polimerizacije.,

### Objectives and competences:

Subject specific objectives and competencies:

- To introduce students to the atomic and molecular structure of polymers according to the basic classification of polymeric materials,;
- To introduce students to the principles of polymerization reactions,;

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| <ul style="list-style-type: none"> <li>- Študente seznaniti s poimenovanji polimerov.,</li> <li>- Študente seznaniti z osnovnimi metodami vrednotenja polimerov.,</li> <li>- Študente seznaniti z osnovno metodo predelave polimerov, reakcijsko ekstruzijo.,</li> <li>- Študente usposobiti za suvereno opavljanje osnovnih laboratorijskih spretnosti v laboratoriju.</li> </ul> | <ul style="list-style-type: none"> <li>- To introduce the students to the terms of polymers;,,</li> <li>- To introduce students to the basic methods of polymer characterization method/evaluation;,,</li> <li>- To introduce students to the basic method of polymer processing, reaction extrusion,</li> <li>-To train students in basic laboratory skills.</li> </ul> |
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#### **Predvideni študijski rezultati:**

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| <p>Znanje in razumevanje:</p> <ul style="list-style-type: none"> <li>- Študent pojasni kemijsko sestavo polimerov, osnovne delitve polimerov, reakcij polimerizacije.,</li> <li>-</li> <li>- Študent pojasni fizikalna stanja polimerov, procesov degradacije.,</li> <li>- Študent pojasni in opredeli metode vrednotenja polimerov.</li> <li>- Študent pojasni procese predelave polimerov, ekstruzije.</li> </ul> |
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#### **Intended learning outcomes:**

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| <p>Knowledge and understanding:</p> <ul style="list-style-type: none"> <li>- Explaining the chemical composition of polymers, basic polymer partitioning, polymerization reactions;,,</li> <li>- Explaining the physical states of polymers, degradation processes;,,</li> <li>- Explaining of polymer evaluation methods;,,</li> <li>- Explaining of polymer processing, extrusion.</li> </ul> |
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#### **Metode poučevanja in učenja:**

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| <ul style="list-style-type: none"> <li>- predavanje,</li> <li>- laboratorijske vaje</li> </ul> |
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#### **Learning and teaching methods:**

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| <ul style="list-style-type: none"> <li>- Lecture,</li> <li>- Laboratory work</li> </ul> |
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#### **Načini ocenjevanja:**

Delež (v %) / **Assessment:**  
Weight (in %)

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|                        |    |                   |
|------------------------|----|-------------------|
| Način:                 | 90 | Type:             |
| - Pisni izpit          | 10 | - Written exam    |
| - Laboratorijsko delo. |    | - Laboratory work |

**Reference nosilca / Lecturer's references:**

PUŠNIK ČREŠNAR, Klementina, PLOHL, Olivija, FRAS ZEMLIČ, Lidija. Functionalised fibres as a coupling reinforcement agent in recycled polymer composites. *Materials*. June 2024, vol. 17, iss. 9, [article no.] 2739, 17 str., ilustr. ISSN 1996-1944. DOI: [10.3390/ma17112739](https://doi.org/10.3390/ma17112739).

PUŠNIK ČREŠNAR, Klementina, ZAMBOULIS, Alexandra, BIKIARIS, Dimitrios, AULOVA, Alexandra, FRAS ZEMLIČ, Lidija. Kraft lignin/tannin as a potential accelerator of antioxidant and antibacterial properties in an active thermoplastic polyester-based multifunctional material. *Polymers*. April 2022, vol. 14, iss. 8 (1532), 18 str., ilustr. ISSN 2073-4360. [Digitalna knjižnica Univerze v Mariboru – DKUM](#), DOI: [10.3390/polym14081532](https://doi.org/10.3390/polym14081532).

PUŠNIK ČREŠNAR, Klementina, AULOVA, Alexandra, BIKIARIS, Dimitrios, LAMBROPOULOU, Dimitra A., KUZMIČ, Katja, FRAS ZEMLIČ, Lidija. Incorporation of metal-based nanoadditives into the PLA matrix: effect of surface properties on antibacterial activity and mechanical performance of PLA nanoadditive films. *Molecules*. July 2021, vol. 26, iss. 14 (4161), str. 1-28, ilustr. ISSN 1420-3049. [Repozitorij Univerze v Ljubljani – RUL](#), DOI: [10.3390/molecules26144161](https://doi.org/10.3390/molecules26144161).