

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** INŽENIRSTVO MATERIALOV  
**Course Title:** ENGINEERING OF MATERIALS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Kemijsko inženirstvo, 2. stopnja	/	1.	2.
USP Chemical Engineering, 2 <sup>nd</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course Type:** izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:** IN2I04

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	30	/	/	/	75	5

**Nosilec predmeta / Lecturer:** Izr. prof. dr. Marjan Marinšek /  
Dr. Marjan Marinšek, Associate Professor

**Jeziki / Languages:** **Predavanja / Lectures:** slovenski / Slovenian  
**Vaje / Tutorial:** /

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Izbira sodobnih materialov zahteva od inženirja, da pozna fizikalne, kemijske in mehanske lastnosti materiala. Mnoge fizikalne lastnosti, posebej tiste, ki niso odvisne od mikrostrukture (na primer gostota, elastični modul, tališče..) tudi niso odvisne od načina priprave – izdelave. Mnoge mehanske lastnosti (na primer natezna in zlomna trdnost..) so odvisne od načina izdelave in mikrostrukture. Zato mora študent poznati osnovne principe o lastnostih materialov; kako so odvisni od mikrostrukture, sestave, kako se spreminjajo s pripravo, kako korozija spreminja (skrajša) čas uporabe in kako so komponente kompatibilne

**Content (Syllabus outline):**

Selection of advanced materials requests from engineer the knowledge of physical, chemical and mechanical properties. A number of physical properties, especially microstructure insensitive (like density, Young's modulus, melting point) are processing independent. On the other side, many mechanical properties (like tensile and fracture strength..) depend on microstructure and processing parameters. Students need to know and understand the relations of materials properties and microstructure, how processing parameters change the properties and how the corrosion influences material's life time. Engineer must

z drugimi materiali v kompleksnih strukturah. Na izbranih aktualnih primerih bodo podane in s študenti diskutirane osnove inženirstva materialov in njihova praktična uporabnost.

Težišče bo usmerjeno v:

- kovine

postopki izdelave izbranih kovinskih materialov; oblikovanje; toplotna obdelava; kovinski prahovi, prašna metalurgija, razvoj

- keramika in steklo

priprava prahov, oblikovanje, sintranje, modifikacija površin, razvoj

- polimeri in kompoziti

postopki izdelave izbranih materialov, recikliranje, definicija glavnih tipov kompozitov in kje so uporabni, razvoj

- nanotehnologija

sinteza, karakterizacija in uporabnost izbranih nanomaterialov, razvoj

consider also how components are compatible with other materials of complex structures.

Fundamentals of materials engineering, along with their relevant applications, will be presented and discussed with students. Focus will be given to:

- Metals

manufacturing of metallic materials and tailoring of their properties; metal-casting processes, heat treatment; metal powders

- Ceramics and Glasses

powder preparation, shaping, sintering, tailoring of properties, modification of surfaces

- Polymers and Composites

processing techniques, recyclability, general composite types and where composites are typically used, tailoring of properties

- Nanotechnology

synthesis, characterization and application of various nanomaterials, development.

### Temeljna literatura in viri / Readings:

1. The Principles of Materials Selection for Engineering Design, Pat L. Mangonon, Prentice Hall, 1999, 824 strani (50%)
2. Engineering Materials 2, An Introduction to Microstructures and Processing, 4<sup>th</sup> ed. M.F. Ashby, D.R.H. Jones, Elsevier, 2013, 553 strani (20%)
3. Engineering Design with Polymers and Composites 2<sup>nd</sup> ed. , J.C. Gerdeen, H.W. Lord, R.A.L. Rorrer, Taylor&Francis Group (CRC), 2011, 349 strani, (10%)

Nanostructures and Nanomaterials, Synthesis, Properties and Applications, 2<sup>nd</sup> ed., Guozhong Cao, Ying Wang, World Scientific, 2011, 581 strani (20%)

### Cilji in kompetence:

Načrtovanje materialov s specifičnimi lastnostmi, korelacija med procesom za pripravo materiala, dobljenimi karakteristikami in njihovo uporabnostjo.

### Objectives and Competences:

Designing materials with specific properties, correlation between the materials preparation process, resulting characteristics and material applications.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Študent spozna osnovne principe o lastnostih materialov; kako so odvisni od mikrostrukture, kako se spreminjajo s pripravo, kako korozija spreminja (skrajša) čas uporabe in kako so komponente kompatibilne z drugimi materiali

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Students understand the relations of materials properties and microstructure, how processing parameters change the properties and how the corrosion influences material's applicability

v kompleksnih strukturah.	
<u>Uporaba</u> Načrtovanje materialov s specifičnimi lastnostmi, izbor procesa za doseganje takega cilja.	<u>Application</u> Design of materials with specific properties, selection of processing route to obtain requested properties.
<u>Refleksija</u> Študenta znanja pridobljena v predhodnih študijskih letih uporablja za analizo kompleksnih problemov pri načrtovanju novih materialov ali takih s specifičnimi karakteristikami.	<u>Analysis</u> Students will integrate knowledge acquired in previous years to analyse complex problems in design of new materials or materials with specific properties.
<u>Prenosljive spretnosti</u> Razvita sposobnost kritičnega razmišljanja in logičnega sklepanja. Sposobnost študija domače in tuje literature ter predstavitve rezultatov.	<u>Skill-transference Ability</u> Ability of critical thinking and deduction; Ability of studying relevant literature from the field of materials processing and ability of clear presentation to public.

**Metode poučevanja in učenja:**

Predavanja, seminar, priprava seminarja.

**Learning and Teaching Methods:**

<b>Načini ocenjevanja:</b>	Delež (v %) / Weight (in %)	<b>Assessment:</b>
Pisni in ustni izpit	80	Written and oral exam
Seminar	20	Seminar

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

- ZUPAN, Klementina, **MARINŠEK, Marjan**, PEJOVNIK, Stane, MAČEK, Jadran, ZORE, Karmen. Combustion synthesis and the influence of precursor packing on the sintering properties of LCC nanopowders. Journal of the European ceramic society, ISSN 0955-2219. [Print ed.], 2004, vol. 24, no. 6, str. 1935-1939
- DIMITROVSKA-LAZOVA, Sandra, KOVACHEVA, D., ALEKSOVSKA, Slobotka, **MARINŠEK, Marjan**, TZVETKOV, P. Synthesis and structural details of perovskites within the series  $\text{PrCo}_{1-x}\text{Cr}_x\text{O}_3$  : (x = 0, 0.33, 0.67 and 1). Bulgarian Chemical Communications, 2012, vol. 44, no. 1, str. 37-46
- CRNJAK OREL, Zorica, MAČEK, Jadran, **MARINŠEK, Marjan**, PEJOVNIK, Stane. Coprecipitation of copper/zinc compounds in metal salt-urea-water system. V: MAČEK, Marjeta (ur.), SUVOROV, Danilo. Refereed reports of IX Conference & Exhibition of the European Ceramic Society : 19-23 June 2005, Portorož, Slovenia, (Journal of the European ceramic society, vol. 27, no. 2-3, 2007). Amsterdam: Elsevier, 2007, vol. 27, no. 2/3, str. 451-455