PRAKTIKUM IZ MATERIALOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Praktikum iz materialov
Course title:	Practical Course in Materiačs Characterization
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Kemijsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik, 3. letnik		izbirni

Univerzitetna koda predmeta/University course code:	0100300
Koda učne enote na članici/UL Member course code:	INSI33

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
		45 LV + 30 SV			75	5

Nosilec predmeta/Lecturer:	prof. dr. Marjan Marinšek
Vrsta predmeta/Course type:	izbirni strokovni/Elective Professional
Jeziki/Languages:	Predavanja/Lectures:
	Vaje/Tutorial: Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Predmet se izvaja kot laboratorijske vaje, podprte s seminarskimi vajami. Praktične vaje vključujejo skupinsko projektno delo, teoretično in eksperimentalno, na specifični tematiki – materialu s ciljanimi lastnostmi: od načrtovanja in sinteze materiala do končne karakterizacije produkta. V prvem sklopu študentje zberejo potrebne informacije za načrtovanje sestave, strukture in postopka sinteze specifičnega produkta s ciljanimi lastnostmi. Identificirajo uporabne tehnike in metode za spremljanje poteka sinteze in za določanje lastnosti produkta. V drugem sklopu študentje sintetizirajo produkt. Spremljajo napredovanje sinteze ter vpliv procesnih parametrov na strukturo in lastnosti materiala.	The course implements laboratory work, supported by seminar exercises. Practical course includes project team work, both theoretical and experimental. Students in groups design a specific material with desired properties. Material design includes planning, synthesis, and product characterisation. Project starts with literature survey regarding composition, structure and synthesis route of a desired product. Students specify methods of controlling the synthesis progress and characterization techniques of the products. Project continues with experimental laboratory work. Students follow progress of synthesis and effects of synthesis parameters on structural and functional properties of the products.

V tretjem sklopu študentje interpretirajo dobljene rezultate ter razložijo vplive sestave, procesa sinteze in strukture materiala na uporabne lastnosti materiala. Vsebina projektnega dela je izbrana tako, da študenti pri delu pridobijo čim večji obseg strokovnih in socialnih kompetenc.	Finally, students analyse the obtained results and interpret functional and structural properties of the obtained products with regard to process parameters during the synthesis. The content of the project work is selected so that students acquire the widest possible range of professional and social competencies.

Temeljna literatura in viri/Readings:

1. R. O. Ebewele, Polymer Science and Technology, CRC Press, Boca Raton, 2000, 463 str., (50 %).
2. K. Friedrich, S. Fakirov, Z. Zhang, Polymer composites : from nano-to-macro-scale. Springer, New York, 2005, 341 strani. (20%)
3. Zhang s., Li L., Kumar A, Materials Characterization Techniques, CRC Press, London, 2009, 328 strani. (50%)
4. Kaufman E. N., Characterization of Materials 1&2, A John Wiley and Sons Publication, New Jersey, 2003, 1392 strani. (30%)

Cilji in kompetence:	**Objectives and competences:**
Študenti pridobijo ali okrepijo kompetence s področja poznavanja in rokovanja z naprednimi karakterizacijskimi metodami in znajo kritično presoditi o smiselnosti uporabe določene tehnike. Seminarske vaje, vpete v laboratorijsko delo, povežejo eksperimentalno dobljene rezultate s teoretičnimi. Študenti tako pokažejo, da so sposobni računsko ovrednotiti specifične probleme s področja materialov in jih povezati z mehanskimi, električnimi, termičnimi lastnostmi izbranih materialov. Delo v skupini vpliva na razvijanje socialnih veščin sodelovanja, konstruktivne izmenjave mnenj, predlogov in skupinsko težnjo po čim kvalitetnejši izvedbi dela. Tako pridobljeno znanje in kompetence omogočijo bodočemu inženirju kvaliteten dialog s strokovnjaki drugih profilov v praksi in sodobni interdisciplinarni pristop k reševanju nalog.	Students obtain or improve competencies in the field of knowledge and handling of advanced characterization methods and are able to critically evaluate the feasibility of using a particular technique. The purpose of seminar exercises, integrated in the laboratory work, is connecting the experimentally obtained results with the theoretical ones. Students thus show that they are able to computationally evaluate specific problems from the field of material science and relate them to mechanical, electrical, thermal properties of the selected materials. Working in a group affects the advance of social skills of cooperation, constructive exchange of opinions, ideas and group ambition for the best possible work. The expertise and competencies acquired in this way enable the future engineer to have a quality dialogue with experts of other profiles in practice and a modern interdisciplinary approach to problem solving.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Študentje spoznajo soodvisnost med zgradbo in lastnostmi materialov ter spoznajo inovativen pristop k reševanju dane problematike. Študent pridobi sposobnost za povezavo praktičnih in teoretičnih znanj. Nauči se skupinskega reševanja problemov ter strokovne komunikacije in sodelovanja z ostalimi člani skupine. Uporaba Predmet pri študentu razvija sposobnost prenosa znanj iz teoretičnih v praktična na konkretni problematiki ter študentu omogoča okrepitev socialnih kompetenc na podlagi dela v skupini. Pridobljena znanja je sposoben uporabljati za samostojno, logično in kritično razmišljanje o lastnostih, načrtovanju, izbiri in uporabi različnih materialov.	Knowledge and Comprehension Students learn about the relationships between the structure and material properties as well as learn about an innovative approach to specified problem solving. The student acquires the ability to combine practical and theoretical knowledge. Students acquire group problem solving, professional communication and cooperation with other group members. Application The course develops the student's ability to transfer knowledge from theoretical to practical on specific problems. It enables the student to strengthen social competencies based on group work. Students are competent to use the acquired knowledge for independent, logical and critical thinking about the properties, tailoring, selection and use of several materials.

Refleksija Znanja, ki so uporabna pri laboratorijskih in seminarskih vajah tega predmeta so vezane na vsebine premetov, ki obravnavajo materiale, njihovo načrtovanje, uporabo in njihov propad. Zaradi svoje interdisciplinarnosti so povezane tudi z osnovnimi znanji s področij fizike in kemije. Prenosljive spretnosti Sposobnost uporabe principov vede o materialih pri njihovi karakterizaciji in vrednotenju njihovih lastnosti tako pri raziskovalnem kot razvojnem delu.	Analysis Practical course and computation depends on course curriculum addressing the development of materials, their design, use and failure. Due to the interdisciplinarity nature, the course is also related to basic knowledge from the fields of physics and chemistry. Skill-transference Ability Ability to apply the principles of material science with respect to evaluation of materials' functional properties in research and development work

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Seminarske in laboratorijske vaje • Skupinsko projektno delo	- Solving computational problems, - practical course, - individual seminar work

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit (100 %). Opravljeno projektno delo je pogoj za pristop k izpitu.	100,00 %	Written exam (100 %). Accomplished project work is a prerequisites to exam attendance.

Reference nosilca/Lecturer's references:

1. JAPIĆ, Dajana, DJERDJ, Igor, **MARINŠEK, Marjan**, CRNJAK OREL, Zorica. In situ and ex situ TEOS coating of ZnO nanoparticles and the preparation of composite ZnO/PMMA for UV-VIS absorbers. Acta chimica slovenica, 2014, vol. 60, no. 4, str. 797-806
2. JAPIĆ, Dajana, PARAMO, Jorge Antonio, **MARINŠEK, Marjan**, STRZHEMECHNY, Yuri M., CRNJAK OREL, Zorica. Growth-morphology-luminescence correlation in ZnO-containing nanostructures synthesized in different media. Journal of luminescence, 2012, vol. 132, iss. 6, str. 1589-1596
3. RAZPOTNIK, Tanja, **MARINŠEK, Marjan**, NOVOSEL, Barbara, ZUPAN, Klementina, FRANCETIČ, Vojmir, MAČEK, Jadran. A polymer complex solution process for the synthesis and characterization of Ni-YSZ cermet material. Ceramics international, 2008, vol. 34, no. 7, str. 1741-1746