

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	UPORABA IN OSNOVE PROPADA GRADIV
Course Title:	USE OF MATERIALS AND MATERIALS DECOMPOSITION

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Tehniška varnost, 2. stopnja	/	1. ali 2.	1., 2., 3.
USP Technical Safety, 2 nd Cycle	/	1 st or 2 nd	1 st 2 nd 3 rd

Vrsta predmeta / Course Type:

izbirni / Elective

Univerzitetna koda predmeta / University Course Code:

TV2B2

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	15	15 SV	/	/	75	5

Nosilec predmeta / Lecturer:

doc. dr. Boštjan Genorio /
Dr. Boštjan Genorio, Assistant Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: slovenski / Slovenian

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:

Predmet obsega naslednja poglavja:

- vpliv lastnosti materiala na trajnost in zanesljivost delovanja
- mehanizem nastanka poškodb pri obremenitvi, kemijskih procesih, vplivu okolja, bioloških vplivih in pri slabem ravnanju uporabnikov z napravami in objekti
- osnovni mehanizem utrujanja
- osnovni mehanizmi elektrokemijske korozije in korozije v plinih, elektrodni procesi, termodinamika in kinetika elektrokemijske korozije, lastnosti korozijsko odpornih materialov
- mehanizmi mehanske in kemične

Content (Syllabus outline):

obrade, lastnosti obrabno odpornih materialov

- mehanizmi biološkega propadanja

metode za spremljanje poškodb, vzdrževanje in načini sanacije

Temeljna literatura in viri / Readings:

Batchelor, A. W., Loh N. L. Chandrasekaran, M.: Materials degradation and its control by surface engineering, 2nd Ed., London, Imperial College Press, 2002
Trethewey, K. R., Chamberlain, J.: Corrosion for science and engineering, 2nd Ed., Harlow, Longman, 1995
Mangonon, P. L.: The principles of materials selection for engineering design, Upper Saddle River, Prentice Hall, 1999

Cilji in kompetence:

Študentje se seznanijo z vplivi obremenitve in okolja na življenjsko dobo materialov v obratovanju. Spoznajo mehanizem nastajanja utrujanja, korozije in obrabe materialov na makro in mikro nivoju. Seznanijo se s pomenom propadanja materialov za trajnost in zanesljivost delovanja sistemov, naprav in objektov glede na gospodarske in družbene posledice. Spoznajo osnovne postopke sprotne spremljanja, nastanka in napredovanja propada ter osvojijo postopke vzdrževanja in sanacije.

Objectives and Competences:

Students understand degradation mechanisms in different materials (metallic, ceramic, polymer, composites) and common practical solutions.

Subject specific competences include:

- understanding the principles of thermodynamics which lead to corrosion
- understanding corrosion kinetics, based on the concept of mixed potentials
- understanding chemical degradation processes,
- acquiring methods for determining the rate of corrosion
- acquiring control methods for material degradation and its prevention
- using appropriate engineering approaches to prevent corrosion.

Predvideni študijski rezultati:

Znanje in razumevanje
Pridobil bo celovita znanja o lastnostih materialov s poudarkom na kemijskih, fizikalnih in mehanskih lastnostih. Razumel bo zakaj in katere lastnosti so neodvisne od priprave, katere lastnosti pa so v bistvu odvisne od izbire procesa priprave in z njim določene mikrostrukture. Ob tem bo spoznal konkretne materiale (kovine, polimerne snovi, keramiko, kompozite idr.), ki se uporabljajo v industrijskih in drugih aplikacijah ter pridobil znanja potrebna za pravilno tolmačenje podatkov v priročnikih in bazah podatkov. To

Intended Learning Outcomes:

Knowledge and Comprehension
Student will the relation between materials properties and chemical and physical properties. The question why some materials properties depend on processing and some do not will be answered. Microstructure as important variable will be elaborated. The most important properties of materials (metals, ceramics, polymers and composites) used in industrial processes will be given and compared.

je še posebej pomembno kadar je gradivo izpostavljeno korozivni sredini ali drugim pogojem in obremenitvam, kjer prihaja do interakcije kemijskih, fizikalnih in mehanskih vplivov.	
Uporaba V okviru predmeta bo študent pridobil znanja potrebna za sodelovanje z drugimi strokovnjaki pri izboru primerne materiala za določeno aplikacijo ter za analizo tveganja in nevarnosti odpovedi pod normalnimi pogoji obratovanja in možnosti, da bo pri dodatnih obremenitvah materialov, zaostrenih ali izrednih razmerah prišlo do sprememb, ki povečajo tveganja do mere, nesprejemljive za varno obratovanje.	Application Student will get the knowledge needed for cooperation with experts from other disciplines in selection of appropriate material for given application. Furthermore risk assessment for work under normal and extreme working conditions will be elaborated. Student must be able to define why changes in material occur and when they don't allow anymore safe operation.
Refleksija Kritična uporaba teoretičnih znanj pri interpretaciji praktičnih meritev; Kritična presoja rezultatov, pridobljenih z različnimi metodologijami	Analysis Rational use of theory in interpretation of real corrosion tests. Coherent evaluation of results obtained by various experimental techniques.
Prenosljive spretnosti Pri predmetu bo študent pridobil laboratorijske spretnosti, znal bo uporabljati literaturne podatke, izvajati kemijske in nekatere fizikalne meritve, eksperimentalne podatke bo znal ustrezno obdelati ter primerno interpretirati.	Skill-transference Ability Ability for work in laboratory, identification and solution of corrosion problems related to materials properties. Ability to collect and categorize literature (web) information and ability to present acquired knowledge in written and oral form.

Metode poučevanja in učenja:

Predavanja

Learning and Teaching Methods:

Lectures.

Načini ocenjevanja:

Ustni izpit (40%)
Seminarska naloga (60%)
Ocene: 6-10 pozitivno, 1-5 negativno

Delež (v %) /

Weight (in %) **Assessment:**

Oral exam (40%)
Seminar (60%)

Reference nosilca / Lecturer's references:

Strmcnik, D.; Lopes, P. P.; Genorio, B.; Stamenkovic, V. R.; Markovic, N. M. Design Principles for Hydrogen Evolution Reaction Catalyst Materials. Nano Energy 2016, 29, 29–36.

<https://doi.org/10.1016/j.nanoen.2016.04.017>.

Staszak-Jirkovský, J.; Malliakas, C. D. D.; Lopes, P. P. P.; Danilovic, N.; Kota, S. S. S.; Chang, K.-C.; Genorio, B.; Strmcnik, D.; Stamenkovic, V. R. R.; Kanatzidis, M. G.; et al. Design of Active and Stable Co-Mo-Sx Chalcogels as PH-Universal Catalysts for the Hydrogen Evolution Reaction. Nat. Mater. 2016, 15 (November), 197–203. <https://doi.org/10.1038/nmat4481>.

Vizintin, A.; Genorio, B.; Dominko, R. CHAPTER 8: Application of Graphene Derivatives in Lithium-Sulfur Batteries; 2018; Vol. 2018–Janua. <https://doi.org/10.1039/9781788012829-00222>.

Bobnar, J.; Lozinšek, M.; Kapun, G.; Njel, C.; Dedryvère, R.; Genorio, B.; Dominko, R. Fluorinated Reduced Graphene Oxide as a Protective Layer on the Metallic Lithium for Application in the High Energy Batteries. *Sci. Rep.* 2018, 8 (1), 5819. <https://doi.org/10.1038/s41598-018-23991-2>.

S.-Jirkovsky, J.; Subbaraman, R.; Strmcnik, D.; Harrison, K. L.; Diesendruck, C. E.; Assary, R. S.; Frank, O.; Kobr, L.; Wiberg, G. K. H.; Genorio, B.; et al. Water as a Promoter and Catalyst for Dioxygen Electrochemistry in Aqueous and Organic Media. *ACS Catal.* 2015, 5, 6600–6607. <https://doi.org/10.1021/acscatal.5b01779>.

Strmcnik, D.; Castelli, I. E.; Connell, J. G.; Haering, D.; Zorko, M.; Martins, P.; Lopes, P. P.; Genorio, B.; Østergaard, T.; Gasteiger, H. A.; et al. Electrocatalytic Transformation of HF Impurity to H₂ and LiF in Lithium-Ion Batteries. *Nat. Catal.* 2018. <https://doi.org/10.1038/s41929-018-0047-z>.

Šest, E.; Dražič, G.; Genorio, B.; Jerman, I. Graphene Nanoplatelets as an Anticorrosion Additive for Solar Absorber Coatings. *Sol. Energy Mater. Sol. Cells* 2018, 176. <https://doi.org/10.1016/j.solmat.2017.11.016>.