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| **Study program** Applied chemistry with the management basics |
| **Course title** Chemistry and technology of materials (H267C) |
| **Name of lecturer/lecturers** Aleksandra R. Zarubica, Milena N. Miljković |
| **Type of course** Elective |
| **Number of ECTS allocated** 6 |
| **Course objectives**Acquiring knowledge about the possibility of designing and synthesizing modern materials in the form of films and coatings, and chemical processes/reactions that take place during synthesis. Acquisition of knowledge, acquisition abilities and experiences in physical-chemical characterization of high-tech materials in the form of films and coatings, and their application in selected processes in the context of sustainable development (catalysis and/or adsorption). Application of appropriate mathematical and software tools/application programs in the calculation of individual properties of materials, as well as the assessment of their efficiency in test reactions and real processes in industry and the environment. The design of the mentioned modern materials should ensure finding useful materials that provide appropriate yields/effects when used. The application of these materials as adsorbents or catalysts ensures the satisfaction of the fundamental postulates of sustainable development. |
| **Course outcomes**After successfully completing the course, the student should be able to: come up with a detailed design for the synthesis of materials in the form of a film or coating of a given chemical composition; predict and describe all chemical and physical-chemical reactions/processes that occur during synthesis; lists and compares methods for complete characterization of materials in the form of films and coatings; explain the influence of all physical-chemical characteristics of materials on their effectiveness during application; draw/establish graphics dependencies and displays of mutually selected parameters/properties (texture, structure, morphology) of materials or these dependencies with realized effects in test processes; considers physical-chemical, thermodynamic and kinetic parameters of processes in which materials are applied (adsorption and/or catalysis); performs the necessary data analysis independently (theoretical-mathematical or software approach) based on theoretical knowledge and practical application, and establish optimized process parameters; adequately communicates and presents fundamental and empirical data in oral and/or in written form, independently or in cooperation with colleagues (team work, if necessary); and yes professionally sets and plans work on a suitable topic in chemistry and material technology and coordinates it with principles of sustainable development.  |
| **SYLLABUS***Lectures*Chemistry of ZrO2: structure and properties; Chemistry and technology of ZrO2: processing and application; Chemistry of TiO2: structure and properties; Chemistry and technology of TiO2: processing and application; Chemistry of zeolites: properties and structure; Zeolite chemistry and technology - processing and application; Chemistry of carbon nanotubes: structure, properties and growth; Chemistry and technology of carbon nanotubes: processing and applications; Obtaining films and coatings; Application-deposition of coatings using selected methods from the liquid phase precursors; Deposition of films and coatings by selected methods from the vapor phase of precursors; Chemical vapor deposition; Growth and structure of films and coatings deposited from the vapor phase; Application of films and coatings; Extraction of ceramic fibers, application of ceramic fibers.*Laboratory work*Synthesis of two-layer mixed hydroxides/oxides and non-stoichiometric oxides; Application of two-layer of mixed hydroxides/oxides - adsorption and decomposition of dyes, pesticides and antibiotics; Characterization of ceramic materials - films and coatings; Textural properties of ceramic materials - films and coatings; Calculation of the specific surface area of the material and analysis of the porosity of films and coatings; Structural properties of materials - films and coatings; Morphological properties of ceramic materials - films and coatings; Imaging with an electron microscope and analysis of images of films and coatings; Tests of acid-base centers of materials - films and coatings; Visit to the ceramic materials industry - field teaching; Field teaching - visit to the forensic department. |
| **References**A. Zarubica, Hemija i tehnologija materijala, Prirodno-matematički fakultet, Univerzitet u Nišu, 2015.1. D. Trifunović, M. Jančić, Strukture i osobine materijala, Tehnološko-metalurški fakultet, Univerzitet u Beogradu, Beograd, 1975.
2. A. Zarubica, M. Ranđelović, Praktikum iz Hemije i tehnologije materijala, Prirodnomatematički fakultet, Univerzitet u Nišu, 2013.
3. Handbook of Nanotechnology, Bhushan (Ed.), Springer, 2007.
4. Handbook of Materials, Measurement, Methods, H. Czichos, T. Saito, L. Smith (Eds.), Springer, 2006.
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| **Active teaching classes** | **Lectures** 60 | **Laboratory work** 15 |
| **Teaching mode**Lectures, interactive teaching, field teaching, laboratory exercises, consultations and seminar paper. |
| **ASSESSMENT METHODS AND CRITERIA (Max 100 points)** |
| **Pre exam duties** | **Points** | **Final exam**  | **Points** |
| Activity during lectures | 10 | Written examination | 20 |
| Practical teaching | 10 | Oral examination | 40 |
| Teaching colloquia | 20 |  |  |
| Seminar |  |  |  |