



ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАИ

1000 София
ул. „Сердика“ № 4
<http://edu.bas.bg>

email: tdc-phd@cu.bas.bg
тел.: 02 987 31 67
02 979 52 60

Basic Information:

Course Title: **Methods for testing metallic materials**

Lecturer: Assoc. prof. Vanya Dyakova

Phone: +359887224173

Email: v_diakova2ims.bas.bg

Total Teaching Hours: 30

Annotation

The course of lectures and practical exercises "Methods for testing metals, alloys and products made of them" is intended for training doctoral students in the doctoral program "Methods for testing materials, products and equipment".

The course examines some of the main methods for testing and characterizing metals, alloys and products made of them: optical emission spectroscopy (OES); methods for determining the hardness and strength characteristics of metals and welded joints; microscopic methods for determining the macro- and microstructure of metallic materials - optical microscopy (OM), scanning electron microscopy (SEM), transmission electron microscopy (TEM), computed tomography (CT); methods for corrosion testing of metals, alloys and various types of coatings (CT).

The lecture for each of the methods also includes practical classes, during which doctoral students become familiar with the basic techniques for preparing test specimens, working with the equipment, processing and analyzing the results obtained.

Course content (brief description by topics or modules)

Topic / Module 1: Determination of chemical composition and mechanical properties of metals:

- Introduction to the theoretical foundations of the Optical Emission Spectroscopy (OES) method and the device and operation of the Optical Emission Spectrometer Q4 TASMAR, BRUKER; Observation and conducting a test to determine the chemical composition of steel.
- Introduction to the theoretical foundations of methods for measuring hardness and tensile strength. Observation and participation in conducting a test.

Topic / Module 2: Microscopic methods of analysis and computer tomography - light microscopy (CM), scanning electron microscopy (SEM), transmission electron microscopy (TEM):

- Theoretical foundations of the methods. Device and functioning of the light, scanning and transmission microscope. Types of analysis and interpretation of the results;
- Practical exercises for preparing samples for testing and observation.
- Computer tomography - observation and results.

Topic / Module 3: Corrosion of metals - types of corrosion and testing methods:

- Introduction to methods - salt spray testing and gravimetric analysis methods;
- Electrochemical analysis methods.



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Teaching and assessment methods

Hybrid learning - online and in-person.

Theoretical foundations and practical exercises.

Assessment through interview and test.

Competencies acquired as a result of training (3–5 points)

Basic theoretical knowledge and practical skills in the field of metallic materials research.

Literature:

- Nikolay V. Tkachenko , Optical Spectroscopy. Methods and Instrumentations, 2006
- ASM Metals Handbook, Volume 09: Metallography and Microstructures
- BDS 3690:1973 Steel. Microstructural analysis
- ASM Metals Handbook, Volume 08: Mechanical Testing and Evaluation
- BDS 9440:1972 Metals. Compressive test method.
- BDS EN ISO 6507-1:2024 Metals. Rockwell hardness test
- BDS EN ISO 6507-1:2024 Metallic materials. Vickers hardness test. Part 1: Test method
- BDS EN ISO 6506-1:2014 Metallic materials. Brinell hardness test. Part 1: Test method
- BDS EN ISO 4136:2022 Mechanical tests of welded joints of metallic materials. Tensile test across the seam.
- BDS EN ISO 6892-1:2020 Metals. Tensile test. Part 1: Test method at room temperature.
- BDS EN ISO 6892-2:2018 Metallic materials. Tensile testing.
- ASM Metals Handbook, Volume 12: Fractography
- 13. BDS 16398:1986 Corrosion protection. Metals and alloys. Methods for evaluating the results of corrosion tests
 - BDS EN ISO 9227:2024 Corrosion tests in artificial atmospheric conditions. Salt spray tests.
 - BDS EN ISO 11463:2021 Corrosion of metals and alloys. Assessment of pitting corrosion.

Additional information (optional) (e.g., special requirements, laboratory equipment, prior knowledge)

Необходими са предварителни познания по металознание, физика на металите, оптика.