



ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

1000 София
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Basic Information:

Course Title: Application of Mössbauer Spectroscopy in Solid-State Chemistry for the Investigation of Novel and Nanosized Materials

Lecturer: Assoc. Prof. D. Paneva, PhD

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Total Teaching Hours: 30 hours + 15 practicum

Annotation (up to 150 words)

The lecture course is oriented towards PhD students with interests in the field of solid state chemistry and catalysis. Basic knowledge of structure of the materials considered in the solid-state aspect, instrumental characterization methods, methods for processing of experimental data are needed.

The lecture material is aimed at studying the principles and applications of Mossbauer spectroscopy in the field of material science and catalysis. It is a powerful tool for characterizing the local electronic structure of a studied element (mostly iron or tin) in both crystal and nanostructured or amorphous materials, glass, etc. by determining the local coordination, binding and oxidation state. The tracking of various stages of the synthesis and operation of the catalyst with the Mossbauer spectroscopy can be used to determine the mechanism of the catalytic reaction. For this purpose, modern techniques for recording the spectra under different conditions - room temperature, liquid nitrogen temperature, transmission and conversion spectra will be considered. The resulting experimental Mossbauer spectra will be interpreted using modern approaches for processing and interpreting spectral data using specialized software and databases. It is envisaged that this will be realized in the conditions of the lecture course and in separate practical exercises for working with specialized Mossbauer software.

Course content (brief description by topics or modules)

Topic / Module 1: Fundamentals of Mössbauer Spectroscopy

Topic / Module 2: Applications of Mössbauer Spectroscopy in Materials and Catalysts Research

Topic / Module 3: Processing and Interpretation of Mössbauer Spectra

Teaching and assessment methods

Lecture course - group or individual

Practical exercises and work with specialized software

Theoretical and practical examination

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

- In-depth knowledge of the principles and applications of Mössbauer spectroscopy in materials science and catalysis.
- Acquisition of practical skills for recording, processing, and interpreting Mössbauer spectra.
- Understanding of the relationship between local structure, oxidation state, and material properties.
- Skills for working with specialized software and spectral analysis databases.
- Ability to apply Mössbauer spectroscopy in the investigation of catalysts and functional materials.



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Literature:

1. Mössbauer Spectroscopy and Transition Metal Chemistry, Fundamentals and Applications. Gütlich P., Bill E., Trautwein A.X. Trautwein, Springer; Berlin/Heidelberg, Germany: 2011.
2. Mössbauer Spectroscopy – Principles and Applications, Philipp Gütlich, https://www.blogs.uni-mainz.de/fb09akguetlich/files/2017/11/Moessbauer_Lectures.pdf
3. Mössbauer spectroscopy - An indispensable tool in solid state research, Gütlich, P., Schröder, C., Schünemann V., Spectroscopy Europe 24 (4) 2012, https://www.researchgate.net/publication/287448153_Mossbauer_spectroscopy_-_An_indispensable_tool_in_solid_state_research