

1. *Title*

Introduction to Materials Science

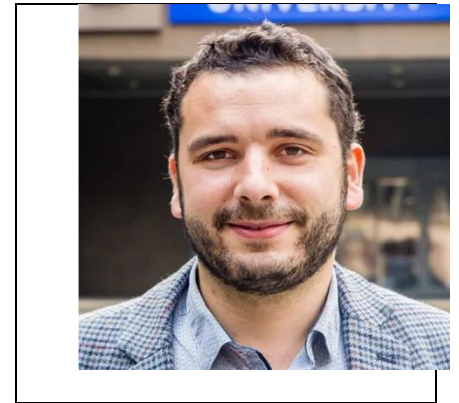
2. *Lecturer(s)*

Research Professor ITMO

Institut Jean Lamour – Univ. Lorraine, France

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3. *Course Language*

English

4. *Credits and assessment form (exam, ungraded credit test, graded credit test):*

Final exam

5. *Brief annotation:*

Materials science is a course that studies the patterns that determine the structure and properties of materials depending on their composition and processing conditions.

The purpose of the course is to give the basics of materials science, the principles of choosing structural materials, the technology of their production and processing; to instill skills of practical determination of physical and mechanical properties of materials and directed impact on them; to expand the scientific and technical horizons of students.

Objectives of the lectures: to acquaint students with the current state of the science of the structure and properties of metallic and non-metallic materials, methods of production and processing; to teach students to navigate the variety of modern structural materials, to know their classification and labeling, as well as the main trends in the creation of materials of the future based on the achievements of scientific and technological progress

6. *Course content*

Lectures:

1) *Understand the crystallographic classification of materials*

- *Structure*
- *Symmetries*

2) *Defects of crystalline structure*

- *Origin*
- *Types*
- *Influence on properties*

3) *Diffraction*

4) *Basics in Thermodynamics of Materials*

- *Gibbs energy curves*

5) *From Gibbs curves to Phase diagrams*

- *Notion of stability, metastability and instability*

6) *Reading and interpreting phase diagrams*

7) *How materials grow?*

- *Thermodynamic approach (Surface vs. Volume)*
- *Kinetic approach (JMAK models)*

8) *How does microstructure influence properties*

- *Mechanical*
- *Optical*
- *At different scales*

9) *Processes to control materials Microstructure*

10) *Use the right tool for the right purpose*

- *Electron microscopy*
- *Diffraction techniques*
- *Near-field techniques*

11) *Interpretations and artefacts*

Personal or group project

- *Report: peer-reviewed by both professor and on 'student reviewer'*
- *Oral presentation with a panel*
- *Based on 'real' research problems*

Final exam