



1. Subject name	Materials Science				
2. Subject name in Hungarian	Anyagtudomány				
3. Code	BMEKOGGD001	4. Evaluation type	exam grade	5. Credits	4
6. Weekly contact hours	4 (0) Lecture	0 (0) Practice	0 (0) Lab		
7. Curriculum	PhD Programme	8. Role	Basic course		
9. Working hours for fulfilling the requirements of the subject					84
Contact hours	56	Preparation for seminars	0	Homework	8
Reading written materials	8	Midterm preparation	0	Exam preparation	12
10. Department	Department of Automotive Technologies				
11. Responsible lecturer	Dr. Bán Krisztián				
12. Lecturers	Dr. Bán Krisztián				
13. Prerequisites	recommended: BMEKOGGM601 - Advanced materials and technologies				
14. Description of lectures					
Material structures: bonding types, materials with crystalline and amorphous structure. Thermodynamics, diffusion, phase transitions. Non-equilibrium systems and thermodynamics: amorphous and nanostructured materials and their properties. The role of surface in material properties. Material properties: effect of different bonding types, defect structure (real structure) on transport, optical, magnetic and mechanical properties. Material testing: procedures for polycrystalline materials: X-ray diffraction, texture test. SEM, DSC, TEM as test methods. Metallographic examinations, microscopic properties of structural materials, examination of grain structure. Spectroscopy. Mechanical (tensile, micro- and macro-hardness, impact energy) test methods and equipments, non-destructive testing methods for material defects. Special material testing methods.					
15. Description of practices					
16. Description of laboratory practices					
17. Learning outcomes					

**A. Knowledge**

- Recognizes new regularities in the types of chemical bonds.
- It recognizes new laws of crystalline and amorphous structure.
- It recognizes new regularities in the field of thermodynamics.
- It recognizes new laws of diffusion.
- It recognizes new regularities about the thermodynamic background, types, energetic relations of phase transitions, and the importance of the interface in phase transitions.
- Recognizes new regularities about types of non-equilibrium systems.
- It recognizes new regularities about the role of the interface in material properties.
- Recognizes new regularities in the properties of amorphous and nanostructured materials.
- Recognizes new regularities about the effects of different bonds, error structures (real structures in transport, optical, magnetic and mechanical properties.
- Recognizes new regularities with major direct structural analysis methods: XRD, texture, SEM, TEM, optical microscopy.
- It recognizes new regularities in major spectroscopic examination procedures.
- Recognizes new laws regarding the DSC test method.
- Recognizes new laws through the application of major mechanical and non-destructive material testing methods.

**B. Skills**

- It is capable of understanding the entire process and its elements, or of a process. plan.
- It is capable of deeper, causal, scientific analysis of a technological or measurement process.

- Can formulate suggestions for the development of a technological or measurement process.
- He / she is able to collect literature on a specific research topic for a focus question and to compile a summary based on it.
- They are able to interpret the results found in the literature.
- He / she is able to design experimental designs and research methods on a research topic.
- Able to interpret test results.

#### C. Attitudes

- It strives to develop its knowledge independently.
- It strives to ensure that each topic area and / or theme. look for relationships between disciplines.
- It seeks to ensure that the literature and literature. interpret your own research results individually and in teamwork, listening to the thoughts of others.
- It seeks to share its knowledge.

#### D. Autonomy and Responsibility

- Responsibly apply the knowledge gained in the subject subject to its limitations.
- It manages according to ethical standards and communicates the results to others and itself.
- It seeks to carry out the task entrusted to it independently, in accordance with ethical standards.
- You are aware of the extent to which your responsibilities extend to informing your colleagues or supervisors of the results and if needed.

### 18. Requirements, way to determine a grade (obtain a signature)

The course ends with an oral examination.

### 19. Opportunity for repeat/retake and delayed completion

Possibilities for supplementation takes place in accordance with the applicable study and examination rules.

### 20. Learning materials

1. Charles Kittel: Introduction to solid state physics,
2. Thornton, Calangelo: Fundamentals of engineering materials, Prentice-Hall, Inc. New Jersey, 1985,
3. Flinn, Trojan: Engineering Materials and Their Applications,
4. Kalpakijan S.: Manufacturing Engineering and Technology, Prentice Hall, 2013.
5. Auxiliary materials and ppt's downloadable from the department website.

<b>Effective date</b>	27 November 2019	<b>This Subject Datasheet is valid for</b>	Inactive courses
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