



1. Subject name	Advanced materials and technologies				
2. Subject name in Hungarian	Korszerű anyagok és technológiák				
3. Code	BMEKOGGM601	4. Evaluation type	mid-term grade	5. Credits	5
6. Weekly contact hours	3 (17) Lecture	1 (11) Practice	0 (0) Lab		
7. Curriculum	Vehicle Engineering MSc (J)	8. Role	Mandatory (mc) at Vehicle Engineering MSc (J)		
9. Working hours for fulfilling the requirements of the subject					150
Contact hours	56	Preparation for seminars	14	Homework	15
Reading written materials	50	Midterm preparation	15	Exam preparation	0
10. Department	Department of Automotive Technologies				
11. Responsible lecturer	Dr. Bán Krisztián				
12. Lecturers	Dr. Bán Krisztián, Dr. Markovits Tamás, Dr. Lovas Antal				
13. Prerequisites					
14. Description of lectures					
<p>The course provides a deeper knowledge of non iron-based structural materials applied in vehicle industry. Modern light metal alloys, elastomers, plastics, composites and ceramics are described. The physical properties, production technologies and peculiarities of manufacturing are described in details of the mentioned structural materials of vehicles. During the course the students are introduced into the basic knowledge necessary for each topic, mentioned above, such as thermodynamic stability, metastability, non-equilibrium systems, the effect of phase relations on material properties, strength enhancement, and material interactions.</p> <p>The characteristics of composites and hybrid materials and their production technologies are presented. Students are introduced to the technological bases of surface modification phenomena and technologies as well as additive manufacturing.</p> <p>Within the scope of the course we discuss the aspects of material selection in the consideration of operating conditions of the vehicles and environmental protection.</p>					
15. Description of practices					
<p>The aim of the practices to translate the theoretical knowledge of the lecture into practice by examples and solving practical tasks in the topics such as equilibrium transformations, quality certificates, selection of semi-finished products based on specified criteria from metallic and non-metallic raw materials as well as to provide a material model for a real material based on material testing.</p>					
16. Description of labortory practices					
17. Learning outcomes					

A. Knowledge

- Knows the characteristics of metallic bonding and what is the role of it in the properties of metallic systems.
- Knows how the phase relationships which can be read from the phase diagram affect the properties.
- Knows the concept and types of metastability.
- Knows the mechanisms of strength enhancement.
- Knows the classification of light metals based on microstructure characteristics.
- Knows the purpose of the manufacturer's quality certificate and the most important contents of it.
- Knows the most important properties of sheet products in the point of view of technology.
- Knows the phase conditions are formed in metal-gas systems.
- Knows the concept of surface modification, its main goals, and the most important procedures.
- Knows the advantages and disadvantages of using ceramic materials, the major physical properties of ceramics, and the most important aspects of ceramic design.
- Knows the most important steps in the manufacturing of modern technical ceramics.
- Knows the types of composite materials, their structural features and their effect on physical properties.

- Knows the types of plastics and elastomers, their structural features and their impact on physical properties.
- Knows the types of material models.

B. Skills

- Able to see and explain the relationship between the phase diagram and the physical properties of binary systems.
- Able to see and explain how the types of metastability are related to the possibilities of strength enhancement.
- Able to see and explain the relationship between the strength-enhancing mechanisms and the equilibrium phase conditions (shape of the diagrams).
- Capable of interpreting any manufacturer's quality certificate.
- Able to select a sheet material based on the deformations given by a sheet forming technology.
- Able to propose a surface modification method to achieve a surface property, analyze its feasibility, advantages and limitations.
- Able to determine a flexible-plastic model by using the results of a tensile test.
- Able to collect literature on a specific topic and compile a summary based on it.

C. Attitudes

- Strives to find relationships between the different topics.
- Strives to interpret independently what has been said in lectures and practices (relationships, statements, diagrams), to be open to thinking together with the instructor and his / her students.
- Strives for active participation in lectures and practices.

D. Autonomy and Responsibility

- Accepts the frameworks for completing the subject, and performs its tasks independently and responsibly, in accordance with ethical norms.
- Apply responsibly the knowledge acquired during the course with regard to their validity limits.
- The task is performed independently, according to the designated conditions and ethical norms.

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

Students prepare a literature research about a topic agreed with the lecturer, from which they have to prepare a written summaries and hand in to the end of the semester, or perform a subtask of the research project of the department. During the semester, we have two midterm exams for which the students will be awarded. The result of the submitted manuscript and two midterm exams are the basis for calculating the grade in 50-25-25%.

19. Opportunity for repeat/retake and delayed completion

Both midterm exams can be substitute twice, the supplementation of the written work is possible during the supplementation week.

20. Learning materials

- Charles Kittel: Introduction to solid state physics,
- Thornton, Calangelo: Fundamentals of engineering materials, Prentice-Hall, Inc. New Jersey, 1985,
- Flinn, Trojan: Engineering Materials and Their Applications,
- Auxiliary materials and ppt's downloadable from the department website.

Effective date	10 October 2019	This Subject Datasheet is valid for	2024/2025 semester II
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