SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University
1.2 Faculty	Chemistry and Chemical Engineering
1.3 Department	Chemical Engineering
1.4 Field of study	Chemical Engineering
1.5 Study cycle	Master
1.6 Study programme / Qualification	Advanced Chemical Process Engineering

2. Information regarding the discipline

2.1 Name of the discipline	**Ceramics, binders and vitreous materials and advanced processing methods – CME7134**						
2.2 Course coordinator	Conf. dr. ing. Liliana BIZO						
2.3 Seminar coordinator	Conf. dr. ing. Liliana BIZO						
2.4 Year of study	2	2.5 Semester	3	2.6 Type of evaluation	E	2.7 Type of discipline	DS/Comp

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					20
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					20
Tutorship					6
Evaluations					3
Other activities:					

3.7 Total individual study hours	69
3.8 Total hours per semester	125
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1. curriculum	-
4.2. competencies	-

5. Conditions (if necessary)

5.1. for the course	• Students should switch off the mobile phones during courses and seminars. • Students should be present at the courses without any time delay.
5.2. for the seminar /lab activities	• The deadline for presenting the homework results will be agreed between the seminar holder and the students. No delay is accepted

	for the presentation of the homework results unless well-founded reasons are proven. • In case of presenting the homework with delay, the grade will be penalized by 0.5 points/ week of delay. • Students should be present at the seminars without any time delay.

6. Specific competencies acquired

Professional competencies	• Defining the language and identification of advanced concepts for advanced materials realisation • Explaining and understanding operation of specific devices, equipments and processes for the production of advanced materials • Conducting a extensive bibliographic study related to the research topic chosen, organizing and synthesizing of data with aquiring specific terminology; general and specific knowledge of research methods • Use specialized knowledge to establish research strategy, realization of experiments and interpretation of results • Using conceptual and methodological research for new theoretical approaches in synthesis of materials • Selecting and using appropriate research methods for a correct interpretation of the results and formulation of pertinent conclusions • Using the basic and applicative concepts in the development of research projects
Transversal competencies	• Performing research and design activities in a autonomous way, using specific equipments (included computer aided techniques) and conforming to the ethical rules • Developing of self guided evaluation of own professional performance and self assessment of the needs for continuous professional improvement based on permanent knowledge update related to his/her activity field • Communicating the own points of view, in a clear and concise way, using communication means based on conventional and non-conventional information technology instruments

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• To familiarize students with the basic concepts, theories and models of the advanced oxide materials
7.2 Specific objective of the discipline	• Providing the basic information regarding the synthesis and advanced processing methods of some special ceramics, binders and vitreous materials • Acquiring knowledge on the composition, microstructure, advanced processing methods in correlation with the function of using the oxide materials

8. Content

8.1 Course	Teaching methods	Remarks
8.1.1. High reliability ceramics. Processing methods, densification concepts, colloidal powder processing. Silicon nitride powders. Powder Synthesis and Characterization. Powder Dispersion. Surface properties. Powder sintering. Ceramic Properties.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.2. Stabilised zirconia ceramics. Wet processing. Microstructure. Forming. Thermal treatment. Properties. Structural ceramics. Thin films-deposition methods.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.3. Electronic ceramics. Processing. Wet Forming. Slip Casting. Thermal treatment. Properties. Microwave processing of ceramics.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.4. Ceramic composites. Microstructure and processing. Sintering and Hot Forming. Reaction Processing. Melt Processing Methods. Chemical Vapor Deposition.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.5. Oxide-salt-water binders. A. Binders in system $MgO-MgCl_2(MgSO_4)-H_2O$. Phase equilibrium, compositions, characteristics. B. Binders analogous to Sorel cement. Alkaline–earth and with other cationic elements binding systems.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.6. Oxide-acid-water binders. A. Phosphate binders. Phase equilibria. Reaction products. Hardening mechanism. B. Biocements. Types (calcium-phosphate, zinc-phosphate dental cement, magnesite-phosphate and silicate-phosphate).	Lecture giving, explanation, conversation, exemplification, debate	
8.1.7. Binders for high temperatures (refractories). Aluminate-phosphate, magnesite-phosphate and chromo-phosphate binders, etc.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.8. Oxidic materials with vitreous structure. Characterization of the vitreous structure. Correlation of composition-structure-properties-applications.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.9. Choosing the preparation process of products according to the shape and applications.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.10. Technical glasses: electrotechnical glasses, Vycor glasses, semiconducting glasses, isolating glasses.	Lecture giving, explanation, conversation, exemplification, debate	

8.1.11. Technical glasses: optical and selective absorption glasses. The condition imposed to optical glasses, optical and selective absorption glasses, photosensitive glasses, optical fibers.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.12. Glass-ceramic materials: oxidic systems used to obtain glass-ceramic materials. Criteria for determining compositions for glass-ceramics with predefined properties.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.13. Glasses used in nuclear technology.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.14. Vitreous biomaterials. Biological glasses with controlled corrosion, radio therapy glasses, glass-ceramics for hyperthermia.	Lecture giving, explanation, conversation, exemplification, debate	

Bibliography

1. R. Riedel, I.-Wei Chen (Eds.), ***Ceramics Science and Technology***, Wiley-VCH, **2008**, ISBN: 978-3-527-63196-4 (ePDF).
2. J. Heinrich, F. Aldinger (Eds.), ***Ceramic Materials and Components for Engines***, Wiley-VCH, **2001**, ISBN: 3-527-30416-9 (ePDF).
3. I. Teoreanu, ***Bazele tehnologiei lianţilor anorganici***, Editura Didactica şi Pedagogica, Bucureşti, **1993**, Biblioteca Centrală Universitară.
4. P. Balta, ***Tehnologia sticlei***, Editura Didactică şi Pedagogică, Bucuresti, **1984**, Biblioteca Centrală Universitară, Biblioteca Facultăţii de Chimie.
5. F. Goga, ***Tehnici de analiză a materialelor oxidice***, Presa Universitară Clujeană, **2006**, Biblioteca Facultăţii de Chimie, ISBN: (13)978-973-610-495-4.
6. PowerPoint presentation, **2023**.

8.2 Seminar / laboratory	Teaching methods	Remarks
8.2.1. Presentation and discussion of experimental works. Work safety rules.	Conversation method, learning by discovery, individual learning, team working	
8.2.2. Colloidal powders processing.	Conversation method, learning by discovery, individual learning, team working	
8.2.3. Stabilized zirconia and thin films deposition methods.	Conversation method, learning by discovery, individual learning, team working	
8.2.4. Microwave processing of electronic ceramics.	Conversation method, learning by discovery, individual learning, team working	
8.2.5. Sintering and hot pressing of ceramic composites.	Conversation method, learning by discovery, individual learning, team working	
8.2.6. Physical and chemical deposition of thin films.	Conversation method, learning by discovery,	

	individual learning, team working	
8.2.7. Combustion method for binders obtaining.	Conversation method, learning by discovery, individual learning, team working	
8.2.8. Theoretical method for properties prediction of vitreous materials.	Conversation method, learning by discovery, individual learning, team working	
8.2.9. Composition and raw materials recipe design for special glasses.	Conversation method, learning by discovery, individual learning, team working	
8.2.10. Study of the melting processes in borate-silicate glasses.	Conversation method, learning by discovery, individual learning, team working	
8.2.11. Synthesis of low melting glasses. Synthesis and thermal analysis of a glass-ceramic.	Conversation method, learning by discovery, individual learning, team working	
8.2.12. Synthesis of colored glasses. Color characterization by dominant wavelength determination	Conversation method, learning by discovery, individual learning, team working	
8.2.13. Recovery of lab works/Applications	Conversation method, learning by discovery, individual learning, team working	
8.2.14. Evaluation of laboratory works.	Conversation method, learning by discovery, individual learning, team working	

Bibliography

1. L. Gagea, ***CERAMICĂ de laborator. Lucrări şi probleme***, Casa Cărţii de Ştiinţă, Cluj-Napoca, **2003**, BCU, Biblioteca Facultăţii de Chimie, Biblioteca Departamentului de Inginerie Chimică.
2. F. Goga, ***Tehnici de analiză a materialelor oxidice***, Editura Presa Universitară Clujeană, **2006**, Biblioteca Facultăţii de Chimie.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

Feedback from industry (Companies: Saint Gobain, HOLCIM) has been used to comply with the expected competencies desired by potential employers. By acquiring the theoretical and methodological concepts and approaching the practical aspects included in the ***Ceramics, binders and vitreous materials and advanced processing methods*** discipline the students acquire a consistent knowledge bag, in accordance with the competences of the Diploma Supplement and the qualifications of the ANC.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)

10.4 Course	The correctness of answers, assimilation and understanding of the issues treated in class The ability to particulate the overall phenomena to a specific product	Oral examination. Access to examination is conditioned by the presentation of the prepared homework results. The fraud is punished by expelled from the exam according the ECTS regulations.	70 %
10.5 Seminar/lab activities	The correctness of answers, assimilation and understanding of the issues treated to the laboratory The quality of the laboratory works prepared The activity carried out in the laboratory	Labratory works corresponding to lab activities are delivered in the last week of teaching activity. Laboratory test will take place in the last week of teaching activity.	30 %
10.6 Minimum performance standards			
Minimum condition for exam promoting: 5 grade at laboratory test and 5 grade at oral examination. Knowledge of basic concepts; composition and microstructure of an oxidic product, main technological parameters, elaboration of a technologic flow for an advanced material with main stages, correlation of properties and applications.			

Date

10 aprilie 2024

Signature of course coordinator

Signature of seminar coordinator

Date of approval

16.04.2024

Signature of the head of department

Prof. habil. dr. ing. Graziella L. Turdean