

## Information sheet for the course Selected Chapters from Ceramic Materials

<b>University:</b> <i>Alexander Dubček University of Trenčín</i>	
<b>Faculty:</b> <i>Faculty of Industrial Technologies in Púchov</i>	
<b>Course unit code:</b> <i>MI-I-PV-37</i>	<b>Course unit title:</b> <i>Selected Chapters from Ceramic Materials</i>
<b>Type of course unit:</b> <i>optional</i>	
<b>Planned types, learning activities and teaching methods:</b> <i>State Examination Subject ; face to face</i>	
<b>Number of credits:</b> <i>2</i>	
<b>Recommended semester:</b> <i>4<sup>th</sup> semester in the 2<sup>nd</sup> year full-time 6<sup>th</sup> semester in the 3<sup>rd</sup> year part-time</i>	
<b>Degree of study:</b> <i>the 2<sup>nd</sup> degree of study (Engineer's degree)</i>	
<b>Course prerequisites:</b> <i>Completion of all compulsory and optional courses of the study plan, including MI-I-P-15 Ceramic Materials.</i>	
<b>Assessment methods:</b> <i>Successful completion of the state examination subject.</i>	
<b>Learning outcomes of the course unit:</b> <i>Student will successfully complete the state examination subject.</i>	
<b>Course contents:</b>	
<ol style="list-style-type: none"> <li>1. <i>Definition of ceramics. Properties of ceramic materials – advantages, limitations. Types of ceramics – classical ceramics, construction ceramics. Oxide ceramics (<math>Al_2O_3</math>, <math>ZrO_2</math>), non-oxide ceramics (<math>SiC</math>, <math>Si_3N_4</math>, <math>BN</math>, <math>MoSi_2</math>)</i></li> <li>2. <i>Application of construction ceramic materials – abrasion resistant components, hybrid ceramic engine, abrasive materials, cutting tools, bearings, bioceramic materials, electrotechnical devices, heat exchangers, coatings, military and cosmic applications, high-tech ceramics.</i></li> <li>3. <i>Raw materials needed to ceramics production – classification: by origin, by function in ceramic mixture.</i></li> <li>4. <i>Plastic raw materials – types of clay raw materials and their properties, plasticity, application options. Clay minerals – structure, types of clay minerals.</i></li> <li>5. <i>Non-plastic raw materials – classification. Opening materials (grogs) – types, function in ceramic mixture. Fillers – types, function in ceramic mixture. Fluxes – types (<math>K</math> spars, <math>Na</math> spars, <math>Ca</math> spars), function in ceramic mixture.</i></li> <li>6. <i>Treatment of raw materials. Floating of kaolin. Grinding of ceramic mixture – mills, mode of grinding, principle of grinding, wet grinding, dry grinding, grinding of very fine powders.</i></li> <li>7. <i>Drainage of ceramic suspension. Filter pressing. Spray drying. Production of the most important synthetic raw material needed to production of ceramics (<math>Al_2O_3</math>, <math>TiO_2</math>, <math>ZrO_2</math>, <math>SiC</math>, <math>Si_3N_4</math>, transformed reinforced ceramics)</i></li> <li>8. <i>Forming of ceramic products – forming methods of advanced ceramics. Methods of dry forming – pressing – types, procedure, shapes of products. Methods of wet forming – casting from suspension – procedures, shapes of products. Methods of plastic forming – plasticization (fillers), procedure, device. High-pressure injection – procedure, shapes of products and types of products. Hot pressing. Hot isostatic pressing. Forming of ceramic mass turning on the potter's wheel.</i></li> <li>9. <i>Thermal treatment of ceramic products – processes, devices. Ovens – types of ovens. Furnaces – types of furnaces (by construction, by ways of operation and by source of energy) Chamber furnace – construction, principle of work. Tunnel furnace – construction, principle</i></li> </ol>	

- of work. Principle of work of periodically and continuously operating device.*
10. *Drying – definition of drying, humidity and humidity ratio, ways of binding of humidity in ceramic material. Bigot curve – retraction, critical humidity, sensitivity coefficient of material to drying.*
11. *Firing ceramics – definition of firing process, ways of firing, phases of firing process, conditions of firing process. Processes in ceramic material during the firing: dehydroxidation of clay minerals; Burnout of organic substances – reactions during burnout of organic substances, influence of Fe compounds on combustion of organic substances, influence of calcium carbonate. Formation of new crystalline phases in body – formation of mullite, cristobalite. Melting of spars – melting of Na-spar and K-spar individually, in mixture and with addition of quartz. Reactions in solid phase – kinetics of homogeneous and heterogeneous reactions. Sintering – processes during sintering, stages of sintering.*
12. *Surface treatment of ceramic products. Glazing – functions of glazes, types of glazes, properties and classification of glazes, colored glazes, preparation of glazes. Engobing – properties and utilization of engobing.*

**Recommended of required reading:**

1. *Hanykýř V., Kutzendorfer J.: Technologie keramiky, Vega s.r.o. 2000, ISBN 80-900960-6-3*
2. *J.Hlaváč: Základy technologie silikátov, SNTL, Praha, 1987.*
3. *J. Majling a kol.: Technológia špeciálnych anorganických materiálov, STU, Bratislava.*
4. *Z.Pospíšil a kol.: Jemná keramika, SNTL/Alfa Banská Bystrica.*
5. *V.Hanykýř, J. Kutzendörfer: Technologie keramiky, vyd. I., VEGA, s.r.o., 2000.*

**Language:** *Slovak*

**Remarks:**

**Evaluation history:**

Number of evaluated students: 0

A	B	C	D	E	FX
0.0	0.0	0.0	0.0	0.0	0.0

**Lecturers:** *prof. Ing. Darina Ondrušová, PhD.*

**Last modification:** *31.03.2014*

**Supervisor:** *prof. Ing. Darina Ondrušová, PhD.*