Module name: Chemistry of coal


Faculty of: Energy and Fuels

Field of study: Chemical Technology  Specialty: Clean Fossil and Alternative Fuels Energy - KIC

Study level: Second-cycle studies  Form and type of study: Full-time studies

Lecture language: English  Profile of education: Academic (A)  Semester: 1

Course homepage: —

Responsible teacher: dr inż. Jodłowski Grzegorz (jodlowsk@agh.edu.pl)

Academic teachers: dr inż. Jodłowski Grzegorz (jodlowsk@agh.edu.pl)

Module summary
This module gives deep insight on structure, physico-chemical properties and application of carbonaceous materials. Students experimentally evaluate some of properties of coal and active carbons.

Description of learning outcomes for module

<table>
<thead>
<tr>
<th>MLO code</th>
<th>Student after module completion has the knowledge/ knows how to/is able to</th>
<th>Connections with FLO</th>
<th>Method of learning outcomes verification (form of completion)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Social competence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_K001</td>
<td>Student can demonstrate her/his ability to seek new information and update her/his professional and personal competence</td>
<td>TC2A_K01</td>
<td>Report</td>
</tr>
<tr>
<td></td>
<td>Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_U002</td>
<td>Student is able to carry out experiments in the physico-chemical laboratory, interpret the obtained results and formulate conclusions</td>
<td>TC2A_U02</td>
<td>Report</td>
</tr>
<tr>
<td></td>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_W001</td>
<td>Student is able to define chemical composition and physicochemical and functional properties of carbonaceous materials</td>
<td>TC2A_W01</td>
<td>Report</td>
</tr>
</tbody>
</table>
Module card - Chemistry of coal

| M_W002 | Student is able to explain of gaining, technology of processing and use of fossil fuels and carbon based materials |
| TC2A_W02 | Participation in a discussion |

FLO matrix in relation to forms of classes

<table>
<thead>
<tr>
<th>MLO code</th>
<th>Student after module completion has the knowledge/ knows how to/is able to</th>
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</table>

<table>
<thead>
<tr>
<th>Form of classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
</tr>
</tbody>
</table>

Social competence

M_K001 | Student can demonstrate her/his ability to seek new information and update her/his professional and personal competence |

Skills

M_U002 | Student is able to carry out experiments in the physico-chemical laboratory, interpret the obtained results and formulate conclusions |

Knowledge

M_W001 | Student is able to define chemical composition and physicochemical and functional properties of carbonaceous materials |

M_W002 | Student is able to explain of gaining, technology of processing and use of fossil fuels and carbon based materials |

Module content

Lectures

Course overview
The aim of the course is to acquire a fundamental knowledge on the structure, properties and chemistry of coal and carbonaceous materials. Students should: 1) understand coal structure models and the genesis of natural coal, carbonaceous materials sources and physical and chemical properties of coal and carbonaceous materials; 2) understand the influence
of different parameters of coal structure on the applicability of coals; and 3) be able to carry out
and interpret basic physico-chemical analyses of carbonaceous materials.

Lectures content are:
- Introduction to coal technology, nomenclature and classification
- Theory of coal and organic derivatives genesis and metamorphism.
- Modern models of coal structure.
- Lignite and hard coal structure and microstructure.
- Carbonaceous natural fuels classification and sources.
- Texture and chemistry of coal surface.
- Carbo-chemistry of coal (coal treatment).
- Introduction to coal liquefaction and gasification.

Laboratory classes

The determination of:
- Density of hard coal by pycnometry.
- Decolouring properties of hard and active coals.
- Wetability of hard coal.
- Specific surface area of hard coal.
- Elemental analysis of hard coal.
- Surface groups of hard coal.
- Self-ignition of hard coal.

Method of calculating the final grade

Grading formula: \[ FG = PMW_{labwork} \cdot PMG_{labwork} + PMW_{labtest} \cdot PMG_{labtest} + PMW_{labrep} \cdot PMG_{labrep} \]

Where:
- \( FG \) - final grade
- \( PMW_{labwork} \) - Laboratory works part weighting factor – 0,2
- \( PMW_{labtest} \) - Laboratory test part weighting factor – 0,5
- \( PMW_{labrep} \) - Laboratory reports part weighting factor – 0,3
- \( PMG_{labwork} \) - Grade of achieved LOs relevant to laboratory works
- \( PMG_{labtest} \) - Grade of achieved LOs relevant to laboratory test
- \( PMG_{labrep} \) - Grade of achieved LOs relevant to laboratory reports

Report contains: short introduction, list of chemicals and apparatuses, set of operations, calculations, comments (problems, improvements, etc.), conclusions.

All LO weighting factors associated with part of the module (PM) equal 1.

Prerequisites and additional requirements

Fundamental knowledge on organic chemistry

Recommended literature and teaching resources

6. http://www.coalonline.info/site/coalonline/content/home
Scientific publications of module course instructors related to the topic of the module


“Identyfikacja struktury węgla kamiennego z wykorzystaniem sorpcji wielu sorbatów —Identification of bituminous coal structure by using many sorption data”, Grzegorz S. JODŁOWSKI, Marta WÓJCIK, Przemysł Chemiczny 2014 t. 93 nr 12, s. 2038–2041.


Additional information

The overall assessment consist of two steps:
1. Assessment of fulfilling of module learning outcomes and OLOs.
2. Assessment and grading of the quality of students work.

EIT OLOs assessed in the industrial internship:
• Making value judgments and sustainability competencies (EIT OLO 1)
• Research skills and competencies (EIT OLO 5)
• Intellectual transforming skills and competencies (EIT OLO 6)
• Leadership skills and competencies (EIT OLO 7)

The Method of assessments indicated in point description of learning outcomes for modulen icludes assessment of learning outcomes and OLOs

Student workload (ECTS credits balance)

<table>
<thead>
<tr>
<th>Student activity form</th>
<th>Student workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation in lectures</td>
<td>14 h</td>
</tr>
<tr>
<td>Participation in laboratory classes</td>
<td>14 h</td>
</tr>
<tr>
<td>Realization of independently performed tasks</td>
<td>15 h</td>
</tr>
<tr>
<td>Preparation for classes</td>
<td>5 h</td>
</tr>
<tr>
<td>Preparation of a report, presentation, written work, etc.</td>
<td>10 h</td>
</tr>
<tr>
<td>Summary student workload</td>
<td>58 h</td>
</tr>
<tr>
<td>Module ECTS credits</td>
<td>2 ECTS</td>
</tr>
</tbody>
</table>