CERAMIC MATERIALS FOR ENERGY INDUSTRY

(3 ECTS) *Elective*

Responsible person:

Dr. Magdalena Dudek

Learning outcomes:

The main objective of the course is to bring to the students the knowledge of the physicochemical properties of ceramic materials and their possible application to energy industry

After completion of the course students should be able to:

- Describe the physicochemical properties of ceramic materials
- Discuss and present to the public the recent possibility of application of ceramic materials as components for chemical and energy industry
- Propose adequate materials solutions for a given process in chemical or energy industry
- Basing on experimental/technological data, discuss the reasons for high temperature application of ceramic materials in energy industry
- Discuss and present to the public new possibilities of utilization of some materials as components for renewable energy
- Choose an appropriate analytical method to determine physicochemical properties of ceramic materials

Course main content:

The course is built of three parts: lectures (15 h), laboratory (15 h) and seminar (15 h)

Lectures:

During lectures students will be acquainted with the most important issues in materials science and technology. Lectures will concern the following subjects:

Introduction of ceramic materials, ceramic for turbine engines, thermal barrier coatings, corrosion of selected ceramic materials in hot gas environment, ceramic membranes in carbon dioxide capture applications and potentials, Direct carbon fuel cell, solid oxide fuel cells , ceramic materials for renewable energy

Laboratory:

1. The oxidation and corrosion behaviour of non-oxide ceramic materials,
2. Preparation and characterization of 8YSZ thermal barrier coatings,
3. Direct carbon fuel cell with a solid oxide electrolyte,
4. Solid oxide fuel cell

Seminars:

Seminars are connected to subjects presented during the lectures and concern application, preparation as well as characterization methods for ceramic materials for energy sector or chemical industry. The student has to prepare a presentation illustrating a problem indicated by the teacher, basing on literature data and discuss it.

Admission requirements:

Basics in chemistry physical chemistry, materials science

Literature:

3. C. Barry Carter, M. Grant Norton, Ceramic materials: Science and Engineering, Springer
4. K. Li, Ceramic membranes for separation and reactions, Imperial College London UK,
5. Fuel cell technology
6. Materials from lectures, (scientific journals, technical specifications)

Assessment:

- evaluation of laboratory reports
- evaluation of presentation prepared for a seminar and discussion following the presentation
- examination: written examination – solving problems defined by the ILOs.

Rules of final credit: The average of the grades: laboratory (30 %), seminar (30 %) and examination (40 %).