

**Course title:** Circular economy in technology and waste utilization – selectable / regular course

**Number of contact hours:** 45 hours (30h seminar, 15h laboratories)

**ETCS credits:** 3

**Course description:** Circular economy-definition, description and rules. Circular economy legislations. From linear to circular—the opportunities presented by a circular economy. Barriers to re-use, Regulatory barriers to using recycled content (secondary raw materials). Best available techniques for sustainable production.

End of waste criteria. Turning waste into value-examples. Waste to energy. Closed Loop recycling of the high-added-value materials in the secondary circle of materials flow, in order to decrease the demand of primary raw materials.

Case examples of circular products demonstrated through detailed case studies: Inorganic industry, biological waste streams, waste streams from different industries.

The lecture reviews hybrid organic-inorganic materials; examples of innovative technologies inspired by nature will be provided. Recycling of waste containing nanomaterials will be discussed. Methods for treatment of waste containing nanomaterials will be reviewed (incineration, landfilling, agricultural application)

Laboratories: 3 technological processes fulfilled circular economy rules

**Education effects** (P6S\_UW P7S\_UW, P7S\_WG):

- **knowledge:** student knows circular economy rules and its practical utilization; is familiar with existing law-regulations; knows the barriers of using secondary raw materials; knows the examples of close loop recycling; knows circular products; knows basic types of hybrid organic-inorganic materials; knows their properties; recognizes innovative technologies inspired by nature; knows methods of treatment of waste containing nanomaterials

- **skills:** student can obtain and analyze circular products, can obtain hybrid organic-inorganic materials; is able to point out the best treatment method of given waste containing nanomaterials

- **social:** student understands the reason and benefits of using circular economy in technology and waste treatment; understand the reason of using innovative technologies inspired by nature; understands the reason of recycling and treatment of waste containing nanomaterials; is able to work independently and in the group both at the laboratories and during preparation of the report

**Literature:** 1. The Circular Economy: A Wealth of Flows - 2nd Edition, 2017, Ken Webster

2. [http://ec.europa.eu/environment/circular-economy/index\\_en.htm](http://ec.europa.eu/environment/circular-economy/index_en.htm)

**Assessment method:** presentation of selected topics, completing the laboratories (presence and delivering of reports from each performed exercise)

**Prerequisites:** Basic knowledge in chemistry and technology

**Primary target group:** All specialties students

**Lecturer:** dr inż. K.Gorazda, dr inż. J.Pulit-Prociak,

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