



COURSE DATASHEET

Semester:	2012/13/2
Course:	Catalytic Processes in the Hydrocarbon Industry and Up-to-Date Fuels
Code:	VEMKMOL458E
Responsible department:	Department of Hydrocarbon and Coal Processing
Department code:	MKOL
Responsible instructor:	Dr. Jenő Hancsók

Course objectives:

To give a summary of the theoretical and practical knowledge of chemical engineering on the catalytic processes of hydrocarbon processing. To give an overview about the production, standards, blending components, additives, logistic and life cycle assessment of energetic products of the hydrocarbon processing (gasoline, diesel fuel, JET, heating and fuel oils) and give similar information about the alternative fuels, environmental protection aspects.

Course content:

1. The role and importance of catalytic processes in hydrocarbon processing. The history of industrial catalysis Classification of catalytic processes. Homogeneous, heterogeneous enzyme catalysis. Classification, design and selection of catalysts.
2. Heterogeneous catalysts in hydrocarbon processing. The role of the support(s), the metal component(s), and the promoter(s). Shape selective catalysis. A few examples of the production of catalysts. Overview of catalytic reactors and reactor systems. Criteria for the selection and layout of the reactor.
3. The operation of catalytic reactors: control the activity before the catalyst loading, installation of various catalysts (drying, activation, etc), continuous monitoring of operational parameters of reactor(s), catalyst sampling, etc.).
4. Regeneration of catalysts ("in situ" és "ex situ"), draining of reactors. Review of the hydrocarbon catalytic systems. Catalytic processes in hydrocarbon industry, and environmental protection I.- II.
5. Relationships of energetic products. The role of mobility in sustainable development. Devices of the mobility and their characterization. Characterization and classification of internal combustion engines. Classification of fuels. Flexible refinery for fuel production.
6. Direct and indirect regulation of quality of engine fuels. Hungarian and international standards and other international regulations (WWFC) of gasolines. Production of gasoline blending components. Types of gasoline additives. Analytical and performance properties.
7. Blending and additivation of gasolines. Standards, production and additivation of aviation gasolines.
8. Production and additivation of Jet fuels. Hungarian and international standards and other international regulations (WWFC) of diesel fuels. Production of diesel fuel blending components. Analytical and performance properties.
9. Types of diesel fuel additives. Production and blending of diesel fuels.
10. Production and additivation of fuel and heating oils. Life cycle assessment (LCA) of the energetic products of hydrocarbon industry.
11. Logistic of energetic products (including fuel stations). Energetic products of hydrocarbon industry and



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the environment.

12. Definition, importance and classification of alternative fuels. Fuel purpose production and application of light hydrocarbons (CNG, LPG). Production and application of biogas.

13. The production of synthetic liquid hydrocarbons from synthesis gas (based on natural gas, coal, biomass, etc.). Oxygenates. Natural triglycerides and their derivatives (bio-diesel, bio gas oil, bioJET, etc.).

14. Hydrogen. Electricity. Mixtures/emulsions of alternative and traditional fuels. Comparison of alternative and traditional fuels. Major alternative powertrains. Development tendency of powertrains and fuels.

1. Production of motor gasoline components with high octane number by catalytic isomerization.
2. Production of reduced sulphur- and aromatic containing diesel fuel by hydrodesulphurization
3. Production of reduced aromatic containing JET fuel by catalytic hydrogenation
4. Hydrogenation of triglycerides to fuel
5. Formulation of modern motor oils by using base-oils and additives
6. Production of synthetic crude oil by cracking of waste plastics

Requirements, evaluation and grading:

Requirements:

Examination paper.

Examplpes of Examination Questions are in annex. (<50% = 1; >85%=5)

Possibilities for repeating the subject:-

Accepted equivalent subjects:-

Learning efforts necessary to satisfy the requirements of the subject:

Presentation of a catalyst used in oil industry, and petroleum, a critical presentation of a selected technology of fuel production from crude oil, from the raw materials over the consumption to the recovery of metal components; and presentation of the chemistry and technology, and the properties of an alternative motor fuels.

Total: 104 hour:

- Contact time: 52 hour
- Self preparation: 26 hour.
- Presentation: 26 hour.

Required and recommended readings:

Required and suggested references:



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Required and recommended readings:

- 1-7th International Colloquium on Fuels, 1997, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, Edited by Bartz, W.J. Technische Akademie Esslingen.
- Carley, A.F., Davies, P.R., Hutchings, G.J., Spencer, M.S.: "Surface Chemistry and Catalysis", 2002, 381 oldal
- Auerbach, S.M.; Carrado, K.A, Dutta, P.K.: "...Handbook of Zeolite Science and Technology", Marcel Dekker Inc., 2003, New York, Basel, ISBN: 0-8247-4020-3.
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- Chen, N.Y. et al.: Shape Selective Catalysis in Industrial Applications 2.edition, Marcel Dekker Inc., N.Y. Basel Hong Kong, 1996.
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- Fogler, H.S.: "...Elements of Chemical Reaction Engineering", Prentice Hall International, 1992, 838 oldal
- Gates, B.C., Katzer, J.R., Schuit, G.C.A.: "...Chemistry of Catalytic Processes", McGraw-Hill, 1979, 387 oldal
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- Hancsók J.: Korszerű motor- és sugárhajtómű üzemanyagok, II. DÍZELGÁZOLAJOK, Veszprémi Egyetemi Kiadó, Veszprém, 1999
- Hancsók J.: Korszerű motor- és sugárhajtómű üzemanyagok, III. ALTERNATÍV MOTORHAJTÓANYAGOK, Veszprémi Egyetemi Kiadó, Veszprém, 2004.
- Hancsók J. és mtsai.: Üzemanyagok és felhasználásuk, Tribotechnik Kft., Budapest, 1998.
- Hancsók Jenő, Baladincz Jenő, Magyar János: "...Mobilitás és környezet" cikksorozat gyűjteményes kiadványa, Pannon Egyetemi Kiadó, Veszprém, 2009.
- Haycock, R.F., és Thatcher, R.G.F.: Fuel Additives and Environment, ATC,(The technical Committee of Petroleum Additive Manufactures in Europe), Document 52, 1992



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Required and recommended readings:

- Hobson, G.D.: Modern Petroleum Technology, J. Wiley, 1986.
- Imelik, B., Vedrine, J.C.: ...Catalyst Characterization – Physical techniques for Solid Materials”, Plenum Press, 702 oldal (5 kötet)????
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- Stiles, A.B., Koch, T.A.: ...Catalyst Manufacture”, Marcel dekker Inc., 1995, 288 oldal
- Szostak, R.: Molecular Sieves, Van Nostrand Reinhold, N.Y., 1989.
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- Tschöke, H. et al: Diesel – und Benzindirekteinspritzung, Expert Verlag, Renningen, 2001



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Required and recommended readings:

Weitkamp, J. : ...Catalysis and Zeolites”, Springer, 1999 Hong Kong, 1993.