


The structure of the scientific profile (portfolio) of potential scientific leaders of the participants of the International Olympiad of the Association “Global Universities” on the track of postgraduate studies

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| University | National Research Tomsk Polytechnic University |
| English proficiency | B1 |
| Graduate study direction | chemical technology |
| Graduate study code | 2.6 |
| List of research projects of the potential supervisor | <p>2021-2022 - "Mathematical modeling of catalytic cracking considering coke deposition on the catalyst grain" (project Russia - Great Britain). The project is being implemented jointly with colleagues from the University of Southampton (leadership)</p> <p>2021-2022 - "Development of a digital twin of the technology for producing sulfonate surfactants based on modeling the alkylbenzenes C20-C24 sulfonation" (leadership)</p> <p>2019-2021 - "Fundamental Mathematical Models of Petroleum Processing Processes". The project is being carried out jointly with colleagues from Pavlodar University (Republic of Kazakhstan).</p> <p>2020 - "Digital twins of deep oil refining processes". The project is carried out jointly with colleagues from Pavlodar University (Republic of Kazakhstan) (leadership)</p> |
| List of possible research topics | <ol style="list-style-type: none"> 1. Mathematical modeling of the catalytic cracking of residual petroleum feedstock 2. Mathematical modeling of heavy oil feedstock hydroprocessing 3. CFD-modeling of catalytic reactors for deep oil refining 4. Modeling the processes of oil refining catalysts deactivation by coke and heavy metals |
|  <p>Research supervisor: Elena Ivashkina</p> | <p>Supervisor’s research interests: <i>petroleum chemistry, alkylation, dehydrogenation, catalytic cracking, multistage processes, modeling, catalyst deactivation, thermodynamics, kinetics</i></p> |
| | <p>Research highlights:</p> <p>Investigations of the catalytic cracking and catalyst regeneration are carried out. Simulation of heat and mass transfer near the surface of a zeolite particle and modeling of the coke deposits formation on the surface of the catalyst are performed.</p> <p>Complex laboratory, industrial and theoretical studies are being carried out in order to establish the physicochemical laws governing the conversion of hydrocarbons into surfactants based on sulfonic acids.</p> <p>The development of equations for a mathematical model of the sulfonation process is underway.</p> |

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| <p>Doctor of technical Sciences, Professor of Tomsk Polytechnic University</p> | <p>A mathematical model of the catalytic cracking process has been built with due consideration of the catalyst deactivation by coke and heavy metals. This model is sensitive to changes in the raw materials composition and has a high predictive potential in relation to the yield and composition of products when changing technological conditions.</p> <p>A mathematical model of the process of sulfuric acid-catalyzed alkylation of isobutane with olefins was developed with due consideration of the catalyst deactivation by high-molecular hydrocarbons. It is sensitive to changes in the feedstock composition and has a high predictive potential in relation to the yield and composition of alkylate, and its octane characteristics.</p> <p>The developed models are verified using experimental data obtained both in laboratory and industrial conditions. A CFD model of an industrial heavy oil feedstock hydrotreating reactor has been developed and practical recommendations for optimizing its operation were revealed.</p> |
| | <p>Supervisor's specific requirements:</p> <ul style="list-style-type: none"> • <i>Basic chemistry education</i> • <i>Knowledge of the technological foundations of oil and gas refining processes</i> • <i>Experience in CFD modeling, mathematical modeling of chemical processes</i> • <i>Willingness to learn Russian</i> |
| | <p>Supervisor's main publications:</p> <ul style="list-style-type: none"> • <u>Development of a two-fluid hydrodynamic model for a riser reactor</u> Vorobev A., Antonov A., Nazarova G., Ivashkina E., Ivanchina E., Chuzlov V., Kaliyev T. //Chemical Engineering and Technology. – 2022. –T. 45. –№ 4. – C. 709-716 • <u>A predictive model of catalytic cracking: Feedstock-induced changes in gasoline and gas composition</u> Nazarova, G., Ivashkina, E., Ivanchina, E., Oreshina, A., Vymyatnin, E. Fuel Processing Technology, 2021, 217, 106720 • <u>Development of the approach to the modeling of the destructive catalytic hydroprocesses of atmospheric and vacuum distillates conversion. The case of oil distillates hydrodewaxing process</u> Belinskaya, N.S., Lutsenko, A.S., Mauzhigunova, E.N., ...Ivanchina, E.D., Ivashkina, E.N. Catalysis Today, 2021 • <u>Mathematical modeling of multicomponent catalytic processes of petroleum refining and petrochemistry</u> Ivanchina, E.D., Ivashkina, E.N., Dolganova, I.O., Belinskaya, N.S. Reviews in Chemical Engineering, 2021, 37(1), стр. 163–191 |

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| | <ul style="list-style-type: none"> • <u>MODELING OF THE CATALYTIC CRACKING: CATALYST DEACTIVATION BY COKE AND HEAVY METALS</u> <i>Nazarova G., Ivashkina E., Ivanchina E., Oreshina A., Dolganova I., Pasyukova M.</i> <i>Fuel Processing Technology. 2020. T. 200. C. 106318.</i> • <u>MODELING THE H₂SO₄-CATALYZED ISOBUTANE ALKYLATION WITH ALKENES CONSIDERING THE PROCESS UNSTEADINESS</u> <i>Ivashkina E., Dolganova I., Dolganov I., Ivanchina E., Nurmakanova A., Bekker A.</i> <i>Catalysis Today. 2019. T. 329. C. 206-213.</i> • <u>FORMATION OF THE COMPONENT COMPOSITION OF BLENDED HYDROCARBON FUELS AS THE PROBLEM OF THE MULTI-OBJECTIVE OPTIMIZATION</u> <i>Ivanchina E.D., Ivashkina E.N., Chuzlov V.A., Belinskaya N.S., Dementyev A.Y.</i> <i>Chemical Engineering Journal. 2019. T. 374. C. 121283.</i> • <u>INCREASING THE ECONOMIC EFFICIENCY OF GASOLINE PRODUCTION: REDUCING THE QUALITY GIVEAWAY AND SIMULATION OF CATALYTIC CRACKING AND COMPOUNDING</u> <i>Chuzlov V., Nazarova G., Ivanchina E., Ivashkina E., Dolganova I., Solopova A.</i> <i>Fuel Processing Technology. 2019. T. 196. C. 106139.</i> • <u>MODELING THE MULTISTAGE PROCESS OF THE LINEAR ALKYL BENZENE SULFONIC ACID MANUFACTURING</u> <i>Dolganova I., Ivanchina E., Dolganov I., Ivashkina E., Solopova A.</i> <i>Chemical Engineering Research and Design. 2019. T. 147. C. 510-519.</i> • <u>Model of Catalytic Cracking: Catalyst Deactivation Induced by Feedstock and Process Variables</u> / G. Yu. Nazarova, E. N. Ivashkina, E. D. Ivanchina, M. Yu. Mezhova // <i>Catalysts</i> . — 2022 . — Vol. 12, iss. 1 . — [98, 14 p.] |
| | <p>Results of intellectual activity:</p> <p>The ability to control the activity of the catalyst for the dehydrogenation of higher n-paraffins. Patent for invention No. RU 2486168 C1, (application No. 2012116361/04(0246557) dated April 23, 2012).</p> <ul style="list-style-type: none"> • • The program for calculating the parameters of the process of catalytic cracking of vacuum gas oil. Certificate of state registration of the computer program No. 2014661321 • In total more than 40 patents and certificates. |

