Mikhail Granovskiy, Ph.D, P.Eng
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Highlights of Qualifications

_ Life cycle assessment of hydrogen production and utilization technologies in accordance with principles and requirements for conducting and reporting life cycle assessment studies (ISO 14040/44)

_Thermal and power generation analysis (exergy analysis)

_An expert proficiency in midstream purification and downstream reforming of natural gas to generate syngas (hydrogen) for production of methanol, ammonia, Fisher-Tropsh synthesis, and other industrial chemicals; gasification/pyrolysis technologies to produce syngas from coal, biomass, municipal solid waste; hydrogen utilization (hydro-treatment, hydro-cracking, synthetic chemistry); heavy residuals coking; partial oxidation and combustion of hydrocarbons

_20+ year experience in mathematical modeling and simulation of various chemical/catalytic and mechanical processes in order to scaling up, improve their efficiencies or determine the cause of a failure

_ Efficient collaborative work in academic and industrial environments

_Advanced writing skills as evidenced by a solid publication record

_ 10+ teaching experience on undergraduate and graduate level

Technical Skills

Engineering and science: life cycle analysis, numerical determination of design parameters for chemical reactors, heat exchangers, distillery columns, compressors, pumps and turbines, flow and safety valves; mass and energy balances, analysis and development of process flow diagrams (PFD/P&ID) in ChemCad/HYSYS (ASPEN); troubleshooting, improvements, chemical experiments data analysis, scaling-up pilot devices, chemical kinetics and thermodynamics proficiency

Programming Languages: FORTRAN, Visual Basic 6.0 (Microsoft Certified), VB.net, VBA, SQL, Matlab, C/C++

Employment History

Reformed Energy Inc. Bellaire, 6575 W. Loop S Suite 500 TX, USA
2024-Present, Technical Adviser

Adjusting "ChemCad" thermodynamic models to simulate different carbonaceous feedstocks gasification for a proprietary down draft gasifier. A techno-economic assessment of possible feedstocks and the use of oxygen instead of air to utilize gasification technologies to produce syngas, biochar, power, and chemicals.

HX5, LLC (NASA affiliated), Fort Walton Beach, FL, USA
2021-2023, Systems Engineer (energy and exergy analysis)

Comparative analysis of power generation, storage, consumption, and life support systems to determine their efficacy indicators

Southern Research Institute, Birmingham, Al, USA
2019 – 2021, Sr. Advanced Chemical Engineer

Principal investigator for the high-flexibility gasifier project awarded by Department of Energy

Designed a coal gasification pilot plant to produce syngas, conducted feasibility studies and calculated expected techno-economic indicators; compared with the state of the art; equipment datasheet; H&MBs & PFD simulations with ASPEN

(HYSYS) and Chemcad; P&IDs, valves selection and determination of control philosophy (together with Control Engineers); HAZOP analysis

Dynamis Energy LLC., Boise, ID & Houston, TX, USA
2018 – 2019, Sr. Process Development Engineer

Developing, optimization and design of PFD and P&ID diagrams for state of the art waste to energy plants; critical analysis and assessment of modern waste to energy technologies; a mathematical model for scheduling several batch gasification units to obtain a semi-continuous operation

Knighthawk Engineering Inc., Houston, USA
2013 – 2017, Sr. Process Consultant

_Inspected Ryckman Creek Natural Gas Storage Project on increasing levels of H2S in the released gas. It was concluded that an application of H2S scavengers before amine treatment unit was not optimal and led to a significant increase in disposable solvent consumption

_Based on economic efficiency, environmental implications, and feedstock composition conducted preliminary estimations on clients' requests for i) natural gas and other hydrocarbons reforming technologies to produce syngas (H2 and CO); ii) gasification/pyrolysis to process municipal solid waste, plastics, biomass, coal, and etc.; iii) natural gas and syngas purification methods (H2S, CO2, HCl, water and mercury vapors)

_Guided an experiment on non-catalytic reforming of hydrocarbons into syngas by activation with the oxy-hydrogen flame; this reformer could be a part of a compact Gas-to-Liquid facility

_Assessed power generation and chemical engineering processes: based on P&ID and PFD diagrams along with process data and equipment specifications determined the cause of a failure or incorrect performance of critical units such as flare, re-boiler, heat exchanger, safety valve, demister, compressor, thermosyphon cycle with multiphase flow, fluid catalytic cracker. Following the conducted analysis, technological modifications were introduced: a steam supply into the flare was reduced, an increased tube sheet thickness was accepted in a new heat exchanger, and an additional demister was added upstream of the compressor, a conservative valve in cyanide tank was replaced, and etc.

Louisiana State University, Audubon Sugar Institute, USA
2011 –2012, Associate Professor in Research

_Technological pathways for conversion of energy crops (sweet sorghum and energy cane) into bio-fuel and bio-chemicals (mass and energy balances); compared bio-chemical and thermo-chemical pathways; published an article determining economic conditions at which a massive bioethanol production becomes reasonable.

University of Saskatchewan, Department of Chemical and Biological Engineering, Saskatoon, Canada
2009 – 2011, Senior Research Engineer

_Designed an experimental setup (PFD, P&ID) and prepared an investigation plan to study a non-catalytic, universal way to convert poly-aromatic, heavy and light hydrocarbons (methane, propane, and etc.) into syngas; conducted series of experiments; created software for the experimental data analysis; an article was published in a high-score scientific journal

_Investigated downstream heavy oil treatment in a fluidized bed coker (bitumen upgrader). Suggested and tested a new stripper sheds design to mitigate their

fouling; the Company Syncrude Inc. released funding to continue this study; prepared and presented a literature survey related to the problem of fouling in high-temperature hydrocarbon treatment processes

_Delivered a fundamental course of lectures and seminars on "Introduction into Chemical Engineering Processes"

PlascoEnergyGroup Inc. (a new Municipal solid waste to Energy demonstration plant)
Ottawa, Canada
2007 - 2009, Senior Research Process Engineer

_Created a pilot plant heat and mass flow simulation program to define syngas and electricity production capacity. The program allowed scaling-up, varying feedstock composition, degree of its conversion, and etc. The program was greatly utilized in the engineering, marketing and business development departments

_Compared anticipated and factual environmental and efficiency indicators; recommended changes to improve performance. Based on recommendations new equipment was installed (a new waste water treatment skid, amine purification unit, a technology change to improve tar destruction)

_Patented new methods and devices applicable to the PlascoEnergyGroup Inc. intellectual property

_Prepared plans for experimental investigations in the research lab. A thermo-gravimetric analysis of the incoming feedstock was implemented.

_Evaluated gasification processes of Plasco-competitors; reported advantages and disadvantages of Plasco-technology to the top management

University of Ontario Institute of Technology, Faculty of Engineering and Applied Science, Canada
2004 - 2007, Postdoctoral Researcher

_Proposed a cogeneration scheme incorporated a solid oxide fuel cell stack (SOFC) and membrane reactor (with oxygen ion-conductive membranes) for simultaneous electricity and hydrogen (syngas) generation as a downstream technology for natural gas utilization; an efficiency of natural gas utilization was significantly increased; an article was accepted for publication

_Proposed a high-temperature heat pump to link nuclear energy with a chemical cycle to produce hydrogen via water decomposition; accepted as a promising idea at a nuclear Conference; an article was published in a high-score scientific journal

_Computerized energy and mass balances calculations to analyse efficiency of the proposed schemes

_Applied a life cycle assessment (LCA) methodology for the hydrogen production technologies; an article was published and received a high citation index

Moscow State Lomonosov University, Department of Chemistry, Division of Chemical Engineering, Russia.
1987-2003, Associate Professor, Senior Researcher, Researcher

_Integration of power generation and chemical engineering processes in one technological unit for natural gas (methane) utilization; models and programs for thermodynamic analysis (exergy analysis); two patents were issued as an application of this technology

_Processing of experimental data on mechanism and kinetics of catalytic benzene hydrogenation: computerized statistical derivation of a kinetic formula, mathematical model and computer program for calculation of a reaction space in a new combined catalytic heat exchanger-reactor

_Utilization of nuclear heat in chemical engineering processes
_Ran chemical engineering teaching lab; wrote papers for refereed scientific journals; presented results of studies on conferences
_Taught courses: Programming and mathematical models in Chemistry, Theoretical basics of chemical engineering and energy savings in industrial processes

Education

Ph.D. in Chemical Engineering – April, 1993
Moscow State Lomonosov University, Moscow, Russia
Thesis title: "Thermodynamic cycles with catalytic conversion of fuel and working medium"
Diploma Engineer (equivalent to M. Sc. degree) in Chemical Engineering,
1981, Mendeleev University, Moscow, Russia

Affiliation

Association of Professional Engineers of Canada (Ontario)

LIST OF PUBLICATIONS (under Granovskii surname)

1. Granovskii M.S., Borisov S.A., Safonov M.S. Study of asymmetric regimes of action of a planar ctalyst in an exothermic reaction of zero order. Vestnik Moskovskogo Universiteta seriya khimiya. 1989, v.30, N4, 342-345.
2. Fomin A.A., Granovskii M.S.,Safonov M.S, et al. Kinetics of the hydrogenation of benzene on plasma-deposited planar nickel catalyst. Kinetika i kataliz, 1991,v.32,N2, 671-677.
3. Granovskii M.S.,Safonov M.S. Increasing of efficiency of plate thermal exchange reactor due to organizing countercurrent flow of reagent mixture. Teoreticheskie Osnovy Khimicheskoi Tekhnologii. 1992,v.26,№1,137-140.
4. Safonov M.S., Granovskii M.S, Pozharskii S.B. Thermodynamic efficiency of cogeneration of energy and hydrogen in gas-turbine cycle of methane oxidation. Doklady Akademii Nauk (Rossii),1993,v.328,№2, 202-204.
5. Safonov M.S., Pozharskii S.B.,Granovskii M.S. Transformation of high-potential heat by means of reversible gas-phase reactions. Zhurnal Vsesoiuznogo Khimicheskogo Obschestva im. D.I.Mendeleeva (Rossiiskii khimicheskii zhurnal), 1993,v.37,№2, 32-39.
6. Safonov M.S., Granovskii M.S, Pozharskii S.B. Optimum Trajectories for the oxidation of methane in integrated systems of transformation of natural gas into secondary energy-carriers. 5th World Congress of chemical engineering. Paper 46 ad. 14-18 July 1996, San Diego, California. P.21.
7.Safonov M.S,.Fomin A. A,.Serdyukov S.I, Nasonovskii I.S., Voskresenskii N.M., and Granovskii M.S. Mathematical Model and Performance Tests of an Experimental Heat-Exchanger Reactor with a Sectional Catalyst Unit for Benzene Hydrogenation., Theoretical Foundations of Chemical Engineering, 1997, v.31, №3, 302-312.
8.Granovskii M.S, Safonov M.S. Patent of Russian Federation №2050433. "Combined steam-gas energy unit". Filed 20.12.1995.
9.Granovskii M.S, Safonov M.S. Patent of Russian Federation №2097314 "Method for catalytic conversion of natural gas". Filed 27.11.1997.
10. Safonov M.S., Granovskii M.S, Pozharskii S.B. Thermodynamic efficiency of performing catalytic reaction along with expansion or compression of the reacting mixture. 2nd European Congress of Chemical Engineering, Montpellier, France, 5-7 October 1999.
11. Safonov M.S., Granovskii M.S, Pozharskii S.B. A thermodynamic analysis of a combination of the catalytic oxydation of methane and expansion of the reaction mixture in the Gas Turbine Cycle. Russian Journal of Physical Chemistry. 2000, v.74, №5, pp. 748-751.
12. Granovskii M.S., Safonov M.S., Pozharskii S.B. Integrated Scheme of Natural Gas Usage with Minimum Production of Entropy. Canadian Journal of Chemical Engineering. 2002, v.80, 998-1001
13. Granovskii M.S., Safonov M.S. New Integrated Scheme of the Closed Gas-Turbine Cycle with Synthesis Gas Production. Chemical Engineering Science. 2003, v.58, 3913-3921

14. Makunin A.V., Granovskii M.S., Ivanov E.B., Fomin V.M. Thermochemical module for hydrogen production by steam reforming of methanol. Chemical and Petroleum Engineering. 2003, №12, 19-22.
15. Granovskii M., I. Dincer and M.A. Rosen. Environmental and economic aspects of hydrogen production and utilization in fuel cell vehicles. Journal of Power Sources. 157(2006), 411-421.

16. Granovskii M., I. Dincer and M.A. Rosen. Life cycle assessment of hydrogen fuel cell and gasoline vehicles. Int. J. Hydrogen Energy. 31(2006)337-352.

17. Granovskii M., I. Dincer and M.A. Rosen. Application of oxygen ion-conductive membranes for simultaneous electricity and hydrogen generation. Chemical Engineering Journal. 120(2006) 193-202
18. Granovskii M., I. Dincer and M.A. Rosen. Economic and environmental comparison of conventional , hybrid, electric, and hydrogen fuel cell vehicles. Journal of Power Sources. 159 (2006) 1186-1193.
19. Granovskii M., I. Dincer and M.A. Rosen. Exergy analysis of gas turbine cycle with steam generation for methane conversion within solid oxide fuel cells. Journal of Fuel Cell Science and Technology. 5, 031005(2008) (9 pages).
20. Granovskii M., I. Dincer and M.A. Rosen. Greenhouse gas emissions reduction by use of wind and solar energies for hydrogen and electricity production: Economic factors. *International Journal of Hydrogen Energy*, 3*2(2007)927-931*
21. Granovskii M., I. Dincer and M.A. Rosen. Air pollution reduction via use of green energy sources for electricity and hydrogen production. Atmospheric Environment. An International Journal. 41(2007) 1777-1783
22. M. Granovskii**,** I. Dincer and M.A. Rosen, Exergy **a**nd Industrial Ecology: An Application to an Integrated Energy System. Int. J**.** Exergy 5(1), 52-63, 2008
23. Granovskii M., I. Dincer and M.A. Rosen. Performance comparison of two combined SOFC-gas turbine systems. *Journal of Power Sources, 165(2007)307-314*
24. Granovskii M, I.Dincer, M.A.Rosen, I Pioro. Thermodynamic analysis of the use of a chemical heat pump to link a supercritical water-cooled nuclear reactor and a thermochemical water splitting cycle for hydrogen production. Journal of Power and Energy Systems. 2(2008) 756-767
25. Granovskii M, I.Dincer, M.A.Rosen, I Pioro. Performance assessment of a combined system to link a supercritical water-cooled nuclear reactor and a thermochemical water splitting cycle for hydrogen production Energy Conversion and Management, 49(2008) 1873-1881
26. Tsangaris A, Granovskiy M. Gasifier comprising one or more fluid conduits. United States of America Patent and Trademark Office. Published Patent Application (USPTO) Document Number: 20100154304; Publication date : 2010-06-24
27. Granovskii M., Gerspacher R., Pugsley T., Sanchez F. An effect of tar model compound toluene treatment with high-temperature flames. Fuel 92 (2012) 369-372
28. Granovskii M., Gerspacher R., Pugsley T., Sanchez F. Decomposition of tar model compound toluene by treatment with the high-temperature hydrogen/oxygen flame. Proceedings of 19th European Biomass Conference and Exhibition pp. 1530-1538. 6-10 June 2011, Berlin, Germany. DOI:10.571/19thEUBCE2011-VP2.4.1.
29. Sanchez F., Granovskiy M. Application of radioactive particle tracking to indicate shed fouling in the stripper section of a fluid coker. The Canadian Journal of Chemical Engineering, 91(2013) 1175-1182
30. Granovskii, M. An Energy and Economic Analysis of Energy Crops Processing into Bioethanol as a Gasoline Substitute. In Proceedings of the 3rd World Sustain. Forum, 1–30 November 2013; Sciforum Electronic Conference Series, Vol. 3, 2013 , d004; doi:10.3390/wsf3-d004
31. Granovskiy, M. Integrated Coproduction of Power and Syngas from Natural Gas to Abate Greenhouse Gas Emissions without Economic Penalties. ACS Omega journal: https://doi.org/10.1021/acsomega.1c00743; *ACS Omega* 2021, V. 6, (25), 16336-16342
32. Granovskiy, M. US Patent Application. Method and reactor to produce syngas. US 2022/0048766A1. Pub. Date: Feb 17, 2022
33. Granovskiy, M. An Adsorption-Desorption Heat Engine for Power Generation from Waste Heat. Journal of Energy and Power Technology. https://www.lidsen.com/journals/jept/jept-05-04-034; JEPT 2023; 5(4), doi:10.21926/jept.2304034

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1. Granovskii M., I. Dincer and M.A. Rosen. Environmental and economic aspects of hydrogen production and utilization in fuel cell vehicles. Proceedings of the First International Green Energy Conference. June 12-16, 2005. Waterloo. Ontario. Canada.

2. Granovskii M., I. Dincer and M.A. Rosen. Live cycle assessment of hydrogen fuel cell and gasoline vehicles. 2005. Proceedings of International Hydrogen Energy Congress and Exhibition. 13-15 July, 2005. Istanbul. Turkey.
3. Granovskii M., I. Dincer and M.A. Rosen. Economic aspects of greenhouse gas emissions reduction by utilization of wind and solar energies to produce electricity and hydrogen. EIC Climate Change Technology Conference Ottawa, May 9 – 12, 2006 .
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