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Brief Biography:

- 1964 born in Maaria (Turku), Finland
- 1989 Master's degree. Department of Chemical Engineering, Helsinki University of Technology, Finland
- 1997 Doctor of Science (Technology), Department of Chemical Engineering Helsinki University of Technology, Finland

Professional Career:

- 1989–2000 Catalysis Research, Neste Oil Refining (prof. leave 1999-2000), Finland
- 1999–2000 Post Doc, Helsinki University of Technology, Laboratory of Chemical Engineering and Plant Design, Finland
- 2001 → Post doc, after 2003 permanent position as Head of chemical/biological production systems team and laboratory manager, Process Systems Engineering, Max-Planck-Institute of Dynamics for Complex Technical Systems, Germany
- 2009 → Adjunct lecturer in Otto-von-Guericke-University Magdeburg, Faculty of Process and Systems Engineering, Germany

Research Interest: Catalysis, Reaction Engineering and Modelling of Chemical and Energy Conversion Systems, CO₂ Utilisation and Recycle, Chemical Storage of Renewable Energy, Biomass Conversion to Fuels and Electricity, Chemical and Fuel Production with Photosynthetic Organisms, Sustainability (LCA), Process Systems Engineering

Teaching: M.Sc. Courses in Otto-von-Guericke University Magdeburg: Biofuels: Sustainable Production and Utilization (2009-2017), Sustainability Assessment (LCA) for Biofuels, since 2018.

Evaluator activities: for European Commission and national organisations since 2003

Publications:

Book contributions (selection)

- Rihko-Struckmann, L.**, Karinen, R., Catalysis in Etherification Processes, in Catalysis in Finland – An exciting Pathway, Salmi, T., Mäki-Arvela, P. (Ed.), pp. 320-326, Suomen Katalysiseura, ISBN:978-952-93-3085-0, Helsinki, 2013.
- Rihko-Struckmann, L. K.**, Munder, B. Chalakov, L. and Sundmacher, K., Solid Electrolyte Membrane Reactors, Chapter 7: Solid Electrolyte Membrane Reactors, in *Membrane Reactors*, Seidel-Morgenstern (Ed.), pp. 193-233, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2010.
- Hertel, C., Heidebrecht, P., **Rihko-Struckmann, L.** and Sundmacher K. "Hydrogen Production from Reformate Gas by a Cyclic Water Gas Shift Reactor" in 18th World Hydrogen Energy Conference 2010 - *WHEC 2010: May 16.-21. 2010 Book 3: Hydrogen Production Technologies - Part 2* / D. Stolten, T. Grube (Ed.), Essen, 2010.
- Kolah, A., **Rihko-Struckmann, L.**, and Sundmacher, K., Catalytic Distillation Technology Applied to Ether Production, in *Handbook of Methyl Tertiary Butyl Ether*, Hamid, A. (Ed.), Marcel-Dekker, 2004.
- Lappi, M. and **Rihko, L.**, Unregulated Exhaust Emissions from Engine Vehicles, VTT Research Notes 1748, VTT, Espoo, 1996.

Publications in journals (with peer-review)

1. Uebbing, J., Rihko-Struckmann, L. and Sundmacher, K., Exergetic assessment of CO₂ methanation processes for the chemical storage of renewable energies, *Appl. Energy* 233-234 (2019) 271-282.
2. Schack, D., Rihko-Struckmann, L. and Sundmacher, K., A linear programming approach for structure optimization of Renewable-to-Chemicals (R2Chem) production networks, *Ind. Eng. Chem. Res.* SI 57 (2018) 9889-9902.
3. Wenzel, M., Rihko-Struckmann, L. and Sundmacher K., Continuous production of CO from CO₂ by RWGS chemical looping in fixed and fluidized bed reactors, *Chem. Eng. J.* 336 (2018) 278-296.
4. Facht, M., Flassig, R. J., Rihko-Struckmann, L. K.; and Sundmacher K., Carotenoid Production Process Using Green Microalgae of the *Dunaliella* Genus: Model-Based Analysis of Interspecies Variability, *Ind. Eng. Chem. Res. SI* 56 (2017) 12889-12899.
5. Zinser, A., Rihko-Struckmann, L. K. and Sundmacher, K. (2017) Process Optimization by Applying a Simultaneous Dynamic Method, *Comput. Aided Chem. Eng.*, 40C (2017) 2047–52.
6. Schack, D., Rihko-Struckmann, L. and Sundmacher, K., Economic linear objective function approach for structure optimization of renewables-to-chemicals (R2Chem) networks, *Comput. Aided Chem. Eng.* 40B (2017) 1975-1980.
7. El-Sibai, A., Rihko Struckmann, L. K., Sundmacher, K., Model-based Optimal Sabatier Reactor Design for Power-to-Gas Applications, *Energy Technol. (Weinheim, Ger.) SI* 5 (2017) 911-921.
8. Rihko-Struckmann, L. K., Molnar, M., Pirwitz, K., Facht, M., McBride, K., Zinser, A. and Kai Sundmacher, Recovery and separation of carbohydrate derivatives from the lipid extracted alga *Dunaliella* by mild liquefaction, *ACS Sustainable Chem. Eng.* 5 (2017) 588-595.
9. Wenzel, M., Dharanipragada, N.V.R. A., Galvita, V. V., Poelman, H., Marin, G. B., Rihko-Struckmann, L. and Sundmacher, K., CO production from CO₂ via reverse water-gas shift reaction performed in a chemical looping mode: Kinetics on modified iron oxide *J. CO₂ Util.* 17 (2017) 60-68.
10. Wenzel, M., Rihko-Struckmann, L., Sundmacher, K., Thermodynamic Analysis and Optimization of RWGS Processes for Solar Syngas Production from CO₂, 2016, *AIChE J.* 63 (2017) 15–22.
11. Pirwitz, K., Rihko-Struckmann, L., Sundmacher, K., Valorization of the aqueous phase obtained from hydrothermally treated *Dunaliella salina* remnant biomass *Bioresour. Technol.* 219 (2016) 64-71.
12. Zinser, A., Rihko-Struckmann, L. K., and Sundmacher, K. (2016) Computationally Efficient Steady-State

Process Simulation by Applying a Simultaneous Dynamic Method, *Comput. Aided Chem. Eng.*, 38A (2016) 517–22.

13. Schack, D., Rihko-Struckmann, L. and Sundmacher, K., Structure optimization of power-to-chemicals (P2C) networks by linear programming for the economic utilization of renewable surplus energy, *Comput. Aided Chem. Eng.* 38B (2016) 1551-1556.
14. Zinser, A., Rihko-Struckmann, L. and Sundmacher, K., Dynamic Method for Computation of Chemical and Phase Equilibria, *Comput. Chem. Eng.* 89 (2016) 1-10.
15. Facht, M., Hermsdorf, D., Rihko-Struckmann, L. and Sundmacher, K., Flow cytometry enables dynamic tracking of algal stress response: A case study using carotenogenesis in *Dunaliella salina*, *Algal Res.* 13 (2016) 227-234.
16. Rihko-Struckmann, L.K., Datta, P., Wenzel, M., Sundmacher, K., Dharanipragada, N. V. R. A., Poelman, H., Galvita and V., Marin, G.B. Hydrogen and Carbon Monoxide Production by Chemical Looping over Iron-Aluminium Oxides, *Energy Technology* 4 (2016) 304-313.
17. El Sibai A., Rihko-Struckmann, L. and Sundmacher, K., Synthetic Methane from CO₂: Dynamic Optimization of the Sabatier Process for Power-to-Gas Applications *Comput. Aided Chem. Eng.* 37 (2015) 1157-1162.
18. Flassig, R. J. Facht, M., Rihko-Struckmann, L. and Sundmacher, K., Robust process design for the bioproduction of β -carotene in green microalgae, *Comput. Aided Chem. Eng.* 37 (2015) 2117-2122
19. Zinser, A., Ye, K., Rihko-Struckmann, L. and Sundmacher, K. A dynamic method for computing thermodynamic equilibria in process simulation, *Comput. Aided Chem. Eng.* 37 (2015) 299-304.
20. Pirwitz, K., Flassig, R. J., Rihko-Struckmann, L. and Sundmacher, K., Energy and operating cost assessment of competing harvesting methods for *D. salina* in a β -carotene production process, *Algal Res.* 12 (2015) 161-169.
21. Pirwitz, K., Rihko-Struckmann, L. and Sundmacher, K., Comparison of flocculation methods for harvesting *Dunaliella*, *Bioresource Technol.* 196 (2015) 145-152.
22. Flassig, R. J., Migal, I., van der Zalm, E., Rihko-Struckmann, L., and Sundmacher, K., Rational selection of experimental readout and intervention sites for reducing uncertainties in computational model predictions, *BMC Bioinformatics* 16 (2015) No 13.
23. Sharma, D. K., Gautam, K., Jueppner, J., Giavalisco, P. Rihko-Struckmann, L. Pareek, A. and Sundmacher, K., UPLC-MS analysis of *Chlamydomonas reinhardtii* and *Scenedesmus obliquus* lipid extracts and their possible metabolic roles, *J. Appl. Phycol.* 27 (2015) 1149-1159.
24. Facht, M., Flassig, R., Rihko-Struckmann, L. and Sundmacher, K., A growth model of *Dunaliella salina*: Parameter identification and profile likelihood analysis, *Bioresour. Technol.* 173 (2014) 21-31.
25. Datta, P., Rihko-Struckmann, L. and Sundmacher K. Quantification of produced hydrogen in a cyclic water gas shift process with Mo stabilized iron oxide, *Fuel Process. Technol.* 128 (2014) 36-42.
26. Zinser, A., Rihko-Struckmann, L. and Sundmacher, K. Storage of Renewable Energies via Chemical Conversion using CO₂: Energy Systems Analysis, *Comput. Aided Chem. Eng.* 31 (2012) 995-999.
27. Oettel, C., Rihko-Struckmann, L. and Sundmacher, K. Characterisation of the electrochemical water gas shift reactor (EWGSR) operated with hydrogen and carbon monoxide rich feed gas, *Int J Hydrogen Energy* 37 (2012) 11759-11771.
28. Sundmacher, K., Hanke-Rauschenbach, R., Heidebrecht, P., Rihko-Struckmann, L. and Vidakovic-Koch T., Some reaction engineering challenges in fuel cells: dynamics integration, renewable fuels, enzymes, *Curr. Opin. Chem. Eng.* 1(2012) 328-335.
29. Oettel, C., Rihko-Struckmann, L. and Sundmacher, K., Improved CO Tolerance with PtRu Anode Catalysts in ABPBI Based High Temperature PEM Fuel Cells, *J. Fuel Cell Sci. Technol.* 9 (2012) 31009.
30. Oettel, C., Rihko-Struckmann, L. and Sundmacher, K., Combined Generation and Separation of Hydrogen in an Electrochemical Water Gas Shift Reactor (EWGSR), *Int. J. Hydrogen Energy* 37(2012) 6635-6645.
31. Lu, H., Rihko-Struckmann, L. and Sundmacher, K., Spontaneous oscillations of cell voltage, power density

and anode exit CO concentration in a PEM fuel cell, *Chem. Phys. Phys. Chem.* 13 (2011)18179-18185.

32. Krewer, U., Vidakovic-Koch, T. and Rihko-Struckmann, L., Electrochemical Oxidation of Carbon-Containing Fuels and Their Dynamics in Low-Temperature Fuel Cells, *Chem. Phys. Chem.* 12 (2011) 2518-2544.
33. Datta P., Rihko-Struckmann, L. and Sundmacher, K., Influence of molybdenum on the stability of iron oxide materials for hydrogen production with cyclic water gas shift process. *Mater. Chem. and Physics* 129 (2011) 1089-1095.
34. Rihko-Struckmann, L. K., Peschel, A., Hanke-Rauschenbach, R. and Sundmacher, K., Energetic Analysis of the Utilisation of Exhaust CO₂ for the Chemical Storage of Renewable Energy, *Ind. Eng. Chem. Res. Sp. Iss. ISCRE-21*, 49 (2010)11073-11078.
35. Hanke-Rauschenbach, R., Weinzierl, C., Krasnik, M., Rihko-Struckmann, L., Lu, H., and Sundmacher, K., Operating behaviour and scale-up of an EPrOx unit for CO removal in reformat for PEM fuel cell application. *J. Electrochem. Soc.* 156 (2009) B1267-B1275.
36. Cui Y., Galvita, V., Rihko-Struckmann, L., Lorenz, H. and Sundmacher, K., Steam reforming of glycerol: The experimental activity of La_{1-x}Ce_xNiO₃ catalyst in comparison to the thermodynamic reaction equilibrium, *Appl. Catal. B: Environ.* 90 (2009) 29-37
37. Lu H., Rihko-Struckmann, L., Hanke-Rauschenbach, R. and K. Sundmacher. Improved electrochemical CO removal via potential oscillations in serially connected PEM fuel cells with PtRu anodes. *Electrochimica Acta*, 54 (2009)1184-1191.
38. Chalakov, L. Rihko-Struckmann, L., Munder, B. and Sundmacher, K., Oxidative Dehydrogenation of Ethane in an Electrochemical Packed-Bed Membrane Reactor: Model and Experimental Validation, *Chem. Eng. J.* 145 (2009) 385-392.
39. Lu H., Rihko-Struckmann, L., Hanke-Rauschenbach R. and Sundmacher K., Dynamic Behavior of a PEM Fuel Cell during Electrochemical CO Oxidation on a PtRu Anode, Special issue "Hydrogen production for Fuel Cells", *Topics in Catalysis* 51 (2008) 89-97.
40. Galvita V., Rihko-Struckmann L. K., Sundmacher, K., The CO adsorption on a Fe₂O₃-Ce_{0.5}Zr_{0.5}O₂ catalyst studied by TPD, isotope exchange and FTIR spectroscopy *J. Molec. Catal. A: Chem.* 283 (2008) 43-51.
41. Galvita, V., Hempel, T., Lorenz, H., Rihko-Struckmann, L. K. and Sundmacher, K. Deactivation of Modified Iron Oxide Materials in the Cyclic Water Gas Shift Process for CO-Free Hydrogen Production, *Ind. Eng. Chem. Res.*; 47 (2008) 303-310.
42. Suchorski Y., Munder B., Becker S., Rihko-Struckmann, L., Sundmacher, K. and Weiss, H., Variation of the vanadium oxidation state within a VPO catalyst layer in a membrane reactor: XPS mapping and modeling, *Appl. Surf. Sci.* 253 (2007): 5904-5909.
43. Munder B., Rihko-Struckmann L. and Sundmacher, K., Steady-state and forced-periodic operation of solid electrolyte membrane reactors for selective oxidation of n-butane to maleic anhydride *Chem. Eng. Sci.* 62 (2007): 5663-5668 Sp. Issue. ISCRE 19.
44. Chalakov L., Rihko-Struckmann L. K., Munder B., Rau, H. and Sundmacher, K., Reaction induced current generation by butane oxidation in high temperature electrochemical membrane reactor, *Chem. Eng. J.* 131 (2007): 15-22
45. Chalakov, L.; Rihko-Struckmann, L. K.; Munder, B. and Sundmacher, K., Feasibility Study of the Oxidative Dehydrogenation of Ethane in an Electrochemical Packed-Bed Membrane Reactor, *Ind. Eng. Chem. Res.* 46 (2007) 8665-8673.
46. Ye Y.M., Rihko-Struckmann L., Munder B. and Sundmacher, K., Partial oxidation of n-butane in a solid electrolyte membrane reactor - Influence of electrochemical oxygen pumping, *J. Electrochem. Soc.* 153 (2006): D21-D29.
47. Rihko-Struckmann L. K., Ye Y, Chalakov L., Suchorski, Y., Weiss, H. and Sundmacher, K., Bulk and surface properties of a VPO catalyst used in an electrochemical membrane reactor: Conductivity-, XRD-, TPO- and XPS-study, *Catal. Lett.* 109 (2006): 89-96.
48. Suchorski, Y., Rihko-Struckmann, L., Klose, F., Ye, Y., Alandjiyska, M., Sundmacher, K., Weiss, H., Evolution

- of Oxidation States in Vanadium-based Catalysts under Conventional XPS Conditions, *Appl. Surf. Sci.* 249 (2005) 231-237.
49. Ye Y. M., Rihko-Struckmann L., Munder, B., Sundmacher, K., Partial oxidation of n-butane in a solid electrolyte membrane reactor: Periodic and steady-state operations *Applied Catal. A: Gen.* 285 (2005) 86-95.
 50. Munder B., Ye Y.M., Rihko-Struckmann L., Sundmacher K., Solid electrolyte membrane reactor for controlled partial oxidation of hydrocarbons: Model and experimental validation, *Catal. Today* 104 (2005) 138-148.
 51. Sundmacher K, Rihko-Struckmann L. K., and Galvita V., Solid electrolyte membrane reactors: Status and trends, *Catal. Today* 104 (2005): 185-199.
 52. Rihko-Struckmann L.K., Karinen R. S., Krause A. O.I., Jakobsson K., Aittamaa J. R., Process configurations for the production of the 2-methoxy-2,4,4-trimethylpentane - a novel gasoline oxygenate, *Chem. Eng. Process.* 43 (2004) 57-65.
 53. Ye, Y., Rihko-Struckmann, L., Munder, B., Rau H., Sundmacher, K., Feasibility of an Electrochemical Membrane Reactor for Partial Oxidation of n-Butane to Maleic Anhydride, *Ind. Eng. Chem. Res.* 43 (2004) 4551-4558.
 54. Rihko-Struckmann, L. K., Latostenmaa, P. V., Krause, A. O. I., Interaction between the reaction medium and ion exchange resin catalyst in the etherification of isoamylenes, *J. Molec. Catal. A: Chemical* 177 (2001) 41- 47.
 55. Rihko-Struckmann, L. K., Linnekoski, J. A., Krause, A. O. I., Pavlov, O. S., Vapor-Liquid and Chemical Reaction Equilibria in the Synthesis of 2-Methoxy-2-Methylbutane (TAME), *J. Chem. Eng. Data* 45 (2000)1030-1035.
 56. Linnekoski, J. A., Kiviranta-Pääkkönen P., Krause, A.O.I., Rihko-Struckmann, L. K., Simultaneous Isomerization and Etherification of Isoamylenes, *Ind. Eng. Chem. Res.*38 (1999) 4563-4570.
 57. Kiviranta-Pääkkönen, P., Struckmann, L. and Krause A.O.I., Comparison of the Various Kinetic Models of TAME Formation by Simulation and Parameter Estimation, *Chem. Eng. Technol.* 21(1998) no 4, p. 321-325
 58. Kiviranta-Pääkkönen, P. K., Struckmann, L. K., Linnekoski, J. A., Krause, A. O. I., Dehydration of the Alcohol in the Etherification of Isoamylenes with Methanol and Ethanol, *Ind. Eng. Chem. Res.* 37 (1998) p. 18-24
 59. Linnekoski, J. A., Krause, A. O. I., Struckmann, L. K., Etherification and hydration of isoamylenes with ion exchange resin, *Appl. Catal. A: General* 170 (1998) 117-126
 60. Linnekoski, J. A., Krause, A. O. I and Rihko, L. K., Kinetics of the Heterogeneously Catalyzed Formation of tert-Amyl Ethyl Ether. *Ind. Eng. Chem. Res.* 36 (1997), 310-316.
 61. Rihko, L. K., Kiviranta-Pääkkönen, P. K. and Krause A.O. I., A Kinetic Model for the Etherification of Isoamylenes with Methanol. *Ind. Eng. Chem. Res.* 36 (1997), 614-621.
 62. Rihko, L. K. and Krause, A.O. I., The Etherification of FCC Light Gasoline with Methanol. *Ind. Eng. Chem. Res.* 35 (1996), 2500-2507.
 63. Rihko, L. K. and Krause, A. O. I., Kinetics of Heterogeneously Catalyzed tert-Amyl Methyl Ether Reactions in the Liquid Phase, *Ind. Eng. Chem. Res.* 34 (1995) 1172-1180.
 64. Sundmacher, K., Rihko, L.K. and Hoffmann, U., Classification of Reactive Distillation Processes by Dimensionless Numbers, *Chem. Eng. Comm.* 127 (1994) 151-167.
 65. Rihko, L.K., Linnekoski, J. A., and Krause, A. O. I., Reaction Equilibria in the Synthesis of 2-Methoxy-2-Methylbutane and 2-Ethoxy-2-Ethylbutane in the Liquid Phase, *J. Chem. Eng. Data* 39 (1994) 700 - 704.
 66. Rihko, L. K. and Krause, A.O.I., Reactivity of Isoamylenes with Ethanol, *Appl. Catal. A* 101 (1993) 283-295.
 67. Kivi, J., Krause, O., and Rihko L., Eetterit bensiiinikomponentteina (Ether as gasoline components), *Kemia-Kemi* 18 (1991) 356-359.