

Curriculum Vitae

Signe Kjelstrup, Prof. Dr.techn. et dr. ing.

Address:

Institutt for kjemi, Norges Teknisk Naturvitenskapelige Universitet, 7491 Trondheim, Norway
+4773 594179 (office phone) +4773 523488 (private phone)

signe.kjelstrup@chem.ntnu.no (email)

<http://www.ntnu.no/users/signekj> (homepage)

<http://www.chem.ntnu.no/nonequilibrium-thermodynamics/> (group homepage)

Engineering Thermodynamics, Process and Energy Department, Delft University of Technology,
S. Kjelstrup@tudelft.nl

+31-15-27-86658 Secretary: J.Blommaart-Tigchelaar@tudelft.nl

Personal:

Born Aug. 27. 1949, in Oslo

Married to: Dick Bedeaux

Children: Maja Solveig Kjelstrup Ratkje, Agnes Ingeborg Kjelstrup Ratkje

Name in first marriage: Kjelstrup Ratkje.

Education

Siv.ing. Kjemiavdelingen, NTH, 1971, Grade reported to the King of Norway.

Lic.techn. NTH, 1974. Thesis: *Complex formations in Alkali-Aluminium Fluoride Melts*. Passed with distinction.

Dr.techn. NTH, 1982. Thesis: *On the Energetics of Coupled Transport Processes*.

Awards

The Nansen foundation award for young scientists, 1980

Honorary professor University of North-East China, Shenyang

Invited guest professor University of Kyoto, April / October 2000

Guest professor University of Barcelona, 2004

Front page Physical Chemistry Chemical Physics, 2006, Issue 17

Positions held

Research assistant, NTH, 1971-1973, University lecturer, AVH, 1974-1975, Assistant professor, NTH, 1975-1985,
Ass. prof. School of Medicine and Dentistry, University of Rochester, New York, USA, 1978/79 (Fullbright fellow)

Visiting professor, Medical College of Ohio, Toledo, Ohio, USA, 1988/89

Professor, NTH and NTNU, 1986- to present

Visiting professor, University of Leiden Sept. 1996/ June 97

Visiting professor University of Kyoto, April –October 2000

Visiting professor University of Barcelona, February-June 2004

Part-time professor TU Delft, October 2005-

Professional societies

1979-: New York National Academy of Sciences

1987-: International Electrochemical Society, US

1986-: The Norwegian Academy of Technology

1988-: The Royal Norwegian Society of Science and Letters

1992-: The Norwegian Academy of Sciences

1998-: Norsk Kjemisk Selskap

2000-: International Society of Electrochemists

2000-: American Chemical Society

Editorial boards, other international boards

Ass.editor: Energy. The International Journal.

Editorial Board of J. Non-Equilibrium Thermodynamics

Board member Int. Soc. Applied Thermodynamics,

Advisory board for ECOS'99, ECOS'2000, ECOS'2001, 2006, 2007

Referee to

Physical Chemistry and Chemical Physics, J. Phys. Chem. B, Phys. Rev. E, J. Membrane Science,

J. Non-Equilibrium Thermodyn., International Journal of Thermodynamics, ENERGY-The International Journal,

Fluid Phase Equilibra, International Journal of Thermal Sciences, Environmental Science and Technology,

J. Electrochem. Soc. , Electrochim. Acta, J. Applied Electrochemistry, J. Power Sources, Chemical Engineering

Supervisor of 52 M.Sc. (siv.ing) students , 21 doctor students at home institution
Doctoral thesis committee participations abroad (14)

Research interests, short summary

Our group is concerned with development of a thermodynamically founded theory for transport, non-equilibrium thermodynamics for heterogeneous systems or mesoscopic systems. This theory has two different lines of application; a precise description of the transport phenomena themselves, and a mapping of the lost work (energy efficiency) in a non-equilibrium process. Both lines of research are followed; to gain more understanding of the actual process on a molecular level, and to see its consequences in industrial practice. Energy conversion and new energy technology issues are central. The systems of study depend on the group members' interests. At present we are concerned with biological motors, phase transitions, membrane transport, chemical reactors, distillation, biological systems and fuel cells. Through understanding of the physical principles we hope to be able to improve on theoretical description and on process operation and design.

Administrative experience - short summary

Has been Dean of the Faculty of Chemistry and Chemical Technology. Served as the leader of the Graduate Council of the Norwegian Institute of Technology. Was appointed by the Government to various positions in the Research Council System, and in Governmental committees. Was a member of the main executive board of the Norwegian Research Council from 1992-2000. Has served on the council of Hydro Aluminium A/S, and was member of the executive board of Insurance Company Gjensidige - Forenede A/S.

Publications

Theses

Complex formations in Alkali-Aluminium Fluoride Melts, lic.techn. thesis, 1974
On the Energetics of Coupled Transport Processes, dr.techn. thesis, Kgl. Norske Vidensk. Selsk. Skr. **6** (1982) 1- 157

Books coauthored

Non-equilibrium thermodynamics of heterogeneous systems
With Dick Bedeaux, to be published by World Scientific, 2007

Irreversible thermodynamics. Theory and Applications. Wiley, Chichester, 1988
with K.S.Førland and T.Førland
translated to Japanese by Y. Ito, T. Ikeshoji, Y.Tomii and T. Okada, published 1992 (Omsha)
reprinted by Wiley 1994, reprinted by Tapir 2001
translated to Chinese by Q.Xu, printed by Metallurgical Press of China 2001

Elements of Irreversible Thermodynamics for Engineers,
With Dick Bedeaux
Int. Center of Applied Thermodynamics, Istanbul, Turkey, 2000.
ISBN: 975-97568-1-1 Amazone.com
2. ed. With Dick Bedeaux and Eivind Johannessen, Tapir Akademiske forlag, 2006

Books edited (5)

Patent (1)

Publications in international, refereed journals since 2003

138. S. Kjelstrup and G. de Koeijer
Transport equations for distillation of ethanol and water from the entropy production rate, Chem. Eng. Sci., **58** (2003) 1147-1161
139. L. Nummedal, S. Kjelstrup and M. Costea
Minimizing the entropy production rate of an exothermic reactor with constant heat transfer coefficient: The ammonia reaction, Ind. Chem. Eng. Res. **42** (2003) 1044-1056
140. J.M. Rubi and S. Kjelstrup,
Mesoscopic nonequilibrium thermodynamics gives the same thermodynamic basis to Butler-

Volmer and Nernst equations, *J. Phys. Chem. B* **107** (2003) 13471-13477

141. D. Bedeaux, S. Kjelstrup and J.M. Rubi
Nonequilibrium translational effects in evaporation and condensation
J. Chem. Phys. **119** (2003) 9163 -9170
142. D. Bedeaux and S. Kjelstrup,
Irreversible thermodynamics – a tool to describe phase transitions far from global
equilibrium, *Chem. Eng. Sci.* **59** (2004) 109-118
144. G. de Koeijer, A. Røsjorde and S. Kjelstrup,
Distribution of heat exchange in optimum diabatic distillation columns,
Energy **29** (2004) 2425-2440
145. G. de Koeijer, E. Johannessen and S. Kjelstrup, The second law optimal path for a
four- bed SO₂ converter with intermediate heat exchange, *Energy* **29** (2004) 525-546
146. P.J.S. Vie and S. Kjelstrup,
Thermal Conductivities from Temperature Profiles in the Polymer Electrolyte Fuel
Cell. *Electrochim. Acta*, **49** (2004) 1069-1077
147. J-M. Simon, S. Kjelstrup, D. Bedeaux, and B. Hafskjold
Thermal flux through a surface of n-octane. A non-equilibrium molecular dynamics
study, *J. Phys. Chem. B* **108** (2004) 7186-7195
148. E. Johannessen and S. Kjelstrup,
Minimum entropy production rate in plug flow reactors: An optimal control problem
solved for SO₂ oxidation, *Energy* **29** (2004) 2403 – 2423
- 149 G. De Koeijer and S. Kjelstrup,
Application of irreversible thermodynamics to distillation,
Int. J of Thermodynamics, **7** (2004) 107 – 114
150. L. Nummedal, A. Røsjorde, E. Johannessen, and S. Kjelstrup,
Second law optimization of a tubular steam reformer.
Chem. Eng. Proc. **44** (2005) 429 - 440
152. E. Johannessen and S. Kjelstrup,
Numerical evidence for a highway in state space, *Chem. Eng. Sci.*, **60** (2005) 1491-1495
153. E. Johannessen and S. Kjelstrup
Nonlinear flux-force relations and equipartition theorems for the state of minimum entropy
production, *J. Non-Equilib. Thermodyn.* **129** (2005) 136
154. A. Røsjorde and S. Kjelstrup,
The second law optimal state of a diabatic binary tray distillation column.
Chem. Eng. Sci. **60** (2005) 1199-1210
155. S. Kjelstrup, J.M. Rubi, and D. Bedeaux,
Active transport: A kinetic description on thermodynamic grounds
J. Theoretical Biology, **234** (2005) 7-12
157. E. Johannessen and S. Kjelstrup,
A highway in state space for reactors with minimum entropy production,
Chem. Eng. Sci., **60** (2005) 3347-3361
158. D. Bedeaux and S. Kjelstrup
Heat, mass and charge transport and chemical reactions at surfaces,
Int. J. of Thermodynamics **8** (2005) 25-41

159. S. Kjelstrup and A. Røsjorde,
Local and total entropy production and heat and water fluxes in a one-dimensional polymer electrolyte fuel cell, *J Phys.Chem. B.* **109** (2005) 9020-9033
160. A. K. Meland, D. Bedeaux and S. Kjelstrup
A Gerischer Phase Element in the Impedance Diagram of the Polymer Electrolyte Fuel Cell Anode, *J. Phys.Chem. B* **109** (2005) 21380-21388
161. S. Kjelstrup, J.M. Rubi and D. Bedeaux,
Energy dissipation in slipping biological pumps, *Phys. Chem. Chem. Phys.* **7** (2005) 4009-4018
162. A. Zvolinschi, E. Johannessen, and S. Kjelstrup,
The second law optimal operation of a paper drying machine,
Chem. Eng. Sci. **61** (2006) 3653-3662
163. J. Xu, S. Kjelstrup, D. Bedeaux, A. Røsjorde and L. Rekvig,
Verification of Onsager's reciprocal relations for evaporation and condensation using non-equilibrium molecular dynamics simulations, *J. Colloids and Interface Sci.* **299** (2006) 452-463
164. Hironori Nakajima, Toshiyuki Nohira, Yasuhiko Ito, Signe Kjelstrup, and Dick Bedeaux,
The surface adsorption of hydride ions and hydrogen atoms on Zn studied by electrochemical impedance spectroscopy with a non-equilibrium thermodynamic formulation, *J. Non-Equil. Thermodyn.* **31** (2006) 231-255
165. J. Xu, S. Kjelstrup and D. Bedeaux,
Molecular dynamics simulations of a chemical reaction; conditions for local equilibrium in a temperature gradient, *Phys. Chem. Chem. Phys.* **8** (2006) 2017-2027
166. A.K. Meland, S. Kjelstrup and D. Bedeaux
Rate-limiting proton hydration in the anode of the polymer electrolyte fuel cell,
J. Membr. Sci., **282** (2006) 96-108
168. J.-M. Simon, S. Kjelstrup, D. Bedeaux, J. Xu, E. Johannessen,
Interface film transfer coefficients Verification of integral relations by nonequilibrium molecular dynamics simulations, *J. Phys.Chem. B.* **110** (2006) 18528-18536
169. D. Bedeaux, S. Kjelstrup and H.C. Öttinger,
On a possible difference between the barycentric velocity and the velocity that gives translational momentum in fluids. *Physica A*, **371** (2006) 177-187
170. J.M. Rubi, D. Bedeaux and S. Kjelstrup,
Thermodynamics for small molecule stretching experiments
J. Phys. Chem. B. **110** (2006) 12733-12737
171. D. Bedeaux, S. Kjelstrup, L. Zhu, G.M. Koper,
Nonequilibrium thermodynamics – A tool to describe heterogeneous catalysis,
Phys. Chem. Chem. Phys., **8** (2006) 1-7
172. G.J.M. Koper, S. Kjelstrup, T. van de Ven, M. Sadeghi, W.J.M. Douglas,
Entropy production for cylinder drying of linerboard and newsprint,
Int. J. Heat and Mass Transfer, **50** (2007) 1344-1355
173. J. Xu, S. Kjelstrup, D. Bedeaux, J.M. Simon
Transport properties of $2F = F_2$ in a temperature gradient as studied by molecular dynamics simulations. *Phys. Chem. Chem. Phys.*, **9** (2007) 969 - 981