

## Curriculum vitae – Kaj Thomsen

### Personal data:

- Name: Kaj Thomsen
- Work address: Department of Chemical Engineering, DTU, Building 229, 2800 Kongens Lyngby, Tel. 4525 2860, kth@kt.dtu.dk

### Education:

- 1994-1997: Ph.D. in Chemical Engineering, Technical University of Denmark. The ph.d. thesis was titled "Aqueous Electrolytes: model parameters and process simulation". As a part of the ph.d. study, I spent six month at FMC Chemical Research and Development Center in Princeton, New Jersey, USA.
- 1989-1994: M.Sc. in Chemical Engineering, the Technical University of Denmark. The M.Sc. project was titled: "Simulation and design of processes with electrolyte mixtures".

### Work:

- 2002- Associate professor at the department of Chemical Engineering, Technical University of Denmark.
- 2002 Founded the consultancy company Aqueous Solutions Aps with expertise in electrolyte solution thermodynamics
- 1999-2002: Assistant professor at the department of Chemical Engineering, Technical University of Denmark.
- 1997-1999: Assistant research professor at the department of Chemical Engineering, Technical University of Denmark.

### Research area:

- Modelling of CO<sub>2</sub> capture processes
- Thermodynamic modeling of solutions containing electrolytes and non-electrolytes.
- Measurement of the properties of solutions containing electrolytes and non-electrolytes
- Corrosion
- Ionic liquids
- Development of alternative separation processes
- Crystallization

### Patent:

SE 522434: Gudmundson Claes, Kockum Henrik, Joergensen Lars Bo, Andersen Torben Boech, Thomsen Kaj, Rasmussen Peter, "Preparation of sugar from sugar beet or sugarcane, by treating molasses with carbon dioxide at high pressure and separating gas hydrate crystals" (2004)

**Evaluator of Research Proposals:** for The Research Council of Norway

**Referee for the following international scientific journals within the last year:** *Journal of Crystal Growth, Asia-Pacific Journal of Chemical Engineering, Environmental Science & Technology, Fluid Phase Equilibria, Molecular Liquids, Calphad, Journal of Chemical and Engineering Data, Journal of Phase Equilibrium and Diffusion, AIChE Journal, Industrial and Engineering Chemistry Research.*

### Project Management:

Supervision of Research Projects:

- 2008-2010: "Liquefaction of Unprocessed WellStreams", LUWS, (Funding: The Norwegian Research Council and Statoil)
- 2008: "Modelling of molten salt mixtures" (Funding: SQM CL)
- 2007: "Chilled ammonia process for CO<sub>2</sub> capture" (Funding: DONG energy and Vattenfall)
- 2007: "Comparison of Electrolyte Models", (Funding: Shell Global Solutions NL, Akzo-Nobel NL, and SQM CL)
- 2004-2005: "Recycling of Alkali in bio fly ash", (Funding: PSO)
- 1998-2000: "Extension of thermodynamic model to systems with mixed solvents" (Funding: IVC-SEP)

Supervision of Ph.D. students:

- Negar Sadegh, Thermodynamic modelling of acid gases – alkanolamine systems (2009-2012)
- Benedicte Mai Lerche, CO<sub>2</sub> capture from flue gas using amino acid salt solutions (2008-2011)
- Victor Darde, CO<sub>2</sub> capture with aqueous ammonia (2008-2011) (Industrial Ph.D.)
- Lars Jensen, Kinetics of Gas Hydrate formation (2007-2010) (co-supervisor)
- Leila Faramarzi, Design of CO<sub>2</sub> capture units using aqueous alkanolamines (2007-2010) (co-supervisor)
- Rudi Pankratz Nielsen, Optimization and Physical Chemistry of the CatLiq™ Process (2006-2009) (External supervisor)
- Philip Loldrup Fosbøl, Corrosion in Wet Gas Pipelines (2005-2008)
- Yi Lin, Development of an Equation of State for Electrolytes (2004-2007)
- Ada Villafáfila Garcia, Measurement and Modeling of Scaling Minerals (2003-2006)
- Søren Gregers Christensen, Thermodynamics of Aqueous Electrolyte Solutions – Application to ion exchange systems (2002-2005)

### **Teaching Portfolio:**

Attended the following courses on teaching:

- 2007: Course on "Peer Coaching and Supervision" at Learning Lab, DTU
- 2005: Short course on "PhD Supervision" at DTU
- 2005: Short course on "Mentoring of Experts" at DTU
- 2001-2002: Education in Didactics and Teaching Methodology for Teachers at DTU
- 2000: Basic course on Teaching and Learning, DTU

Currently teaching:

- Course 28020, Introduction to Chemical and Biochemical Engineering
- Course 28022, Unit Operations of Chemical Engineering and Biotechnology
- Course 28423, Phase Equilibria for Separation Processes
- Graduate Course on Electrolyte Solution Thermodynamics and Separation Processes

In addition, I supervise 10 - 20 students per year in their MSc and BSc projects.

Member of the teaching board of the Department of Chemical Engineering, Technical University of Denmark

International teaching experience:

- 2008, April 4-11: Gave workshop on Thermodynamic modeling of some properties of salt solutions at University of Cape Town, South Africa
- 2006, August to December: Visiting Professor at Department of Chemical and Biological Engineering, University of Wisconsin-Madison, USA

#### **List of publications in peer reviewed journals**

1. Philip L. Fosbøl; Kaj Thomsen; Erling H. Stenby, , Modeling of the Mixed Solvent Electrolyte System  $\text{CO}_2\text{-Na}_2\text{CO}_3\text{-NaHCO}_3\text{-Monoethylene Glycol-Water}$ , *Industrial & Engineering Chemistry Research*, 48(2009)4565-4578
2. Philip L. Fosbøl, Kaj Thomsen, and Erling H. Stenby, "A Review and Recommended Thermodynamic Properties of  $\text{FeCO}_3$ ", (Accepted for publication in *Corrosion Engineering Science and Technology*)
3. Philip Loldrup Fosbøl, Kaj Thomsen; Erling Halfdan Stenby, "Solubility Measurements in the Mixed Solvent Electrolyte System  $\text{Na}_2\text{CO}_3\text{-NaHCO}_3\text{-Monoethylene Glycol-Water}$ ", *Industrial & Engineering Chemistry Research*, vol: 48(4), p. 2218-2228 (2009).
4. Philip L. Fosbøl, Kaj Thomsen, and Erling H. Stenby, "Reverse Schreinemakers method for experimental analysis of mixed-solvent electrolyte systems", *J. Solution Chem.* 38(2009)1-14.
5. Lars Jensen, Kaj Thomsen, and Nicolas von Solms, "Propane Hydrate Nucleation: Experimental Investigation and Correlation" (*Chemical Engineering Science* 63(2008)3069-3080)
6. Zheng Guo, Bena-Marie Lue, Kaj Thomsen, Anne Boye Strunge Meyer and Xuebing Xu, "Predictions of flavonoid solubility in ionic liquids by COSMO-RS: experimental verification, structural elucidation, and solvation characterization", (*Green Chemistry*, 9(2007)1362-1373)
7. Yi Lin, Kaj Thomsen, and Jean-Charles de Hemptinne, "Multi component equations of state for electrolytes", (*AIChE Journal*, 53(4)(2007)989-1005)
8. Ada Villafáfila García, Kaj Thomsen, and Erling H. Stenby, "Prediction of Mineral Scale Formation in Geothermal and Oilfield operations using the Extended UNIQUAC Model. Part II: Carbonate Scaling Minerals". (*Geothermics*, 35(2006)239-284)
9. Kaj Thomsen, "Modeling Electrolyte Solutions with the Extended Universal Quasichemical (UNIQUAC) Model" (Invited lecture presented at the 11th ISSP in Aveiro, Portugal, 2004) (*Pure and Applied Chemistry*, 77(2005)531-542, issue 3)
10. Søren Gregers Christensen and Kaj Thomsen, "Experimental measurement and modeling of the distribution of solvent and ions between an aqueous phase and an ion exchange resin" (*Fluid Phase Equilibria*, 228-229(2005)247-260).
11. Ada Villafáfila García, Kaj Thomsen, and Erling H. Stenby, "Prediction of Mineral Scale Formation in Geothermal and Oilfield Operations using the Extended UNIQUAC Model. Part I: Sulphate Scaling Minerals" (*Geothermics* 34(2005)61-97)
12. Kaj Thomsen, Maria Iliuta, and Peter Rasmussen "Extended UNIQUAC model for correlation and prediction of vapour-liquid-liquid-solid equilibria in aqueous salt systems containing non-electrolytes. Part B. Alcohol (Ethanol, Propanols, Butanols) - water - salt systems". *Chemical Engineering Science* 59(2004)3631-3647.

13. Søren Gregers Christensen and Kaj Thomsen, "Modeling of Vapor-Liquid-Solid Equilibria in Acidic Aqueous Solutions" (Ind. & Eng. Chem. Res. 42(2003)4260-4268, issue 18)
14. Maria C. Iliuta, Kaj Thomsen and Peter Rasmussen "Modeling of heavy metal salt solubility using the Extended UNIQUAC model" (AIChE Journal, 48(11)(2002)2664-2689)
15. Raphaël Huyghe, Peter Rasmussen, and Kaj Thomsen, "Solid-Liquid Equilibria for the Binary Mixtures 1,4-Xylene + Ethylbenzene and 1,4-Xylene + Toluene". (Chemical Engineering Communications, 191(8)(2004)1017-1023)
16. Selva Pereda, Kaj Thomsen and Peter Rasmussen, "Vapor-Liquid-Solid Equilibria of Sulfur Dioxide in Aqueous Electrolyte Solutions", Chemical Engineering Science 55(2000)2663-2671.
17. Maria Iliuta, Kaj Thomsen and Peter Rasmussen, "Extended UNIQUAC model for correlation and prediction of vapour-liquid-solid equilibria in aqueous salt systems containing non-electrolytes . I. Methanol - water - salt systems", Chemical Engineering Science, 55(2000)2673-2686
18. Thomsen K., Rasmussen P.: "Modeling of Vapor-Liquid-Solid Equilibria in Gas - Aqueous Electrolyte Systems. Chemical Engineering Science, 54(1999) 1787-1802.
19. Thomsen K., Rasmussen P., and Gani R.: "Simulation and optimization of fractional crystallization processes". Chemical Engineering Science 53(1998)1551-1564.
20. Thomsen, K., Rasmussen, P., Gani, R.: "Correlation and prediction of thermal properties and phase behaviour for a class of aqueous electrolyte systems". Chemical Engineering Science 51(1996)3675-3683
21. Thomsen, K., Gani, R., Rasmussen, P.: "Synthesis and analysis of processes with electrolyte mixtures" Computers and Chemical Engineering 19(1995)S27-S32

### **Books and chapter in books**

22. Kaj Thomsen, "Electrolyte Solutions, Thermodynamics, Crystallization, and Separation Methods", 2006. Study material developed and used while being visiting professor at University of Wisconsin-Madison. (To be published)
23. Kaj Thomsen "Thermodynamics of Electrolyte Systems of Industry", (Chapter 19 in book, Thermodynamics for Industry, Edited by TM Letcher, 2004, 219-229)
24. Kemiske Enhedsoperationer 5. udgave, Karsten H. Clement, Peder Fangel, Anker Jensen, Kaj Thomsen, (2004, Chemical Unit Operations, Language: Danish).

### **Proceedings**

1. Fosbøl, Philip Loldrup; Thomsen, Kaj; Stenby, Erling Halfdan, "Improving Mechanistic CO<sub>2</sub> Corrosion Models", Presented at: CORROSION 2009, NACE International's 64 Annual Conference and Exposition. Atlanta, Georgia, USA, 2009, Proceedings from CORROSION 2009 NACE International, 2009
25. Darde, Victor Camille Alfred; Thomsen, Kaj; Well, Willy van; Stenby, Erling Halfdan, "Chilled ammonia process for CO<sub>2</sub> capture", Presented at: ICPWS XV, Berlin 2008. Conference paper published in book/proceeding.
26. Leila Faramarzi, Georgios Kontogeorgis, Kaj Thomsen, Erling Halfdan Stenby, "Thermodynamic modeling of the solubility of CO<sub>2</sub> in aqueous alkanolamine solutions using the extended UNIQUAC model. Application to monoethanolamine and methyldiethanolamine", Energy Procedia, (2008)
27. Kaj Thomsen, Duc Thong Vu, Mette Stenby, Jørgen Peter Jensen, Peter Simonsen and Bo Sander "Leaching of Nutrient Salts from Fly Ash from Biomass Combustion",

Proceedings from 14th European Conference and Technology Exhibition on Biomass for Energy, Industry and Climate Protection, October 2005, p. 1273-1276.

28. Morten Mejlholm, Kaj Thomsen, Peter Rasmussen, Jørgen Vergod, Freddy Knudsen, Hugo Høyer: "SODIUM CHLORIDE DIHYDRATE - A POTENTIAL CAUSE OF SLIPPERY ACCIDENTS" Presented at the XIth PIARC International Winter Road Congress, Sapporo, Japan, January 28-31, 2002. Proceedings of the XIth PIARC International Winter Road Congress, Sapporo, Japan (2002)
29. Kaj Thomsen and Peter Rasmussen, "CO<sub>2</sub> hydrates in Aqueous electrolyte and sucrose solutions" Presentation given at 18<sup>th</sup> ESAT (18. European Seminar on Applied Thermodynamics, Kutná Hora, Czech Republic, 2000).
30. K. Thomsen and P. Rasmussen, "Thermodynamic Model for the Ammonia-Water System" ("Steam Water and Hydrothermal Systems: Physics and Chemistry Meeting the Needs of Industry" Proceedings of the 13<sup>th</sup> International Conference on the Properties of Water and Steam, Editors: P.G. Hill, P. Tremaine, D. Irish, and P.V. Balakrishnan, NRC Press, Ottawa, 2000, 118-125)

### Reports

31. Victor Camille Alfred Darde, Kaj Thomsen, Erling Halfdan Stenby, "Chilled ammonia process for CO<sub>2</sub> capture", (2008)
32. Philip Loldrup Fosbøl, Erling Halfdan Stenby, Kaj Thomsen, "The chilled ammonia process - Evaluation of the energy requirements", (2008)
33. Kaj Thomsen, Jørgen Peter Jensen, Peter Simonsen, Bo Sander "Reuse of Alkali from Fly Ash from Biomass Combustion", Report on research project sponsored by PSO (Danish Power Plants), February 2006.
34. Thomsen K.: "Aqueous Electrolytes: Model Parameters and Process simulation". Dissertation, DTU, 1997.
35. Thomsen, Kaj, "Soda ash liquors: Phase diagrams and process simulation", Confidential report, FMC Chemical Research and Development Center, Princeton, NJ., 1996

### Other publications

36. Philip Fosbøl, Kaj Thomsen, and Erling H. Stenby, "CO<sub>2</sub> - A greenhouse gas and a corrosion problem" (Dansk Kemi 89(2008)19-22)
37. Peter Jørgensen Herslund, Claus Maarup Rasmussen, and Kaj Thomsen, "Development of method for the removal of NH<sub>3</sub> from flyash" (Dansk Kemi 88(2007)14-17)
38. Helge Danneskiold-Samsøe and Kaj Thomsen, "Selective Crystallization of Potassium Salts from Biomass Fly Ash", (Dansk Kemi 87(2006)16-19)
39. Martin Feldskov and Kaj Thomsen, "Precipitation of Vanadium Salts", (Dansk Kemi, 87(2006)13-15)
40. Kaj Thomsen and Peter Rasmussen, "Salt Solubility", (Dansk Kemi, 85(8)(2004)22)
41. Søren Gregers Christensen and Kaj Thomsen, "Modelling of equilibria in ionexchange processes", (Dansk Kemi 84, 9(2003) 21-23)
42. Søren Gregers Christensen and Kaj Thomsen, "Production of fertilizer salts" (Dansk Kemi 83(2)(2002)18-19)
43. Thomsen, Kaj, Rasmussen, Peter. "Nickel sulfate - some supplementary information", (Dansk Kemi 80(1999),(5),33)
44. Kaj Thomsen, Peter Rasmussen, and Rafiqul Gani, "Simulation of fractional crystallization of electrolyte solutions" (Dansk Kemi 76(1995)(10)23-27)