Technical University of Denmark

Annual Report 2005

Department of Chemical Engineering

Annual Report 2005
May 2006
ISBN 87-91435-32-3

Department of Chemical Engineering
Technical University of Denmark, DTU
Søltofts Plads, Building 229
DK-2800 Kgs. Lyngby, Denmark
www.kt.dtu.dk

Editor
May Brandt – mb@kt.dtu.dk

Articles
Erik Kjær Larsen – ekl@kt.dtu.dk

Design & production
Gross Design & Kommunikation
www.gross.dk

Print
Centertryk

Photos
Klaus Holsting

Contents

Annual Review

'The education, research and innovation of the Department shall consolidate our historic position among the best chemical engineering departments in Europe'.
'It is our aim to be the preferred chemical engineering research partner of industries within energy, chemistry, biotechnology and pharmacy'.

Head of Department – an exciting challenge

Highlights 2005

Head of Department – an exciting challenge

Kim Dam-Johansen, Professor, Head of Department

To the Department of Chemical Engineering the year 2005 has been marked by opportunities, major challenges and significant results in several areas:

World class faculty

The faculty of the Department of Chemical Engineering are among the world's leading academic researchers in their field – with a substantial scientific production. Research carried out is supervised by one or several faculty member(s) and is supported by a team of gifted scientists, technicians and administrative officers. In 2005 more than 100 scientific articles and one monograph were published, and several patent applications were delivered.

Practice-based and relevance to industry

Our strong relations to international companies and small and medium sized companies in Denmark allows us to be on the cutting-edge of business evolution. In 2005, the first Advisory Board of the Department of Chemical Engineering was established with executive members from Danish industry. The board's most important objective is to ensure the positive development of our Department through valuable exchange of knowledge and ideas.

Working with real business situations is reflected in all our educational programs, thus giving direct benefit to students. In 2005, the following five new educational programs were initiated and planned by DTU in cooperation with the Department:

- Master in Advanced and Applied Chemistry
- Master in Chemical and Biochemical Engineering
- Bachelor in Health and Production
- Bachelor in Technology and Economy
- Master in Process Analytical Technology (PAT) in cooperation with BioCentrum and KVL

Practice-based and relevance to industry are two essential elements of the research and education of the Department of Chemical Engineering. A wide range of industrial partners participate in our research activities and in the support of our graduate schools:

- Graduate School of Chemical Engineering: " Molecular Product and Process Technology" – (MP_2T)
- Nordic Graduate School of Biofuel Science and Technology
- Graduate School of Polymer Science
- Novozymes Bioprocess Academy

Modern infrastructure

An inspiring work environment and modern infrastructure are preconditions for our continued results and competitiveness. In 2005 the long planned renovation of the Departments buildings and laboratories was initiated. The renovation is finished in summer 2006 and includes:

- A completely new student area with an innovation laboratory, pc room, study room and library.
- Modern research laboratories – including gene-classified laboratories.
- Attractive meeting rooms, flexible work stations, and new public areas – including a lounge where the staff can meet colleagues.

An exciting challenge

The positive development of our environment and society depends on the technical sciences. In the coming years it will be an exciting challenge for us to fulfil the many goals and live up to the high expectations set from society.

Our many achievements in 2005 derive from the strong dedication and commitment of our scientific and professional staff – and in our long-term relationships with our partners in Danish society and industry.

The Leader Team. (From the top, left to right): Erling H. Stenby, May Brandt, Ole Hassager, Hans Livbjerg, Kim Dam-Johansen and Rafiqul Gani

I wish to thank the remarkable people and partners of the Department of Chemical Engineering for outstanding results, good cooperation and positive team spirit through 2005 – and I am looking forward for the years ahead.

I wish you all a pleasant reading

Kim Dam-Johansen
Head of Department

1+2. The Department meeting and the Christmas Party took place at Comwell in Roskilde in December 2005

Highlights 2005

14 January – 13 July
Professor Eduardo Agosin from Pontificia Universidad Católica de Chile, Santiago, Chile visited the Department and gave a Ph.D. course in Wine Production. The stay was financed by the Mønsted's Fond

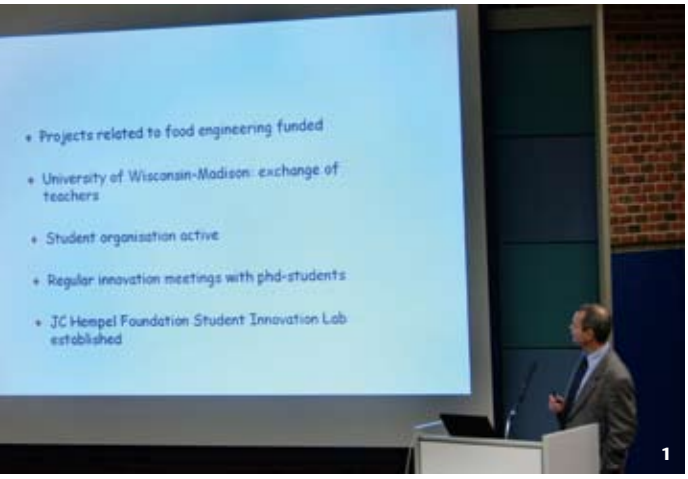
23 January
The Ph.D. Graduate Year Book 2005 and a special Edition of "Dansk Kemi" were distributed among our many contacts

24-25 January
The annual 2-day meeting of the faculty took place in Rolighed, Skodsborg

24 February
Kim Vestergaard Pedersen was awarded the BES prize for the best exam project in 2004 within the area of 'thermal conversion of fuels'. Kim Vestergaard Petersen's M.Sc. project was carried out in the CHEC Centre with Associate Professor Anker Degn Jensen and Professor Kim Dam-Johansen as supervisors. The project was initiated and completed in cooperation with Energi E2 A/S and Elsam A/S. The title is 'Application of fly ash in concrete'

15 March
The Department hosted an Industrial Contact meeting in cooperation with the Embassy of Chile. To this meeting special guests from industry were invited. Head of Department Kim Dam-Johansen presented new aspects of researc and education at the Department of Chemical Engineering. The Ambassador of Chile, Mr. H.E. Jaime Lagos talked about "Chile: a land of contrasts", and Professor Eduardo Agosin gave a speech about wine production in Chile. The meeting was followed by wine tasting and a buffet

4 April
The CHEC research centre hosted its Annual Meeting at DTU together with more than 80 invited guests from partner companies and sponsors



1


2

1+2. Kim Dam-Johansen presents *"Plan af Action 2006"* at the Department meeting at Comwell in Roskilde in December 2005

19 April
Departmental Seminar: Johannes Wesselingh, guest professor at the Department held a very humorous seminar on the subject, "The evolution of my bookshelf"

10 May
Departmental Seminar by Associate Professor Tue Johannessen on the subject, "Setting new standards for efficient and safe hydrogen storage – from applied research to company founding"

10 May
The first General Meeting of the KT's Staff Club took place

25-27 May
The IVC-SEP Annual Discussion Meeting 2005 took place as a 3-day seminar in Roskilde. Many of the 22 Consortium members as well as potential future members were represented. Besides presentations from the IVC-SEP coworkers, three industrial presentations from SQM (Chile), Akzo Nobel (The Netherlands), and Baker Petrolite (USA) gave inspiration to the further work in the centre

27 May
Departmental Seminar by Professor G.V. Rex Reklaitis from Purdue University on the subject, "Enterprise-wide Decision Support Systems"

8-9 June
CAPEC hosted its Annual Meeting in Hotel Frederiksdal in Lyngby where the current activities and latest research were put into perspective with a group of invited guests from partner companies

10 June
Departmental Seminar by Professor John P. O'Connell from University of Virginia on the subject, "Fundamentals, experiments, modelling, and mesoscale simulation to characterize hydrophobic chromatography of peptides and proteins"

1. Professor John Villadsen was awarded the "M.M. Sharma-medal" from the Indian Institute of Chemical Engineers for "a major break-through within Chemical and Biochemical-technology" **2.** Bendt Bendtsen, Minister of Economic and Business Affairs paid a visit to our Pilot facility in building 228. Seen with rector of DTU Lars Pallesen, Head of Department Kim Dam-Johansen, chairman of the DTU Board Mogens Bundgaard Nielsen (foto: Bo Jarner)

15 June
The Departmental Meeting took place in Building 101 at DTU. Presentation of *"The Strategic Plan UMV 2006-09"*

17 June
Departmental Seminar by Professor Klavs F. Jensen from Massachusetts Institute of Technology, Boston, US on the subject, "Chemical and Biological Microfluidic Systems"

20 June
Bendt Bendtsen, Minister of Trade and Industry paid a visit to our pilot facility in building 228

August
A preliminary edition of the book: "Innovate! – design (bio-)chemical, food and pharma products" – was published and now used in the course "Chemical and Biochemical Product Design". The authors are J.A. Wesselingh, Søren Kiil, and Martin E. Vigild

8-25 August
The IVC-SEP Ph.D. Summer School was successful with 20 international participants. During the first two weeks a busy program of lectures and exercises was executed and during the third week the students completed project work

28 August
Departmental seminar by Hans Jørgen Helms, Honorary Director General of the European Commission, who gave an inspiring lecture about the "EU Research Activities" for an interested number of researchers and employees

30 August
A group of employees (35 persons) participated in the DHL-baton

31 August
Departmental Seminar by Professor Elizabeth Haslbeck from Naval Surace Warfare Centre, USA on the subject "Antifouling Coating Systems – Diverse Related Topics (with an emphasis on understanding coating aging and harbor loading)

1. Ph.D. student Natanya Hansen from the Department of Chemical Engineering and high school pupils from Himmelev Gymnasium.
2. Members of the KT-Student Committee inspects the new Student Innovation Laboratory, sponsored by the J.C. Hempel Foundation. From left to right: Peter Tybjerg; Stine Justesen; Mette Krog Jensen; Martin Hagsted Rasmussen

Autumn 2005
Professor Mikko Hupa from Åbo Academy University visited the Department for several periods. The Villum Kann Rasmussen Fond funded these visits

4-6 October
Xplore 2005. This high school simulation event concerning petroleum exploration took place for the second time. More than 500 students participated in the competition sponsored by Maersk Oil and Gas A/S, DONG A/S and DTU. Besides the prize for the winning team, DONG A/S provided an offshore visit by helicopter to a team of students. The competition will run again in 2006

5 October
The Department hosted the Advisory Board for the initial board meeting

31 October
Departmental Seminar by Professor Mikko Hupa, Åbo Academy on the subject, "Molecular process technology – towards better industrial processes and products"

24 November
Departmental Seminar by Professor Caroline Crosthwaite from University of Queensland on the subject, "Chemical Engineering down under – an Australian landscape"

9 December
This year, the Departmental meeting and the Christmas Party took place at Comwell in Roskilde – both events with great success. Presentation of *"Action Plan 2006"*, discussion of future strategic goals and celebration of *"Results 2005"*

14 December
Associate Professor Anker Degn Jensen was awarded a prize of DKK 150.000 from the Reinholdt W. Jorck og Hustrus Foundation.

17 December
Professor John Villadsen was awarded the "M.M. Sharma-medal" from the Indian Institute of Chemical Engineers for "A major break-through within Chemical and Biochemical-technology"

Education

Strategic goal:
'In close interaction with Danish and international industry the Department shall continue to ensure optimum career prospects for our graduates'.

Balancing research and education in a rapidly changing environment

Seeing the invisible through pure math

Balancing research and education in a rapidly changing environment

A range of new educational tracks are ready for launch at the Department of Chemical Engineering and new initiatives for further improving the teaching standards are being implemented. The new chairman of the Educational Committee, Anker Degn Jensen, has a pragmatic view on both change and increasing demands:

"It has to be that way – the very nature of science and research is a constant movement towards higher standards," he says.

In response to the changing needs of both society and industry the new tracks at the Department of Chemical Engineering, DTU (KT) aim to develop exciting and attractive educational possibilities for new students.

"Research and education are inseparable at our department," states Anker Jensen, "our teaching should be balanced equally between the provision of knowledge – the pedagogical aspect – and the nurturing and practical use of the technical insights and knowledge itself."

Elaborates Anker Jensen: "The most important 'product', I believe, of the Department is our students who graduate to become a driving force in society and industry. On a day to day basis the challenge is to keep our scientific staff at the forefront of both science and industrial standards, to the point where you constantly gain new knowledge and develop new skills."

As a mean to continually fine tune and enhance the standards at KT the Educational Committee wants to promote pedagogical and didactic discussion and development. As part of this work, the Department has developed a tailor-made course in practical teaching, in cooperation with Learning Lab DTU.

"We need to constantly evaluate and improve our practical teaching skills and techniques and hopefully get to the point where it becomes a natural conversation issue at the lunch table," says Anker Jensen.

Focus: The five new educational programs

Master in Advanced and Applied Chemistry
The program will make it possible to obtain a broad knowledge of the design of advanced materials. Alternatively, there is a possibility of specialization in three areas of high technological and scientific interest, specifically (i) polymers, (ii) catalysts and catalytic processes and (iii) complex organic chemicals, e.g. pharmaceuticals. Start in September 2006. Study Director is Assosiate Professor Georgios Kontogeorgis from the Department of Chemical Engineering, DTU (KT).

Master in Chemical and Biochemical Engineering
The MSc Chemical and Biochemical Engineering replaces the International MSc in Chemical Engineering from September 2006. The program offers a broad basis within the core of chemical and biochemical engineering science and technology, but may be organized within three lines of study: 1) Chemical and Biochemical Process Technology, 2) Chemical and Biochemical Product Engineering, 3) Energy and Environmental Engineering. Study Director is Assosiate Professor Stig Wedel

Bachelor in Health and Production
This program is one of the results of a strategic increase of the biological content of the bachelor programe at DTU. The program started in September 2005 and is coordinated by BioCentrum, DTU

Bachelor in Technology and Economy
A combination of chemistry, chemical engineering and economy. Starts in September 06, Study Director, Reader Karsten H. Clement

Master in Process Analytical Technology (PAT)
The program starts in September 06 in cooperation with The Royal Veterinary and Agricultural University (KVL). The program is coordinated by KVL.

Anker Degn Jensen, new chairman of the Educational Committee

The overall task of the Educational Committee is to ensure that all necessary courses are available and that the right people and resources are allocated for any course, including the five new tracks listed below:

- Master in Advanced and Applied Chemistry
- Master in Chemical and Biochemical Engineering
- Bachelor in Health and Production
- Bachelor in Technology and Economy – a combination of chemistry, chemical engineering and economy
- Master in Process Analytical Technology (PAT)

With 12 years of experience as a teacher at KT, Anker today divides his time 50-50 between education and research, specializing in combustion, chemical reaction engineering and particle technology. Bridging education and research in an ever-changing field of practical and theoretical science may seem a tall order, but when asked where the biggest rewards lie in his job at KT Anker Jensen suggests several:

”As far as education is concerned, it is pretty straightforward: If the students turn up at your lectures and if they engage and show interest it means that you are probably doing something right. There you have an instant payoff.”

”When it comes to research it is sometimes more difficult to tell when you have succes. To me personally it is very much about the inner fulfillment of tackling difficult problems,” says Anker Jensen. ”Then you have those occasions where you are the first to publish an article in a new field, or maybe you get a prize and a check and a pad on the shoulder. Or maybe you land x million DKK to do a research project. Those moments can be memorable,” says Anker Jensen who emphasizes one major challenge to KT in the near future:

”We need to attract more students with an interest in biotechnology as biochemical engineers are in high demand by industry. We have a lot of expertise in this field and we are eager to pass it on. With a new professorship currently available in bioprocess engineering there is a good chance that we will strengthen our position in this field.”

Seeing the invisible through pure math

When asked to describe the abstract nature of her work, reservoir engineer at DONG E&P A/S Marianne Jørgensen uses a tangible example as an illustration:

"It is more or less like if you pass the busstop and afterwards try to imagine how the surroundings look at the next busstop, maybe 1000 m from the first busstop. We are trying to clarify and outline something which no one has ever seen, and no one ever will."

The invisible things which Marianne tries to visualize are petroleum reservoirs, giant hydrocarbon filled rock formations hidden deep under the waters of the North Sea. And the 'spectacles' she uses to grasp these unwatchable phenomena are highly specialized mathematical formulas.

In close cooperation with geoscientists who probe into the underground and based on their data, Marianne Jørgensen generates computer simulation models which predict the movement of oil and gas in the oil reservoirs using amongst others phase equilibrium calculations. These highly customized and intricate mathematic formulas were the subject of Marianne's Ph.D. project which she finished at the Department of Chemical Engineering, DTU (KT) in 1996.

"Shortly put my job is to predict how much oil and gas it is possible to recover from these underground reservoirs," says Marianne.

Precision matters

The work has many different levels:
"Sometimes we investigate a so-called 'prospect' – meaning a yet undiscovered reservoir in a place where our geoscientists assume there may be one hidden," Marianne explains.

”Sometimes we investigate a recently discovered reservoir to probe how much oil we might be able to recover from it. At other times we use simulations on already ‘up-and-running’ reservoirs and correlate our data to predict and optimize future oil production.

Oil reservoirs are huge – a typical size could be several square kilometers, and a thickness from 10 to several hundred meters – and since the initial drillings are extremely costly it is of the utmost importance that Marianne’s simulations give as precise an image of the underground processes as possible.

Working closely together with geoscientists and other engineers she feels confident that only the optimum achievable ‘images’ of what lies down there in the dark moves on to those who make the strategic decisions about where and when to drill.

A dream job

”I have always felt a need to see my theoretical knowledge put into practical use,” says Marianne, ”and since recovering oil from the Danish underground is no simple task I get all the challenges and diversity from this job that I could ask for. Yes, I guess you could say I have found my dream job.”

After finishing her Ph.D. Marianne stayed in a position as research associate professor at the IVC-SEP Centre for another five years. What eventually made her make the jump to a job in the oil industry was a deepfelt need for practical results of her knowledge:

”I have always wanted to pursue the technical and practical aspects of engineering,” she says, ”but I am happy that I got the opportunity at KT to really dig deep into the details of different technical problems. In my current position I still benefit from the academic approach – I don’t settle for the easy workarounds but rather keep digging until I find the right solution to a given problem.”

Balancing family life and carrier

Marianne is a mother of two and both she and her partner – who is also an engineer and works at BioCentrum DTU – hold fulltime jobs. Combining family life and carrier is a challenge which Marianne tackles with a principle of keeping the two spheres separated.

”I try to avoid working at home but when necessary I delay it until the kids are put to bed,” says Marianne.

She got her first child, Rasmus who is now 10, at the end of her Ph.D. and Rikke, now 6, during her subsequent employment at KT. When the kids were small she tended to tip the balance in favor of the family:
”After Rikke joined the family I took a one year leave – which is really recommendable – and during the years when the kids were small I worked reduced hours,” Marianne says.

”Besides, due to my family priorities I have never applied for jobs neither abroad nor offshore, even though both are obvious choices since Denmark is really just a midget in the international oil industry,” says Marianne. She also stresses the importance of mutual respect for each others carriers when you are two academics under the same roof.

”Having two cars is another priority of ours – it saves a lot in time and logistic planning,” says Marianne Jørgensen who lives with her family only 10 minutes away from DONG’s spacious and beautiful premises in Forskerparken in Hørsholm.

”And that is one thing I find to be really important for carrier and family to harmonize: Living close to where you work,” emphasizes Marianne.

Research & Innovation

Strategic goal:
'The Department will ensure high quality of our research by stable funding, continuous development of research facilities, and by an extensive academic freedom with due respect for the overall department goals'.

When science means business

Exploring the healing properties of polymers

When science means business

In the summer of 2005 Tue Johannessen was granted a leave from his position as Associate Professor at the Department of Chemical Engineering (KT) and made a radical shift in his career when he became Chief Technical Officer and acting CEO of the start-up company Amminex A/S.

Tue Johannessen is one of the five researchers in the DTU-team behind the solid hydrogen storage concept known as the hydrogen tablet – widely acknowledged by both peers and the media as a breakthrough in hydrogen storage – the other four being Claus Hviid Christensen, Jens Kehlet Nørskov, Rasmus Zink Sørensen and Ulrik Quaade. In addition, several students, including Tobias Dokkedal Elmøe from the Department, were involved in the research.

Months before research facts on the hydrogen "tablet" were published in the open literature, the research team had made a decision to actively engage in the process of bringing the fruits of their research to the market place.

Deep understanding required

The five founded a holding company and launched the start-up venture Amminex A/S with DTU and Seed Capital Denmark as co-investors. Tue Johannessen took on the challenge of steering the newborn hydrogen storage company through its first turbulent waters.

"We realized quite early in the research process that there was a commercial potential for the end product," says Tue, "once patents are reported to DTU you have to make a decision: Do you want to work with them yourself or should DTU try to sell them?"

"With this kind of innovative product you really need someone to pick up the ball and kick it further up the field. We thought it would be interesting to stay in the game and I chose to take on the challenge as manager, partly because I wanted to add hands-on business experience to my personal profile, partly because it is important that at least one within the research group with a deep understanding of the product works full time on aggressively opening doors and seeking out potential partners and investors."

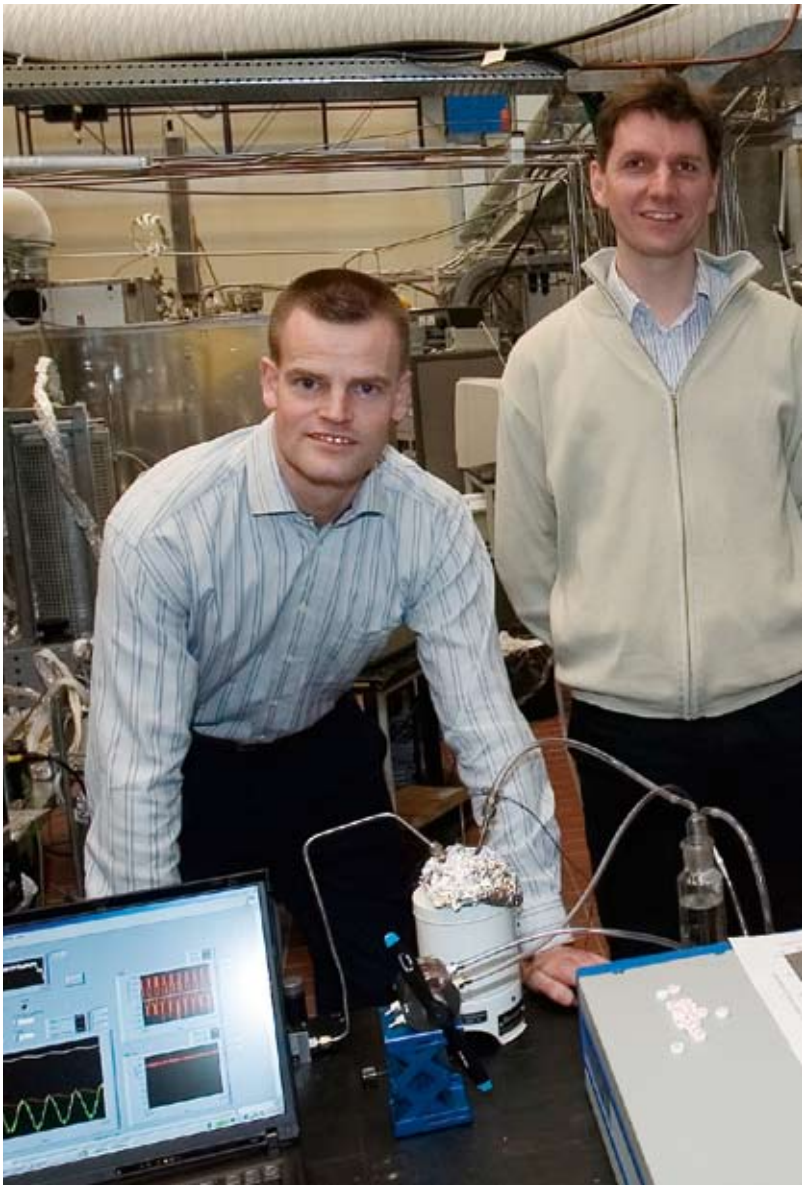
As a firsttimer in entrepreneurship, Tue recognizes that he lacks experience in the financial field. But in the first part of the start-up DTU and SEED Capital Denmark were bringing that knowledge to the table, he states.

"It is important to keep the right perspective," says Tue,"for now I may function as the managing head of a small company with less than five employees, but the objective of the start-up phase is to raise enough capital to attract a strong CEO and step by step establish a framework for the growth of the company."

Rough facts of private enterprise

The role Tue sees for himself in the near-future Amminex A/S is as Chief Technical Officer, but being the main driver behind the start-up has earned him plenty of firsthand experience with the tough realities of starting a company from scratch:

"There are countless practical things to attend to; website, accounting, company name and logo, accommodation ... but it is soothing to know that in a continuation of the university career I will be able to speak about the 'rough facts of private enterprise' not out of pure theory, but out of personal experience," he says.



From left to right: Tue Johannesen, Department of Chemical Engineering and Ulrich Quaade, Department of Physics

Asked if he misses the 'good old days' doing research in the lab, Tue replies:
"Not really ... I am still involved in research and development but it is on a more supervisional level now. Just like the normal kind of interaction a university professor has with his or her students."

A different ballgame

Summarizing his experience as a researching professor turned entrepreneur, Tue says:
"Pursuing the business aspects of a series of research results is definitely another ballgame than doing research. In research you write applications for funding – when you are responsible for a company you operate with a timeframe of finding investment as well as showing the path for earning money back."

"I think it is excellent that KT now offers a course dedicated to Technology and Economy. There are lots of situations where the combination of engineering and financial background makes good sense," says Tue Johannessen.

A storage concept with several market opportunities

The hydrogen storage tablet has become the brand which most people spontaneously identify with Amminex A/S, but the technology behind the ammonia-based tablet is also applicable in so-called De-NOX (removal of nitrogen oxides, NO_x, from diesel exhaust gas)

"Interestingly, our product addresses more than one market. Safe and compact dosing systems for NOx-removal in diesel exhaust have a very well-defined and near-future market. The more long-term perspectives are related to the increasing use of fuel cells in everyday products," explains Tue Johannesen.

Exploring the healing properties of polymers

Imagine if you applied a patch on a wound and never had to think about replacing or removing it. In the course of the healing process the patch would gradually decompose while still supporting and protecting the growth of new cells which would eventually replace the patch material completely.

It may sound like medical science fiction but is nevertheless what Ph.D. student Anne Kathrine Kattenhøj Overgaard is currently trying to create through groundbreaking research at the Graduate School of Polymer Science.

Anne Kathrine stresses that the research is still very much in its prime:

"It could take several years before my basic research is eventually turned into a final product," says Anne Kathrine,"there would have to be thorough clinical testing first and the approval procedures for this kind of medical product would have to run their course. But my main focus right now is to synthesize a polymer-structure, based on biocompatible materials, with the properties required for this particular purpose."

Endless possibilities

Taking her Ph.D. at the Graduate School of Polymer Science seems a natural succession to Anne Kathrine's path in chemical engineering. After obtaining her master degree from Department of Chemical Engineering, DTU (KT) in August 2003 she was employed as a research assistant at Coloplast A/S. Later she went to USA to work at the State University of New York in Syracuse, NY where she could eventually have applied for a Ph.D. position. But an idea fostered by Professor Søren Hvilsted and Coloplast Research spawned a Ph.D. position at the Graduate School of Polymer Science. Anne Kathrine applied for it – and got it.

"I chose to take my Ph.D. here because I had an excellent cooperation with my department on my exam project. Besides, the engaged department at Coloplast Research was the same as where I worked as a research assistant, and finally it seemed like a really interesting project," says Anne Kathrine who is clearly motivated by the prospect of seeing her research put to practical use:

"I am of course fascinated by the endless possibilities that lie inherent in the materials I work with. But at the same time it appeals to me that my research has the potential of actually helping people," says Anne Kathrine.

A win-win situation

So far Anne Kathrine's work on the Ph.D. project has been carried out at The Graduate School of Polymer Science at The Danish Polymer Centre, Department of Chemical Engineering but later she expects to spend time at the Coloplast A/S research facilities.

Polymers are everywhere

Polymers are essentially long chains of repeating molecular units which intertwine in spaghettilike structures. Products based on polymers are everywhere in our daily life – just reach for any plastic item close to you and you have a polymer structure right there.

”The cooperation between a private company and DTU seems to me like a win-win situation for all parties,” says Anne Kathrine. ”Coloplast get research results in a field of their interest, DTU gets a Ph.D. student and gains new knowledge which could eventually be applied in other fields of public interest – and I get the advantage of being in an inspiring and extremely dynamic, multicultural workplace.”

Ph.D. students are obliged to take supplementary courses and one of Anne Kathrine’s courses was a summer school in France where she gained insight into biopolymers and the healing of wounds in general.

”It was delightful to get to meet the people who do research in the same area as me and to find out who are the real experts and where to get assistance if you run into problems,” she says.

The future

And problems will eventually occur. According to Anne Kathrine this is simply the nature of chemistry: ”A synthesis process can take as much as a week. Despite careful planning and execution the results are not always what you expected so this kind of research has it ups and downs. There are days where you stay in the lab till late in the evening. But when things just turn out the way you schemed ... what a great feeling!,” says Anne Kathrine who shares her laboratory with another Ph.D. student, Natanya Hansen.

While the polymers in her lab gradually take on new and revolutionary properties, Anne Kathrine is very aware that other areas of use than healing of wounds could become relevant:

”Right now the product is designed for healing of wounds, but it might also be used for drug-delivery and possibly other fields of medical use,” she says.

Anne Kathrine’s Ph.D. project is scheduled to finish in September 2007 after which a world of possibilities lies open.

”My future could be a job at Coloplast or a similar company or maybe in a university – you have quite a few options with a Ph.D.. But there’s still time to think about all that,” Anne Kathrine says with a confident smile.

Facts about the Graduate School of Polymer Science

The Graduate School of Polymer Science is a research education network including the Department of Chemical Engineering and the Department of Manufacturing Engineering and Management at DTU, the Department of Chemistry at Aarhus University and the Polymer Department at Risø National Laboratory. The school is headed by Professor Ole Hassager. Associated industrial companies include Coloplast A/S, Novo Nordisk A/S, NKT Research & Innovation A/S, Grundfos and Elektro-Isola A/S. The school is supported by the Danish Research Agency.

Organization

Strategic goal:
'The organization of the Department shall be continuously adjusted with the purpose of providing – at any time – modern and dynamic education and research, and with the purpose of running an attractive and efficient organization.'


CHEC | IVC-SEP


CAPEC | DPC.DTU


Aerosol | BioChemical Engineering

Administration & Technical Support

A vital part of our research is conducted in very close collaboration with industrial enterprises and international research organizations.

The industrial relations cover close joint projects with mutual exchange of staff and cooperation on experimental research ranging from microscale over pilot plants to full-scale industrial production plants. This approach ensures high relevance of our research and efficient exchange of technology and know-how.

Kim Dam-Johansen, Director of CHEC

www.chec.kt.dtu.dk
Director, Professor Kim Dam-Johansen | kdj@kt.dtu.dk | Phone: +45 4525 2845
Assosiate Professor Peter Glarborg | pgl@kt.dtu.dk | Phone: +45 4525 2840

CHEC

Combustion and Harmful Emission Control – the CHEC Research Centre

CHEC is an internationally recognized research centre in the field of Chemical Reaction Engineering and Combustion, emphasizing on high-temperature processes and formation and control of harmful emissions. In recent years the activities have expanded into areas of particle technology, production of active pharmaceutical ingredients, and chemical product design.

The research approach involves a combination of modelling and experimental work. Experiments are conducted over scales ranging from small laboratory reactors to full-scale industrial units.

The models typically combine a generic description of the chemical reaction system with a process-specific flow description, and are used to analyze and extrapolate the experimental data, and to provide input for design and optimization.

The work is conducted in collaboration with Danish enterprises as well as a range of national and international research organizations.

The new field of Product Design covers quantitative formulation engineering using traditional Chemical Engineering methods in the design of products, e.g. granular enzymatic products, and controlled release systems in different fields, a.o. paint technology and pharmaceuticals.

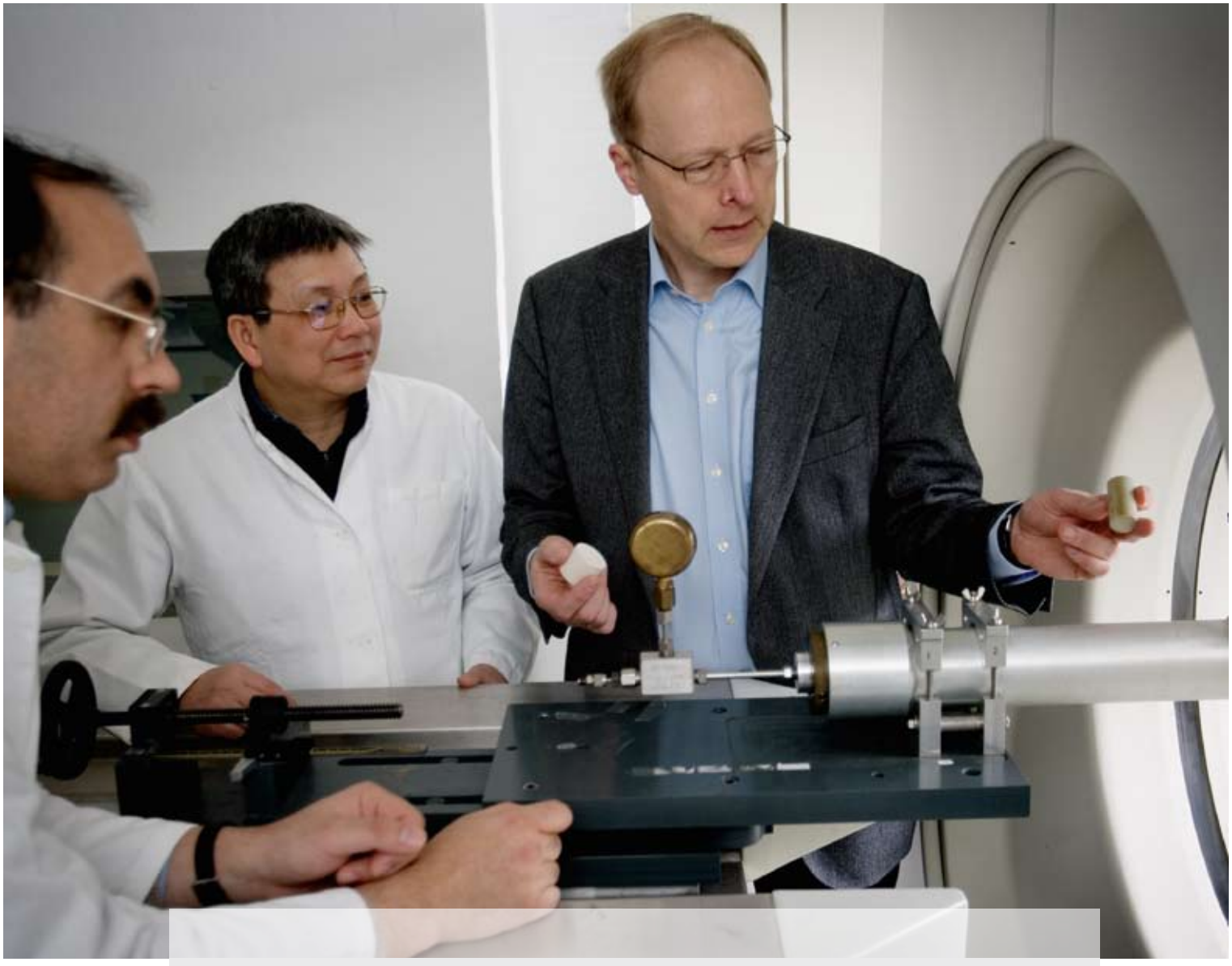
Waste fuel utilization and production of liquid fuel from biomass have received gradually increasing attention in the CHEC Research Centre over the last years. The work is directed towards pyrolysis af biomass, methanol production based on gassification and bioethanol production.

The CHEC Research Centre collaborates with the following industrial partners

- Elsam A/S
- Energi E2 A/S
- F.L. Smidth A/S
- Babcock & Wilcox Vølund ApS
- B&W Energy A/S
- Danish Gas Technology Center A/S
- Rockwool A/S
- Haldor Topsøe A/S
- Hempel A/S
- H. Lundbeck A/S
- NIRO A/S
- Novozymes A/S
- Energinet.dk

The industrial support is supplemented with funding from these organizations

- DTU
- Nordic Energy Research
- The Danish Research Council for Technology and Production Sciences
- The European Union
- The Danish Research Training Council
- The Public Service Obligation Programme



For more than 25 years the IVC-SEP has been a leading research group in the area of applied thermodynamics. In close collaboration with industry, relevant authorities and research organizations, the research of IVC-SEP is implemented in industrial products and processes, and has generated a number of spin-off companies, patents and commercial software.

We believe in the power of knowledge transfer and we commit ourselves to generate research and education to the benefit of society. We strive to continue the proud traditions and excellent performance of the past.

Erling H. Stenby, Director of IVC-SEP

www.ivc-sep.kt.dtu.dk
Director, Professor Erling H. Stenby | ehs@kt.dtu.dk | Phone: +45 4525 2875

IVC-SEP

Centre for Phase Equilibria and Separation Processes (IVC-SEP)
The IVC-SEP is a well established research group with an excellent track record and international reputation in the areas of applied thermodynamics, transport processes, and mathematical modelling. With seven tenured faculty members the centre covers several topics and both experimental and theoretical research.

Currently, the main activities of the centre are in the areas of complex solutions (including polymers, electrolytes, peptides, and associating chemicals), non-equilibrium thermodynamics (diffusion and thermo diffusion), petroleum chemistry at the molecular level, and finally simulation of petroleum recovery processes (from the pore to reservoir scale). Furthermore the centre is active in several research projects of strategic importance such as CO_2 capture and sequestration and oxygenates in gasoline.

The Industrial Consortium of IVC-SEP has existed for 25 years and continues to be a valuable asset for the research and education at the Department. Many companies support research projects in addition to the membership. For instance the CHGP project (Chemicals in Gas Processing) which is sponsored entirely by industry (Total, Statoil, BP, Maersk Oil and Gas, and OMV).

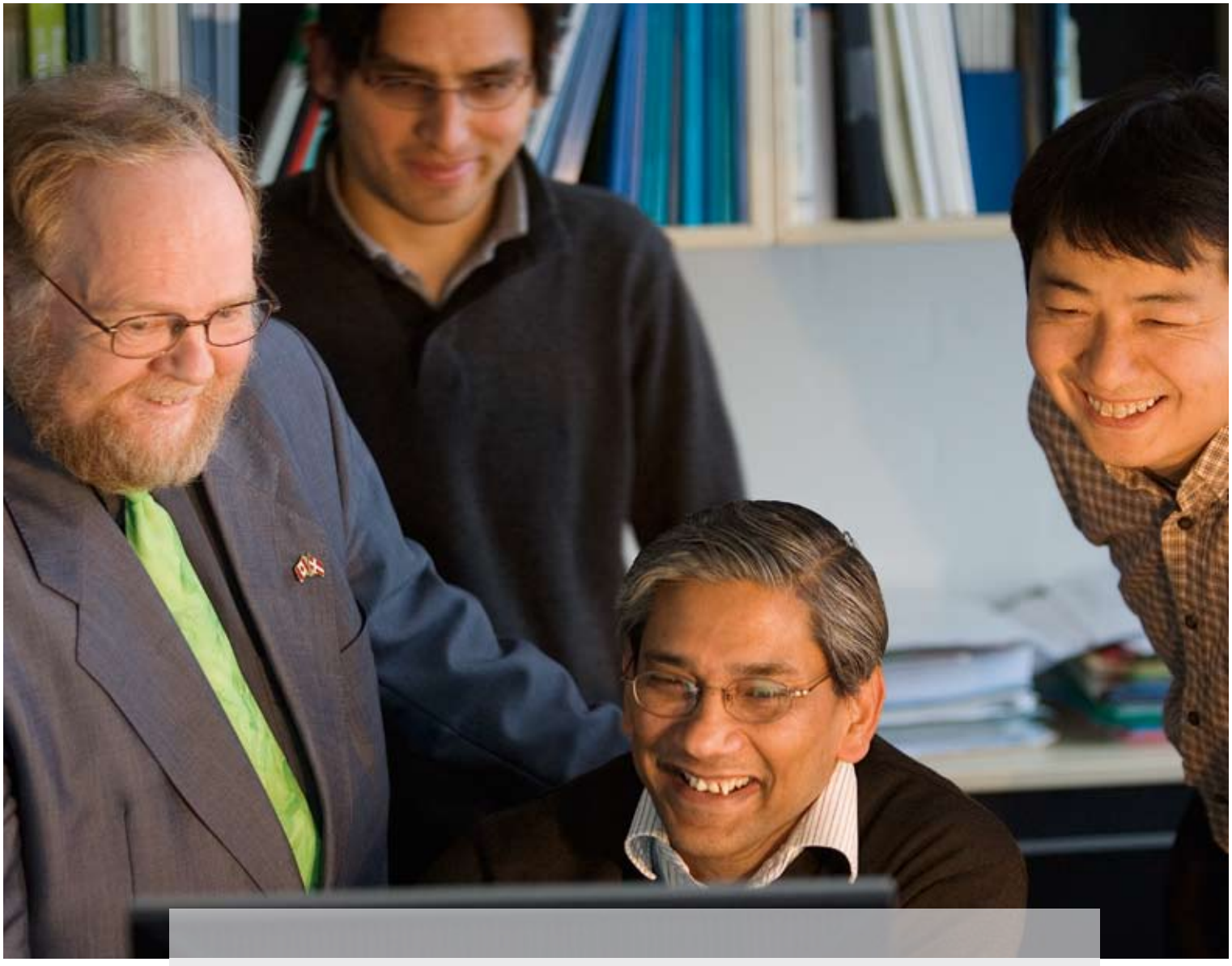
Many students get their first contact to the Danish or international industry through a project in IVC-SEP.
In addition to research funding the Consortium members provide experimental data, samples, and fruitful feed back to the centre.

One highlight from 2005 is the CO_2 capture research where a simple and reliable model has been developed for the amine absorption process. Two Danish companies (Elsam and Energi E2) and the Danish Council for Strategic Research have granted funding for a continuation of this project.

Another highlight is the extension of the electrolyte model, Extended UNIQUAC, to high pressure, high temperature conditions of relevance to petroleum reservoirs and geothermal energy production.

In 2005 the Consortium of IVC-SEP consisted of the following members

- Akzo Nobel (S)
- Baker Petrolite (USA)
- BP (UK)
- Chevron (USA)
- DONG (DK)
- Elsam A/S (DK)
- Energi E2 A/S (DK)
- Eni Agip (I)
- Exxon Mobil (USA)
- Gaz de France (F)
- Haldor Topsøe (DK)
- Institut Français du Pétrole (F)
- Linde (D)
- Mærsk Olie og Gas A/S (DK)
- Norsk Hydro (N)
- OMV (AUT)
- Petrobras (BRA)
- Polimeri Europa (I)
- Statoil (N)
- Shell Global Solutions (NL)
- SQM (Chile)
- Total (F)



Briefly, the research objectives of CAPEC are to develop computer-aided systems for process simulation, process/product synthesis, design, analysis and control/operation principally suitable for chemical, petrochemical/oil, pharmaceutical and biochemical industries.

Our computer-aided systems are developed on the basis of fundamental modelling studies that incorporate correlation and estimation of thermo-physical and phase equilibrium properties as well as modelling of the underlying phenomena/behavior of the processes and operations".

Rafiqul Gani, Director of CAPEC

www.capec.kt.dtu.dk
Director, Professor Rafiqul Gani | rag@kt.dtu.dk | Phone: +45 4525 2882

CAPEC

Computer Aided Process-Product Engineering Centre (CAPEC)

The CAPEC research centre applies a systems approach to develop comprehensive solutions to various industrial problems based on a thorough analysis of scientific issues and actual product/process requirements. The developed systematic methods are generic in character and therefore applicable to a wide range of problems in process and product engineering.

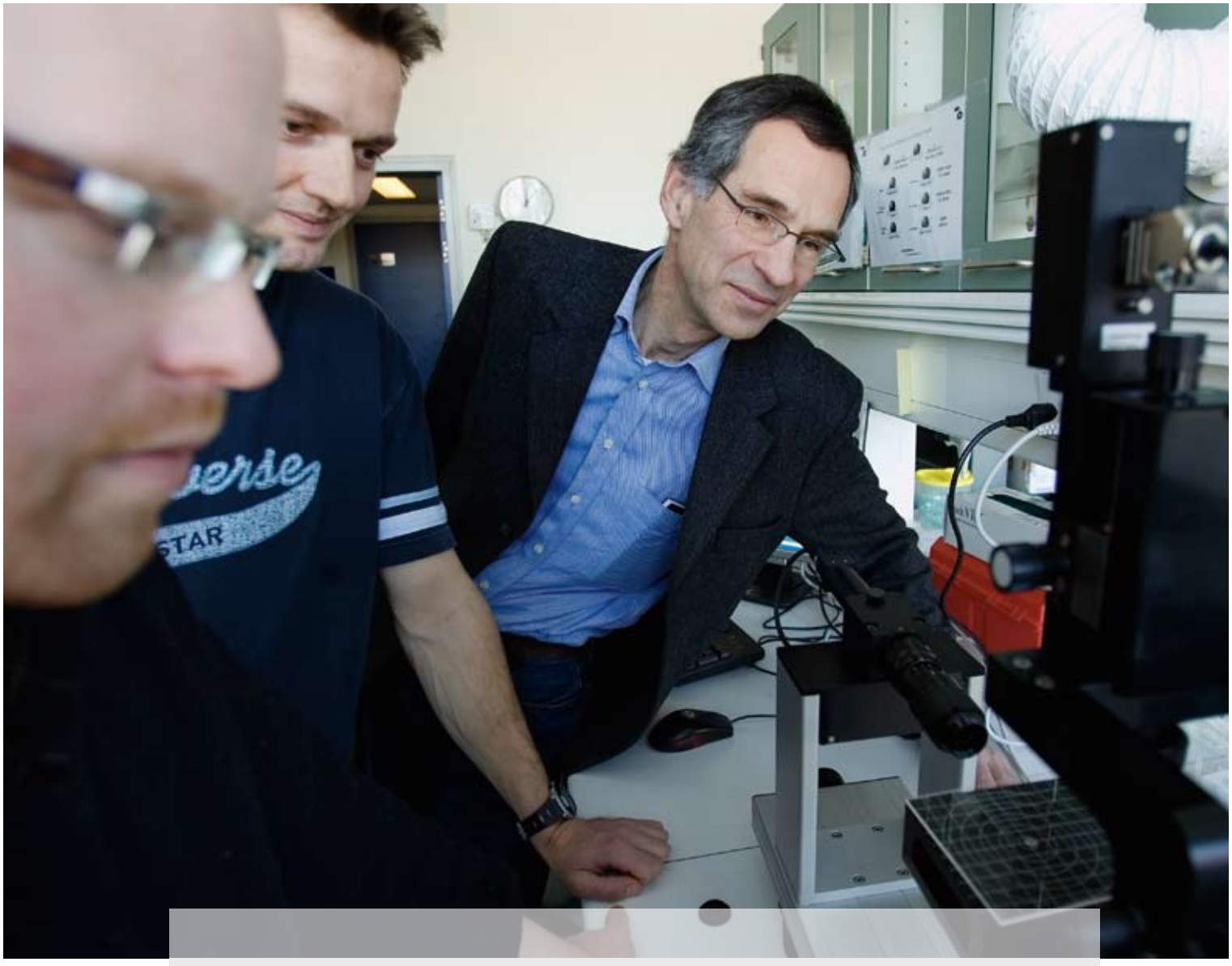
Additionally, the systems approach enables us to convert the developed methods into tools for problem analysis and solution. Thus, the research at CAPEC has resulted in the development of a range of generic simulation techniques and their conversion into state of the art computer-aided tools for modelling, synthesis, design, operation, control and analysis – each method dedicated to systematic and efficient process/product engineering.

The CAPEC research is organized into six research programs arranged in a logical framework ranging from fundamental to applied research. Based on the fundamental modelling at the generic levels, computer-aided methods and tools are developed at the next (intermediate) levels for synthesis, design, analysis and control of process/product/operation. Again, these models, methods and tools are integrated in the final research levels, where applied methods are generated for the development of cleaner, safer and sustainable technologies.

Headed by Professor Rafiqul Gani, the CAPEC research centre constitutes a very distinct group of professors, associate and assistant professors, researchers, postdocs and Ph.D. students that significantly contribute to the joint activities of KT. Additionally, CAPEC usually hosts around 10 M.Sc. and B.Sc. students plus a varying number of visiting students and international visitors.

In 2005 CAPEC was supported by the following industrial consortium

- Novo Nordisk A/S (DK)
- Novozymes A/S (DK)
- Zacco Denmark A/S (DK)
- Danisco-Cultor A/S (DK)
- FLS-Automation A/S (DK)
- AstraZeneca (S)
- Fantoft Process Tech. AS (N)
- Neste Oy (SF)
- Bayer AG (D)
- Process Design Center (D)
- Akzo-Nobel (NL)
- Syngenta (UK)
- Avecia Pharmaceuticals (UK)
- ICI Strategic Tech. Group (UK)
- Roche (CH)
- Firmenich (CH)
- GlaxoSmithKline (USA)
- FMC Corporation (USA)
- SimSci-Invensys (USA)
- Unilever (USA)
- DuPont (USA)
- Optience (USA)
- ChemProcess Technologies (USA)
- US Env. Protection Agency (USA)
- Mitsubishi Chemical Corp. (JPN)
- Processium (F)
- Petrobras (Brasil)
- Instituto Mexicano del Petróleo (MX)
- ProSim SA (F)
- BASF (D)



At the Danish Polymer Centre we are devoted to the application of molecular design, synthesis and processing of polymers to create materials and products with unlimited ranges of properties and applications.

We strive towards this goal in a balanced environment of education, research and industrial cooperation.

Ole Hassager, Director of DPC.DTU

www.kt.dtu.dk/dpc
Director, Professor Ole Hassager | oh@kt.dtu.dk | Phone: +45 4525 2973

DPC.DTU

The Danish Polymer Centre (DPC.DTU)
Organized within the Department of Chemical Engineering and the Department of Manufacturing Engineering and Management, the Danish Polymer Centre (DPC.DTU) is an interdisciplinary centre for polymer education, research and industrial cooperation. The main research areas are polymer chemistry, polymer physics, polymer technology and polymer processing.

Equipped with state of the art instrumentation for polymer characterization, the laboratories of DPC. DTU provides a common ground for polymer chemists, polymer physicists, chemical engineers and mechanical engineers. Current techniques include the synthesis with controlled molecular weight, branching structure and functional groups, the application of scattering methods to study the structure of complex polymer systems, rheological characterization and the design of multi-phase systems.

International Master of Polymer Engineering and Science
In September 2003 DTU created a two year M.Sc. program in Polymer Engineering and Science for international students. The program aims at talented students who hold at least a Bachelor of Science degree in Chemistry, Chemical Engineering, Mechanical Engineering or other relevant fields. Measured in terms of student activity, the polymer students are rated among the best within the 13 DTU international M.Sc. programs.

Graduate School of Polymer Science
Initiated in late 2003, the Graduate School of Polymer Science is a research education network between DPC. DTU, the Department of Chemistry at Aarhus University, Risø National Laboratory and associated industrial companies. The school provides a logical framework for the joint activities of the Danish Polymer Centre.

Financial support to the DPC.DTU is provided by the following organizations

- Aage and Johanne Louise Hansen's Foundation
- The Danish Technical Research Council
- The European Union
- Grundfos A/S
- Chempilots A/S
- Radiometer A/S
- Coloplast A/S

The Graduate School of Polymer Science operates in the following framework

- Risø National Laboratory
- Aarhus University
- DTU
- Coloplast A/S
- Novo Nordisk A/S
- NKT Research & Innovation A/S
- Elektro-Isola A/S
- Grundfos A/S

Some research projects mainly involve students and faculty from the Chemical Engineering field but a majority of research projects benefit from cooporation between departments of DTU.

The basis for the majority of our material research is the continuous development/exploration of high-temperature processing of materials, but traditional areas like reaction engineering and models/-CFD-simulations are necessary fundamental tools for all projects.

Hans Livbjerg, Director of the Aerosol Laboratory

www.aerosol.kt.dtu.dk
Director, Assoc.Professor Hans Livbjerg | hl@kt.dtu.dk | Phone: +45 4525 2949

Aerosol

The Aerosol Laboratory
The Aerosol Laboratory was initiated in the 1990's due to an increased attention to undesired aerosol formation in industrial processes.

The centre applies aerosol dynamics in environmentally related projects, e.g. for investigation of formation and emission of sub-micron particles in coal-fired power plants. In addition, aerosol technology combined with fundamental knowledge in aerosol dynamics is used in high-temperature aerosol processes for the synthesis of nanoparticles, catalysts and composite metal oxides and for the preparation of ceramic membranes/ -membrane reactors.

The Aerosol Group cooporate closely with other departments at DTU, especially Department of Chemistry and Department of Physics.

Research areas

- Flame-assisted aerosol routes for the manufacture of nanoparticles, nanostructured materials and ceramic membranes for catalytic applications
- Fuel cell technology and hydrogen storage
- Combustion aerosols: Theoretical and experimental
  – incl. field studies on full-scale power plants
  – analysis of processes for the formation of hazardous sub-micron particles
- Development and application of mathematical models for aerosol dynamics
- Analysis/design of reactors/processes by Computational Fluid Dynamics (CFD)

The Aerosol Laboratory cooperates with the following industrial partners

Haldor Topsøe A/S
IRD Fuel Cell A/S
Energinet.dk
Elsam A/S
Energi E2 A/S

Launched in 2003, the new Centre for BioChemical Engineering constitutes a strong alliance between BioCentrum-DTU (BiC), Department of Chemical Engineering (KT) and the Danish biotech based industry. The centre is established with the goal to create a new, strong link between generic research and the industrial application of bio-technology.

As I see it, the enterprise uniquely combines the engineering expertise of BiC and KT. The vision of the centre for Biochemical Engineering and the research topics taken up by the centre will inescapably lead to a dramatically higher return on the Danish Biotechnology research investment.

John Villadsen, Head of BioChemical Engineering

Head, Professor, Dr. Tech. John Villadsen | jv@kt.dtu.dk | Phone: +45 4525 2668 / +45 4525 2861

BioChemical Engineering

Centre for BioChemical Engineering – Novozymes Bioprocess Academy

Centre for BioChemical Engineering is a new multi-disciplinary research centre established in 2003 as a cooperation between the two DTU departments, BioCentrum (BiC) and Department of Chemical Engineering (KT). The centre operates in the border area between Biotech and Chemical Product and Process Engineering.

Novozymes Bioprocess Academy was established in 2002 – with substantial support by Novozymes A/S. The academy will ensure the education of candidates with a firm knowledge of product and process engineering acquired both in the laboratory and in the pilot plant to the booming Danish biotech industry. Currently, 8 Ph.D. students and 6 M.Sc. students are enrolled with the academy.

Centre for BioChemical Engineering marks a further development of the already extensive cooperation between KT and BiC– and it contributes positively to fulfilling the DTU vision of creating an exceptionally strong environment for research and education in all aspects of Biotech – from mapping the molecular biology of the cell to design of fully optimized process plants. In 2005 a Research Consortium was established between the Centre for Biochemical Engineering and the three major Danish Bio-based companies: Novozymes, Danisco and Chr. Hansen. With a further 3-5 Ph.D. students working on "Innovative bioprocess technology," the central role of bioprocess technology at DTU has been further highlighted.

Biotech is a spearhead industry in Denmark and several Danish biotech based industries are world leaders in their respective fields. Thus, on a global scale, Danish products and processes contribute to improved health care, welfare, and cleaner processes while generating thousands of new jobs. Via an academically driven research effort in the generic problems of industrial production it is the mission of Centre for BioChemical Engineering to positively enhance the transfer of new research produced in the laboratories to actual industrial implementation.

Centre for BioChemical Engineering cooperates with the following industrial partners

- **Novozymes A/S**
- **Novo Nordisk A/S**
- **H. Lundbeck A/S**
- **Alpharma A/S**
- **Chr. Hansen A/S**
- **Danisco Cultor A/S**
- **Rambøll A/S**
- **Iso Mix A/S**

Our support units provide important services for students, teachers and researchers and are responsible for the full array of technical and administrative functions at the Department.

You will find some remarkable people working as support staff at the Department of Chemical Engineering. Our team enjoys its work and benefits from relationships marked by trust and team spirit, both within our department and with our colleagues throughout the Technical University of Denmark.

May Brandt, MBA, Head of Administration

www.kt.dtu .dk
Head of Administration, May Brandt | mb@kt.dtu.dk | Phone: +45 4525 2807

Administration & Technical Support

Support Staff
Innovative teaching, research and consulting require the support of professional services. Our high-quality services enable us to deliver excellent education and project work.

Working in our support units means being a strong partner for our students, teachers and research teams, and accompanying them throughout all phases of their work.

Finances and Administration
Efficient support from our people in accounting, finances and the administrative functions plays an important role within our department. We provide services in many different areas, including financial accounting, project administration, budget consolidation, forecasts, controlling, contracts, travel expense accounting, facility management and general administration.

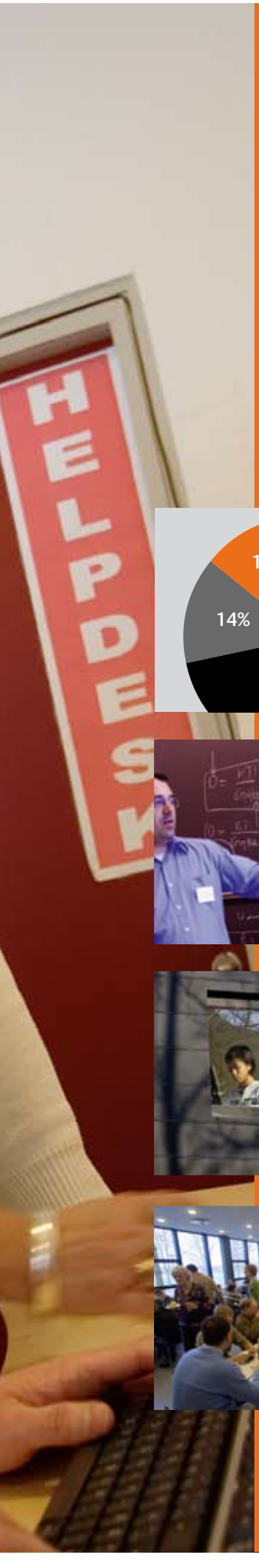
Corporate Communication
Our webeditor ensures that our website meet our high standards with respect to design and business communication, and writes up the latest company news in our corporate website and annual reports.

Service and Planning
The secretaries are the first point of contact for students, partners and colleagues alike. They handle a multitude of inquiries, information, and tasks, and even under pressure they never lose their diplomatic touch. They play a major role in ensuring that a wide range of internal processes run smoothly.

Information Technology Services
The focus of this unit is knowledge management (databases), IT consulting, IT solutions and support which includes ordering, installing, and configuring hardware and software, as well as maintaining the IT back office.

Workshop
Craftsmanship and innovation go hand in hand when the workshop at the Department provides our small and large scale laboratories with custom made, high quality equipment.

Laboratories
Our laboratory technicians ensure high safety standards and efficient caretaking of our laboratories, education and research facilities.



Productivity & Staff

Strategic goal:
'The Department aims to attract an increasing number of students, scientists and external partners by the continued development of an dynamic and innovative environment for research and education.'

Key figures

Productivity – Education

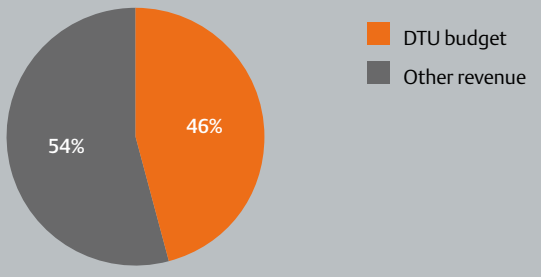
Productivity – Publication

Staff

Key figures: Finances and staff 2005

Revenue 2005

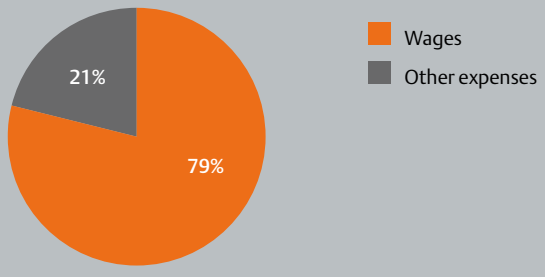
(Total 79,055 mill. DKK *)



*Except buildings

Expenditures 2005

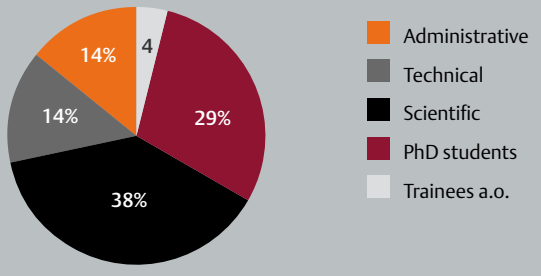
(Total 67,816 mill DKK *)



*Except buildings

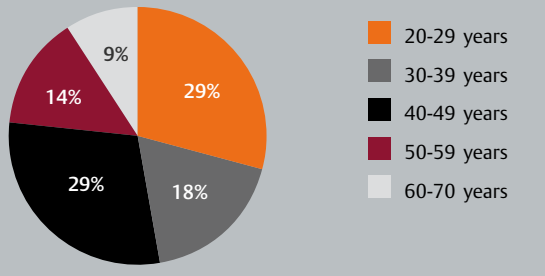
Type of staff

(Total 153 persons)



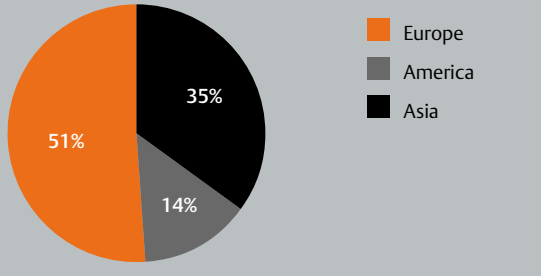
Staff distributed by age

(Total 153 persons)



Foreign scientific staff

(Total 37 persons)



Productivity

Teaching & Education 2005
Students, educational resources and -impact

Students in total (STÅ*)	164
Students per faculty man-year (STÅ*)	6,0
Students per mill DKK (STÅ*)**	5,8
Courses in 5-point units	68,4
Participants in special courses	60
Completed B.Sc. projects	23
Completed M.Sc/Bachelor of Engineering	40
Total Course units	77,4

*One STÅ is the equivalent of one student studying full time in a year
** Relative to the DTU-budget

Research & Innovation 2005
Publications, patents and commercialized research

Scientific publications with referee	90
Contributions to refereed conference proceedings (not indexed in ISI)	38
Books (monographs)	1
Contribution to books	4
Citations 2000-2005	821
Ph.D. theses	15
Other publications, departmental reports	35

Education

Master and Bachelor Courses

The Department participates in a 3½ year education for the Bachelor of Engineering Degree and a 5 year education for the Master Degree. Below, course numbers and names are shown for 2005 with the number of students attending shown in brackets. Courses for the Bachelor of Engineering Degree are marked with (B). The other courses are master courses or common courses.

Spring-semester

28011 Introduction to Chemical Process Engineering (21) (B)
28021 Unit Operations of Chemical Engineering (26) (B)
28110 Chemical and Biochemical Product Analysis (11)
28120 Introduction to Chemical and Biochemical Engineering (93)
28121 Chemical Unit Operations Laboratory (5)
28153 Process Design (11) (B)
28181 Engineering Trainee (16) (B)
28212 Polymer Chemistry (21)
28221 Chemical Engineering Thermodynamics (13)
28312 Computer-Aided Product Design (13)
28321 Chemical Engineering Thermodynamics (27)
28341 Chemical Reaction Engineering (37) (B)
28350 Process Design: Principles and Methods (28)
28351 Process Control (32)
28375 Air Pollution Control (18) (B)
28415 Oil and Gas Production (24)
28423 Phase Equilibria for Separation Processes (29)
28434 Membrane Technology (30)
28443 Industrial Reaction Engineering (31)
28845 Chemical Reaction Engineering Laboratory (13)
28852 Risk Assessment in Chemical Industry (28)
28863 Introduction to Fortran Programming (13)

Course given in co-operation with other departments

01913 Mathematical Models for Chemical and Biochemical Systems (38) (B)
28171 Introduction to Working Environment and Environmental Problems (16) (B)
28231 Laboratory in Chemical and Biochemical Engineering (19)
28885 Introduction to Oil and Gas Technology (15) (B)
42110 Materials Science (101)
42981 Materials Science (34) (B)
42983 Corrosion and Materials Selection (11)

Fall-semester

28001 Introduction to Chemistry and Chemical Engineering (45)
28012 Chemical and Biochemical Process Engineering (51) (B)
28021 Unit Operations of Chemical Engineering (31) (B)
28120 Introduction to Chemical and Biochemical Engineering (62)
28140 Introduction to Chemical Reaction Engineering (30)
28150 Introduction to Process Control (22)
28153 Process Design (4) (B)
28181 Engineering Trainee (16) (B)
28213 Polymer Technology (24)
28241 Chemical Kinetics and Catalysis (22)
28310 Chemical and Biochemical Product Design (29)
28315 Colloid and Surface Chemistry (54)
28316 Colloid and Surface Chemistry, Laboratory Course (9)
28321 Chemical Engineering Thermodynamics (27) (B)
28341 Chemical Reaction Engineering (25) (B)
28351 Process Control (30) (B)
28420 Separation Processes (36)
28515 Enhanced Oil Recovery (10)
28530 Transport Processes (49)
28811 Polymers in Processes and Products (22)
28845 Chemical Reaction Engineering Laboratory (21)
28851 Chemical Plant Operation (14)
28861 Mathematical Modelling for Chemical Engineers (40)
28863 Introduction to Fortran Programming (4)

Courses given in co-operation with other departments

01913 Mathematical Models for Chemical and Biochemical Systems (24) (B)
12002 Design of Biotechnological and Environmental Processes (73)
12411 Introduction to Petroleum Technology (47)
26010 Introductory Project in Chemistry (30)
27406 Biotechnology Purification Methods (43)
28171 Introduction to Working Environment and Environmental Problems (20) (B)
28172 Introduction to Working Environment and Environmental Problems (24) (B)
28244 Combustion and High Temperature Process (37)
41015 Mechanics and Materials (62)
42981 Materials Science (32) (B)
42983 Corrosion and Materials Selection (24)

Master of Science Degrees

40 students finished their research projects for the M.Sc. Degree and B.Sc. Degree in Engineering. The project titles and names of the students are listed below

Aggregation and fibrillation of Glugacon (Emil Holst-Pedersen)

Anode optimization for PEM fuel cells (Michael Ulrik Borg Jensen)

Bio-chemical Engineering (Pavle Andric)

Block copolymers for adhesives (Xiaoxue Yuan)

Brownian Dynamics Simulation of Polymer Behavior in Microfluidic Systems (Xueyu Zhu)

CFD Modelling of Pilot Scale Combustion Reactor (Yunhui Cao)

Continuous droplet polymerization (Shijie Wang)

Determination of model parameters in the Extended UNIQUAC model for electrolytes (Pedro Neves Leáo de Campos)

Development and control of an ammonia delivery system for NOx-removal in an automotive unit (Tobias Dokkedal Elmøe)

Development of pressure sensitive valves for microfluidics (Jose Manuel Marin Roman)

Direct Partial Oxidation of Methane to Methanol (Anja Egede Rasmussen)

Dynamic Microfiltration with a Vibrating Hollow Fiber Membrane Module (Søren Prip Beier)

Dyrolysis of Tire Rubbert (Lars Schultz)

Evaluating the potential for enzymatic CO2 capture from flue gas (Valentina Marcucci)

Fast curing epoxy systems (Salomeh Melat)

Feasibility Study of Ceramic Ultrafiltration (Jonas Harboe)

Flexibilization of phendlic resins (Amra Tihic)

Fluid bed granulation and coating (Peter Dybdahl Hede)

Gypsom from wet flue gas desulphurization (Brian Brun Hansen)

Industrial Crystallization – Towards methodologies for optimization of batch cooling (Bruno P. Nielsen)

Kinetics of Hydrate Formation (Tore Sylvester Jeppesen)

MD simulation of polymer melts (Yanwei Wang)

Measurement of solid-liquid equilibrium concentrations of sparingly soluble minerals at temperature and pressure (Eduardo Ribeiro)

Methods for improving selectivity in ultra- and microfiltration (Mar Fernandez Pachero)

Mixing and mass Transfer in Pilot Scale equipment using novel methods of dispersion (Ling Hua)

Modelling of cement mills (Jakob Kjøbsted Huusom)

Modelling of petroleum-alcohol mixtures (Liv Hovgaard)

Modelling of phase equilibria for petroleum reservoir fluids containing water and hydrate (Carsten Lundstrøm)

Modelling of waterflooding in stochastically heterogeneous reservoirs (Ricardo Elias Walker Gutierrez)

Modelling of wax and the Fischer-Tropsch process (Christian Wix-Nielsen)

Novel Biocompatible and –degradable Block Copolymers (Ritwik Chattopadhyay)

Phase behaviour of napthenic acid in mixtures (Anders Bitsch-Larsen)

Pigment leaching from antifouling paints (Beatriz Coronas)

Polymerization and rheology of model polymers (Martin Denberg)

Precipitation of Vanadium- and Nickelsalts (Martin Thomas Høyer Feldskov)

Preparation of aligned nanoporous crosslinked polyisoprene from diblock copolymers (Kenneth Andersen)

Shedding of Ash Deposits in Straw Fired Boilers (Birgitte Madsen)

Silicone hydrogel contact lenses: Free radical polymerization of 2-hydroxyeth supercritical carbon dioxide (Anne Marie Jensen)

Simulation of CO2 Injection in Weyburn for EOR and Sequestration (Abdul Rashid Abouc Nabi Román)

Synthesis and Characterization of Branched PLGA (Astrid Toftkær)

Bachelor of Science Degrees

8 students finished their research program for the B.Sc. Degree. The project titles and names of the students are listed below

Improvement of the fire resistance of rooting products (Lars Dam Madsen and Kristoffer Moos)

Mechanical properties of anticorrosive coatings (Simon Jacobsen)

Oxide Scale Formation on Alloys for Catalyzed Hardware (Trine Colding Lomholt)

Partial Oxidation of natural Gas (Dani Lynge Johansson)

Synthesis of catalyst for PEM fuel cells with Flame Spray Pyrolysis (Henrik Bischoff Jensen)

Thermal properties of man-made vitreous fibres (Morten Lüthje)

Zinc Epoxy for corrosion protection (Ulrik Bork)

Publications

Ph.D.- Theses

Ada Villafafila Garcia: Modelling of Mineral Scale Deposition, Ph.D.-thesis, 2005

Dennis Bonné: Optimal and Reproducible Operation of Batch Processes, Ph.D.-thesis, 2005

Diego Meseguer Yebra: Efficient and Environmentally Friendly Antifouling Coatings, 2005

Edgar Ramirez Jimenez: Modelling, Design, Operability and Analysis of Reaction-Separation Systems, Ph.D.-thesis, 2005

Helle Nygaard: Mathematical Modelling and Experimental Investigation of Full-scale Gypsum Producing Wet Flue Gas Desulphurisation. Ph.D.-thesis, 2005

Irene Papaeconomou: Integration of Synthesis and Operational Design of Batch Processes, Ph.D.-thesis, 2005

J.B. Jørgensen: Moving Horizon Estimation and Control, Ph.D.-thesis, 2005

Kåre Jørgensen: Drying rate and morphology of slurry droplets, 2005

Loïc d'Anterroches: Process Flow Sheet Generation & Design through a Group Contribution Approach, Ph.D.-thesis, 2005

Mads Thaysen: Hybrid Modelling for Enhanced Bioreactor Performance, Ph.D.-thesis, 2005

Michael Andersen: Syntese og reformering af metanol, Ph.D.-thesis, 2005

Nuria Muro Suné: Prediction of solubility and diffusion properties of pesticides in polymers, Ph.D.-thesis, 2005

Oleg Medvedev: Diffusion Coefficients in Multicomponent Mixtures, Ph.D.-thesis, 2005

Simone van Lith: Release of Inorganic Elements during Wood-Firing on a Grate, 2005

Susanta Mitra: Chemical Degradation of Specific Uncrosslinked and Crosslinked Rubbers upon Exposure to Specific Non-absorbing Aqueous Chemicals, Ph.d.-Thesis, 2005

Books/Monographs, Chapters in Books

Abildskov, J, "Solubility and Related Properties of Large Complex Chemicals – Part 2", DECHEMA Chemistry Data Ser., 15 2005.

Gani, R; Papaeconomou, I., 2005, "Conceptual Design and Synthesis of Batch Processes", Ch. 3, In: Batch Processes, Editors: E. Korovessi & A.A. Linninger, CRC Taylor and Francis, Boca Raton, Florida, USA, pp 43-82

Jørgensen, S.B; Bonné, D.; Gregersen, L.; 2005, "Monitoring and Control of Batch Processes", Ch. 11, In Batch Processes, Editors: E. Korovessi & A. A. Linninger., CRC Taylor and Francis, Boca Raton, Florida, USA, pp 419-462

Villadsen, J., 2005, "Batch Reactors in the Bioindustries", Ch. 4, In Batch Processes, Editors: E. Korovessi & A. A. Linninger., CRC Taylor and Francis, Boca Raton, Florida, USA, pp. 83-106

Reviewed Journal Publications

Abild-Pedersen, F; Lytken, O; Engbaek, J; Nielsen, G; Chorkendorff, I; Norskov, JK. 2005. Methane activation on Ni(111): Effects of poisons and step defects. SURFACE SCIENCE 590 (2-3): 127-137.

Abildskov, J; O'Connell, JP. 2005. Thermodynamic method for obtaining the solubilities of complex medium-sized chemicals in pure and mixed solvents. FLUID PHASE EQUILIBRIA 228: 395-400, Sp. Iss. SI.

Ademovic, Z; Wei, J; Winther-Jensen, B; Hou, XL; Kingshott, P. 2005. Surface modification of PET films using pulsed AC plasma polymerisation aimed at preventing protein adsorption. PLASMA PROCESSES AND POLYMERS 2 (1): 53-63.

Andersen, M; Johansson, M; Chorkendorff, I. 2005. Isotopic exchange of CO adsorbed on Pt(111). JOURNAL OF PHYSICAL CHEMISTRY B 109 (20): 10285-10290.

Andersen, M; Lytken, O; Engbaek, J; Nielsen, G; Schumacher, N; Johansson, M; Chorkendorff, I. 2005. Search for new catalysts from a fundamental basis. CATALYSIS TODAY 100 (1-2): 191-197.

Arvelakis, S; Frandsen, FJ. 2005. Study on analysis and characterization methods for ash material from incineration plants. FUEL 84 (14-15): 1725-1738.

Arvelakis, S; Frandsen, FJ; Dam-Johansen, K. 2005. Alkali Induced Corrosion of Silicon Carbide Heating Elements in a High Temperature Furnace. IFRF COMBUSTION JOURNAL, 200504: 1-14.

Batina, N; Reyna-Cordova, A; Trinidad-Reyes, Y; Quintana-Garcia, M; Buenrostro-Gonzalez, E; Lira-Galeana, C; Andersen, SI. 2005. Qualitative analysis of thin films of crude oil deposits on the metallic substrate by Fourier transform infrared (FTIR) microscopy. ENERGY & FUELS 19 (5): 2001-2005.

Baylaucq, A; Boned, C; Canet, X; Zeberg-Mikkelsen, CK; Quinones-Cisneros, SE; Zhou, HG. 2005. Dynamic viscosity modeling of methane plus n-decane and methane plus toluene mixtures: Comparative study of some representative models. PETROLEUM SCIENCE AND TECHNOLOGY 23 (2): 143-157.

Broholm, MM; Christophersen, M; Maier, U; Stenby, EH; Hohener, P; Kjeldsen, P. 2005. Compositional evolution of the emplaced fuel source in the vadose zone field experiment at airbase Vaerlose, Denmark. ENVIRONMENTAL SCIENCE & TECHNOLOGY 39 (21): 8251-8263.

Buchardt, CN; Johnsson, JE; Kiil, S. 2005. Experimental investigation of the degradation rate of adipic acid in wet flue gas desulphurisation plants. FUEL 85: 725-735.

Cameretti, LF; Sadowski, G; Mollerup, JM. 2005. Modeling of aqueous electrolyte solutions with perturbed-chain statistical associated fluid theory. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (9): 3355-3362.

Chakraborty, D; Bischoff, H; Chorkendorff, I; Johannessen, T. 2005. Mixed phase Pt-Ru catalyst for direct methanol fuel cell anode by flame aerosol synthesis. JOURNAL OF THE ELECTROCHEMICAL SOCIETY 152 (12): A2357-A2363.

Cheng, HY; Kontogeorgis, GM; Stenby, EH. 2005. Correlation and prediction of environmental properties of alcohol ethoxylate surfactants using the UNIFAC method. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (18): 7255-7261.

Christensen, CH; Sorensen, RZ; Johannessen, T; Quaade, UJ; Honkala, K; Elmoe, TD; Kohler, R; Norskov, JK. 2005. Metal ammine complexes for hydrogen storage. JOURNAL OF MATERIALS CHEMISTRY 15 (38): 4106-4108.

Christensen, SG; Thomsen, K. 2005. Experimental measurement and modeling of the distribution of solvent and ions between an aqueous phase and an ion exchange resin. FLUID PHASE EQUILIBRIA 228: 247-260, Sp. Iss. SI.

Cismondi, M; Brignole, EA; Mollerup, JM. 2005. Development and Application of a Three-Parameter RK-PR Equation of State. FLUID PHASE EQUILIBRIA 232: 74-89.

Cismondi, M; Brignole, EA; Mollerup, JM. 2005. Rescaling of Three-Parameter Equations of State: PC-SAFT and SPHCT. FLUID PHASE EQUILIBRIA 234: 108-121.

Coutinho, JAP; Vilela, T; Pereira, P; Pessoa, P; Santos, MMM; Kontogeorgis, GM. 2005. Process engineering versus product engineering – A case study on volatile organic compounds removal. CHEMICAL ENGINEERING RESEARCH & DESIGN 83 (A4): 352-356.

d'Anterroches, L; Gani, R. 2005. Group contribution based process flowsheet synthesis, design and modelling. FLUID PHASE EQUILIBRIA 228: 141-146, Sp. Iss. SI.

Damstrup, ML; Jensen, T; Sparso, FV; Kiil, SZ; Jensen, AD; Xu, X. 2005. Solvent optimization for efficient enzymatic monoacylglycerol production based on a glycerolysis reaction. JOURNAL OF THE AMERICAN OIL CHEMISTS SOCIETY 82 (8): 559-564.

Eskimergen, R; Mortensen, K; Vigild, ME. 2005. Shear instability of a gyroid diblock copolymer. MACROMOLECULES 38 (4): 1286-1291.

Folas, GK; Derawi, SO; Michelsen, ML; Stenby, EH; Kontogeorgis, GM. 2005. Recent applications of the cubic-plus-association (CPA) equation of state to industrially important systems. FLUID PHASE EQUILIBRIA 228: 121-126, Sp. Iss. SI.

Folas, GK; Gabrielsen, J; Michelsen, ML; Stenby, EH; Kontogeorgis, GM. 2005. Application of the cubic-plus-association (CPA) equation of state to cross-associating systems. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (10): 3823-3833.

Frandsen, FJ. 2005. Utilizing biomass and waste for power production – a decade of contributing to the understanding, interpretation and analysis of deposits and corrosion products. FUEL 84 (10): 1277-1294.

Gabrielsen, J; Michelsen, ML; Stenby, EH; Kontogeorgis, GM. 2005. A model for estimating CO2 solubility in aqueous alkanolamines. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (9): 3348-3354.

Galliero, G; Medvedev, OO; Shapiro, AA. 2005. Molecular dynamics simulations of the penetration lengths: application within the fluctuation theory for diffusion coefficients. PHYSICA A-STATISTICAL MECHANICS AND ITS APPLICATIONS 350 (2-4): 315-337.

Publications (continued)

Gani, R; Harper, PM; Hostrup, M. 2005. Automatic creation of missing groups through connectivity index for pure-component property prediction. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (18): 7262-7269.

Gani, R; Jimenez-Gonzalez, C; Constable, DJC. 2005. Method for selection of solvents for promotion of organic reactions. COMPUTERS & CHEMICAL ENGINEERING 29 (7): 1661-1676.

Garcia, AV; Thomsen, K; Stenby, EH. 2005. Prediction of mineral scale formation in geothermal and oilfield operations using the extended UNIQUAC model Part I. Sulfate scaling minerals. GEOTHERMICS 34 (1): 61-97.

Gernaey, KV; Nielsen, MK; Thornberg, D; Hook, B; Munk-Nielsen, T; Ingildsen, P; Jorgensen, SB. 2004. Conservation principles suspended solids distribution modelling to support ATS introduction on a recirculating WWTP. WATER SCIENCE AND TECHNOLOGY 50 (11): 179-188.

Ghasemi, I; Rasmussen, HK; Szabo, P; Morshedian, J. 2005. An investigation on rheology of peroxide cross-linking of low density polyethylene. IRANIAN POLYMER JOURNAL 14 (8): 715-720.

Glarborg, P; Marshall, P. 2005. Mechanism and modeling of the formation of gaseous alkali sulfates. COMBUSTION AND FLAME 141 (1-2): 22-39.

Grcar, JF; Glarborg, P; Bell, JB; Day, MS; Loren, A; Jensen, AD. 2005. Effects of mixing on ammonia oxidation in combustion environments at intermediate temperatures. PROCEEDINGS OF THE COMBUSTION INSTITUTE 30: 1193-1200, Part 1.

Hansen, KK; Nielsen, CJ; Hvilsted, S. 2005. Low molecular weight block copolymers as plasticizers for polystyrene. JOURNAL OF APPLIED POLYMER SCIENCE 95 (4): 981-991.

Heidemann, RA; Madsen, J; Stenby, EH; Andersen, SI. 2005. Wax precipitation modeled with many mixed solid phases. AICHE JOURNAL 51 (1): 298-308.

Hirsimaki, M; Lampimaki, M; Lahtonen, K; Chorkendoff, I; Valden, M. 2005. Investigation of the role of oxygen induced segregation of Cu during Cu2O formation on Cu{100}, Ag/Cu{100} and Cu(Ag) alloy. SURFACE SCIENCE 583 (2-3): 157-165.

Jankova, K; Bednarek, M; Hvilsted, S. 2005. Star polymers by ATRP of styrene and acrylates employing multifunctional initiators. JOURNAL OF POLYMER SCIENCE PART A-POLYMER CHEMISTRY 43 (17): 3748-3759.

Jankova, K; Hvilsted, S. 2005. Novel fluorinated block copolymer architectures fuelled by atom transfer radical polymerization. JOURNAL OF FLUORINE CHEMISTRY 126 (2): 241-250, Sp. Iss. SI.

Jorgensen, K; Bach, P; Jensen, AD. 2005. Impact and attrition shear breakage of enzyme granules and placebo particles-application to particle design and formulation. POWDER TECHNOLOGY 149 (2-3): 157-167.

Juyal, P; Merino-Garcia, D; Andersen, SI. 2005. Effect on molecular interactions of chemical alteration of petroleum asphaltenes. I. ENERGY & FUELS 19 (4): 1272-1281.

Kaarsholm, M; Derawi, SO; Michelsen, ML; Kontogeorgis, GM. 2005. Extension of the cubic-plus-association (CPA) equation of state to amines. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (12): 4406-4413.

Karunanithi, AT; Achenie, LEK; Gani, R. 2005. A new decomposition-based computer-aided molecular/mixture design methodology for the design of optimal solvents and solvent mixtures. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (13): 4785-4797.

Knudsen, JN; Jensen, PA; Lin, WG; Dam-Johansen, K. 2005. Secondary capture of chlorine and sulfur during thermal conversion of biomass. ENERGY & FUELS 19 (2): 606-617.

Kolska, Z; Ruzicka, V; Gani, R. 2005. Estimation of the enthalpy of vaporization and the entropy of vaporization for pure organic compounds at 298.15 K and at normal boiling temperature by a group contribution method. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (22): 8436-8454.

Kontogeorgis, GM; Coutsikos, P. 2005. Comments on "Predictions of activity coefficients of nearly athermal binary mixtures using cubic equations of state". INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (9): 3374-3375.

Kriz, P; Andersen, SI. 2005. Effect of asphaltenes on crude oil wax crystallization. ENERGY & FUELS 19 (3): 948-953.

Lang, T; Jensen, AD; Jensen, PA. 2005. Retention of organic elements during solid fuel pyrolysis with emphasis on the peculiar behavior of nitrogen. ENERGY & FUELS 19 (4): 1631-1643.

Leth-Miller, R; Jensen, AD; Jensen, J; Glarborg, P; Jensen, LM; Hansen, PB; Jorgensen, SB. 2005. Comparative study of reactivity to CO2 of cokes used in stone wool production. FUEL PROCESSING TECHNOLOGY 86 (5): 551-563.

Lim, YI; Jorgensen, SB; Kim, IH. 2005. Computer-aided model analysis for ionic strength-dependent effective charge of protein in ion-exchange chromatography. BIOCHEMICAL ENGINEERING JOURNAL 25 (2): 125-140.

Lin, WG; Song, WL. 2005. Power Production from Biomass in Denmark, JOURNAL OF FUEL CHEMISTRY AND TECHNOLOGY 33(6): 650-655.

Lipnizki, J; Casani, S; Jonsson, G. 2005. Optimisation of ultra-filtration of a highly viscous protein solution using spiral-wound modules. DESALINATION 180 (1-3): 15-24.

Lohse, B; Ramanujam, PS; Hvilsted, S; Berg, RH. 2005. Photodimerization in pyrimidine-substituted dipeptides. JOURNAL OF PEPTIDE SCIENCE 11 (8): 499-505.

Medvedev, OO; Shapiro, AA. 2005. Modeling diffusion coefficients in binary mixtures of polar and non-polar compounds. FLUID PHASE EQUILIBRIA 236 (1-2): 111-124.

Merino-Garcia, D; Andersen, SI. 2005. Calorimetric evidence about the application of the concept of CMC to asphaltene self-association. JOURNAL OF DISPERSION SCIENCE AND TECHNOLOGY 26 (2): 217-225.

Mollerup, JM. 2005. Biothermodynamics – a Tool for a More Efficient Process Development. BIOFORUM EUROPE 6: 56-57

Monsalvo, MA; Baylaucq, A; Reghem, P; Quinones-Cisneros, SE; Boned, C. 2005. Viscosity measurements and correlations of binary mixtures: 1,1,1,2-tetrafluoroethane (HFC-134a)+tetraethylene glycol dimethylether (TEGDME). FLUID PHASE EQUILIBRIA 233 (1): 1-8.

Muro-Sune, N; Gani, R; Bell, G; Shirley, I. 2005. Predictive property models for use in design of controlled release of pesticides. FLUID PHASE EQUILIBRIA 228: 127-133, Sp. Iss. SI.

Norrman, K; Winther-Jensen, B. 2005. Controlling the plasma polymerization process of N-vinyl-2-pyrrolidone. PLASMA PROCESSES AND POLYMERS 2 (5): 414-423.

Ostenfeld, CW; Davies, JC; Vegge, T; Chorkendorff, I. 2005. Growth and hydrogenation of ultra-thin Mg films on Mo(111). SURFACE SCIENCE 584 (1): 17-26.

Plackett, D; Jankova, K; Egsgaard, H; Hvilsted, S. 2005. Modification of jute fibers with polystyrene via atom transfer radical polymerization. BIOMACROMOLECULES 6 (5): 2474-2484.

Queimada, AJ; Marrucho, IM; Coutinho, JAP; Stenby, EH. 2005. Viscosity and liquid density of asymmetric n-alkane mixtures: Measurement and modeling. INTERNATIONAL JOURNAL OF THERMOPHYSICS 26 (1): 47-61.

Queimada, AJ; Miqueu, C; Marrucho, IM; Kontogeorgis, GM; Coutinho, JAP. 2005. Modeling vapor-liquid interfaces with the gradient theory in combination with the CPA equation of state. FLUID PHASE EQUILIBRIA 228: 479-485, Sp. Iss. SI.

Quinones-Cisneros, SE; Andersen, SI; Creek, J. 2005. Density and viscosity modeling and characterization of heavy oils. ENERGY & FUELS 19 (4): 1314-1318.

Quinones-Cisneros, SE; Garcia, J; Fernandez, J; Monsalvo, MA. 2005. Phase and viscosity behaviour of refrigerant-lubricant mixtures. INTERNATIONAL JOURNAL OF REFRIGERATION-REVUE INTERNATIONALE DU FROID 28 (5): 714-724.

Radfarnia, HR; Ghotbi, C; Taghikhani, V; Kontogeorgis, GM. 2005. A modified free-volume-based model for predicting vapor-liquid and solid-liquid equilibria for size asymmetric systems. FLUID PHASE EQUILIBRIA 234 (1-2): 94-100.

Rasmussen, CL; Skjoth-Rasmussen, MS; Jensen, AD; Glarborg, P. 2005. Propargyl recombination: estimation of the high temperature, low pressure rate constant from flame measurements. PROCEEDINGS OF THE COMBUSTION INSTITUTE 30: 1023-1031, Part 1.

Rasmussen, HK; Bach, A. 2005. On the bursting of linear polymer melts in inflation processes. RHEOLOGICA ACTA 44 (5): 435-445.

Rasmussen, HK; Nielsen, JK; Bach, A; Hassager, O. 2005. Viscosity overshoot in the start-up of uniaxial elongation of low density polyethylene melts. JOURNAL OF RHEOLOGY 49 (2): 369-381.

Schmidt, KAG; Quinones-Cisneros, SE; Kvamme, B. 2005. Density and viscosity behavior of a North Sea crude oil, natural gas liquid, and their mixtures. ENERGY & FUELS 19 (4): 1303-1313.

Schulz, H; Madler, L; Strobel, R; Jossen, R; Pratsinis, SE; Johannessen, T. 2005. Independent control of metal cluster and ceramic particle characteristics during one-step synthesis of Pt/TiO2. JOURNAL OF MATERIALS RESEARCH 20 (9): 2568-2577.

Schumacher, N; Boisen, A; Dahl, S; Gokhale, AA; Kandoi, S; Grabow, LC; Dumesic, JA; Mavrikakis, M; Chorkendorff, I. 2005. Trends in low-temperature water-gas shift reactivity on transition metals. JOURNAL OF CATALYSIS 229 (2): 265-275.

Publications (continued)

Sorensen, RZ; Nielsen, LJE; Jensen, S; Hansen, O; Johannessen, T; Quaade, U; Christensen, CH. 2005. Catalytic ammonia decomposition: miniaturized production of COx-free hydrogen for fuel cells. CATALYSIS COMMUNICATIONS 6 (3): 229-232.

Thomsen, K. 2005. Modeling electrolyte solutions with the extended universal quasichemical (UNIQUAC) model. PURE AND APPLIED CHEMISTRY 77 (3): 531-542.

Uerdingen, E; Fischer, U; Gani, R; Hungerbuhler, K. 2005. A new retrofit design methodology for identifying, developing, and evaluating retrofit projects for cost-efficiency improvements in continuous chemical processes. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (6): 1842-1853.

Verdier, S; Andersen, SI. 2005. Internal pressure and solubility parameter as a function of pressure. FLUID PHASE EQUILIBRIA 231 (2): 125-137.

Verdier, S; Duong, D; Andersen, SI. 2005. Experimental determination of solubility parameters of oils as a function of pressure. ENERGY & FUELS 19 (4): 1225-1229.

von Solms, N; Michelsen, ML; Kontogeorgis, GM. 2005. Prediction and correlation of high-pressure gas solubility in polymers with simplified PC-SAFT. INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 44 (9): 3330-3335.

von Solms, N; Rubin, A; Andersen, SI; Stenby, EH. 2005. Directs measurement of high temperature/high pressure solubility of methane and carbon dioxide in polyamide (PA-11) using a high-pressure microbalance. INTERNATIONAL JOURNAL OF THERMOPHYSICS 26 (1): 115-125.

von Solms, N; Zecchin, N; Rubin, A; Andersen, SI; Stenby, EH. 2005. Direct measurement of gas solubility and diffusivity in poly(vinylidene fluoride) with a high-pressure microbalance. EUROPEAN POLYMER JOURNAL 41 (2): 341-348.

Wagner, MH; Kheirandish, S; Hassager, O. 2005. Quantitative prediction of transient and steady-state elongational viscosity of nearly monodisperse polystyrene melts. JOURNAL OF RHEOLOGY 49 (6): 1317-1327.

Winther-Jensen, B; Chen, J; West, K; Wallace, G. 2005. 'Stuffed' conducting polymers. POLYMER 46 (13): 4664-4669.

Winther-Jensen, B; Norrman, K; Kingshott, P; West, K. 2005. Characterization of plasma-polymerized fused polycyclic compounds for binding conducting polymers. PLASMA PROCESSES AND POLYMERS 2 (4): 319-327.

Winther-Jensen, B; West, K. 2005. Interpenetrating networks of two conducting polymers. SYNTHETIC METALS 148 (2): 105-109.

Yebra, DM; Kiil, S; Dam-Johansen, K; Weinell, C. 2005. Reaction rate estimation of controlled-release antifouling paint binders: Rosin-based systems. PROGRESS IN ORGANIC COATINGS 53 (4): 256-275.

Zbogar, A; Frandsen, FJ; Jensen, PA; Glarborg, P. 2005. Heat transfer in ash deposits: A modelling tool-box. PROGRESS IN ENERGY AND COMBUSTION SCIENCE 31: 1-51.

Zeberg-Mikkelsen, CK; Andersen, SI. 2005. Density measurements under pressure for the binary system 1-propanol plus toluene. JOURNAL OF CHEMICAL AND ENGINEERING DATA 50 (2): 524-528.

Zeberg-Mikkelsen, CK; Baylaucq, A; Watson, G; Boned, C. 2005. High-pressure viscosity measurements for the ethanol plus toluene binary system. INTERNATIONAL JOURNAL OF THERMOPHYSICS 26 (5): 1289-1302.

Zeberg-Mikkelsen, CK; Lugo, L; Fernandez, J. 2005. Density measurements under pressure for the binary system (ethanol plus methylcyclohexane). JOURNAL OF CHEMICAL THERMODYNAMICS 37 (12): 1294-1304.

Zeberg-Mikkelsen, CK; Lugo, L; Garcia, J; Fernandez, J. 2005. Volumetric properties under pressure for the binary system ethanol plus toluene. FLUID PHASE EQUILIBRIA 235 (2): 139-151.

Zheng, YJ; Jensen, AD; Johnsson, JE. 2005. Deactivation of V2O5-WO3-TiO2SCR catalyst at a biomass-fired combined heat and power plant. APPLIED CATALYSIS B-ENVIRONMENTAL 60 (3-4): 253-264.

Zhou, H; Jensen, AD; Glarborg, P; Jensen, PA; Kavaliauskas, A. 2005. Numerical modeling of straw combustion in a fixed bed. FUEL 84 (4): 389-403.

Reviewed Conference Proceedings
(published as monographs or as abstracts in journals)

Abildskov J; O'Connell, JP. 2005. Prediction of solubilities of complex medium-sized chemicals. Solutes in pure solvents, mixed solvents and cosolvent mixtures, Computer Aided Chemical Engineering 20: 217-223.

Andersen, N; Johansen, KS; Michelsen, M; Stenby, EH; Olsson, L. 2005. Mathematical modeling of enzymatic hydrolysis of cellulosic model substrates. Journal of Biotechnology 118: S131-S132, Suppl. 1.

Beck, J; Unterberger, S; Scheffknecht, G; Jensen, A; Zheng, Y; Johnsson, JE. 2005. The Effect of Biomass Co-Combustion on DeNOx catalysts. Proceedings of 2nd International Conference on Clean Coal Technology, Sardinia, Italy, 10-12 May.

Biran, S; Jensen, AD; Kiil, S; Bach, P; Simonsen, O. 2005. Determination of inactivation mechanism of enzymes in laundry detergents. Journal of Biotechnology 118: S96-S96, Suppl. 1.

Davidescu, FP; Jorgensen, SB. 2005. Grey-box modeling of continuous cultures of Aspergillus oryzae under oxygen limitation. Journal of Biotechnology 118: S99-S99, Suppl. 1.

Gani, R. 2005. Integrated Chemical Product-Process Design: CAPE Perspectives, Computer Aided Chemical Engineering 20: 21-30.

Gani, R. d'Anterroches, L. 2005. Novel Group Contribution Based Approach in Process Flowsheet Synthesis, Design and Modelling, Computer Aided Chemical Engineering 20: 643-648.

Geiker, MR; Thrane, LN; Szabo, P. 2005. Computational Modelling of SCC Flow. Proceedings SCC 2005: The Second North American Conference on the Design and Use of Self-Consolidating concrete (SCC) and the Fourth International RILEM Symposium on Self-Compacting Concrete 2: 1259-1264, 1 Edition.

Gernaey, K; Lind, M; Jørgensen, SB. 2005. Modelling for control: Understanding role and function of regulatory networks in microorganisms, Proceedings of 16th IFAC World Congress, Prague, Czech Republic, 3-8 July.

Gernaey, KV; Lind, M; Jorgensen, SB. 2005. Understanding role and function of regulatory networks in microorganisms. Journal of Biotechnology 118: S2-S3, Suppl. 1.

Huusom, JK; Jensen, AD; Jørgensen, SB; Michelsen, ML; Knudsen, JN; Recke, B; Jørgensen, JB. 2005. Modelling of Cement Grinding Circuits for Predictive Control. Proceedings of IFAC World Congress, Prague, Czech Republic, 3-8 July, on CD.

Hvilsted, S. 2005. Novel Functional Block Copolymer Avenues. Proceedings of European Polymer Congress, Moscow, Russia, 27 June – 1 July, p 31.

Kristensen, MR; Jørgensen, JB; Thomsen, PG; Michelsen, ML; Jørgensen, SB. 2005. Sensitivity Analysis in Index-1 Differential Algebraic Equations by ESDIRK Methods, Proceedings of 16th IFAC World Congress, Prague, Czech Republic, 3-8 July.

Lin, B; Recke, B; Renaudat, P; Knudsen, JN; Jørgensen, SB. 2005. A Systematic Approach for Soft Sensor Development. Computer Aided Chemical Engineering. 20: 1147-1152.

Lin, B; Recke, B; Renaudat, P; Knudsen, JN; Jørgensen, SB. 2005. Robust Statistics for Soft Sensor Development in Cement Kiln, Proceedings of 16th IFAC World Congress, Prague, Czech Republic, 3-8 July (CD-version)

Lohse, B; Ramanujam, PS; Hvilsted, S; Berg, RH. 2005. Photodimerization in substituted di- and oligopeptides by UV-light for optical data storage. Biopolymers 80 (4): 504-504.

Lohse, B; Ramanujam, PS; Hvilsted, S; Berg, RH. 2005. Photodimerization in substituted di- and oligopeptides by UV-light for optical data storage. Biopolymers 80 (4): 576-576.

Lopez-Arenas, MT; Sales-Cruz, M; Gani, R. 2005. Design and Operation of Copolymerisation Reactors through Modelling and Nonlinear Analysis, Computer Aided Chemical Engineering 20: 439-444.

Mladenovska, Z; Hartmann, H; Kvist, T. Sales-Cruz, M; Gani, R; Ahring, BK. 2005. Thermal treatment of the solid fraction of manure: Impact on the biogas reactor performance and microbial community, ADSW-2005, 1: 218-225.

Mollerup, JM. 2005. Modelling of the binding of ligands to macromolecules. Journal of Biotechnology 118: S47-S47, Suppl. 1.

Nordkvist, M.; Nielsen, P.M.; Budtz, P.; Villadsen, J. 2005. Lactobionic acid production using lactose oxidase. Journal of Biotechnology 118: S2107-S107, Suppl. 1.

Publications (continued)

Nordkvist, M.; Villadsen, J. 2005. Applications of rotary jet heads for mixing and mass transfer. Journal of Biotechnology 118: S35-S35, Suppl. 1.

Ramírez, E; Gani, R. 2005. Design and Control Structure Integration from a Model-Based Methodology for Reaction-Separation with Recycle Systems. Computer Aided Chemical Engineering, 20: 1519-1524.

Rasmussen, JK; Jørgensen, SB. 2005. Experimental Investigation of Data Driven Modelling for Control of Fed-Batch Cultivation, Proceedings of IFAC World Congress, Prague, Czech Republic, 3-8 July, on CD.

Rasmussen, JK; Jorgensen, SB. 2005. Modelling and control of industrial fermentation. Journal of Biotechnology 118: S39-S39, Suppl. 1.

Rasmussen, JK; Madsen, H; Jørgensen, SB. 2005. Modelling for Control of Industrial Fermentation, Computer Aided Chemical Engineering 20: 1351-1356.

Sales-Cruz, M; Gani, R; 2005, Short-Path Evaporation for Chemical Product Modelling, Analysis and Design, Computer Aided Chemical Engineering. 20: 841-846.

Soland, L; Jensen, AD; Nordkvist, M; Michelsen, M; Villadsen, J; Hobley, TJ. 2005. Study of liquid mixing in a pilot scale U-loop fermenter. Journal of Biotechnology 118: S50-S50, Suppl. 1

Suné, NM; Munir, A; Gani, R; Bell, G; Shirley, I. 2005. A framework for product analysis: Modelling and design of release and uptake of pesticides, Computer Aided Chemical Engineering 20: 733-738.

Other Publications

Abildskov, J. EFCE Bologna Recommendations, Chemical Engineering Research & Design (Trans IChemE), 83 1331-1334, 2005.

Abildskov, J; Gani, R. Recent Developments in the Modelling of Thermodynamic Properties for Computer-Aided Process and Product Engineering Applications. Gdansk, Poland, 1-5 June In: Proceedings of 21st European Symposium on Applied Thermodynamics, Gdansk, Poland, 1-5 June, 2005 (pp. 30-32)

Bonne, D; Jørgensen, SB. Multi-linear Control of Batch Processes – with guaranteed convergence. Proceedings of International Workshop on Assessment and Future Directions of Nonlinear Model Predictive Control, Freudenstadt-Lauterbad, Germany, 26-30 August 2005, pp 391-398.

d'Anterroches, L; Gani, R. The Reverse Approach for Synthesis and Design of Chemical Products & Processes. Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

d'Anterroches, L; Gani, R; Harper, PM; Hostrup, M. Design of Molecules, Mixtures and Processes through a Novel Group Contribution Method. Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

Gani, R; Jensen, R. Generation and Evaluation of Sustainable Process Alternatives for Improved Safety using an Integrated Computer Aided System, Proceedings of 2nd Annual International Conference on Environmental Problems, Theory of Sustainable Development & Management Systems, Bialystok, Poland, 2005 (pp 115-120).

Gani, R; Jørgensen, SB; Jensen, N. Design of Sustainable Processes: Systematic Generation & Evaluation of Alternatives. Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

Gani, R; Suné, NM; Munir, A; Bell, G; Shirley, I; Siemanond, K. A Computer Aided Framework for Efficient Formulation Design. Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

Hindiyarti, L; Frandsen, F; Livbjerg, H; Glarborg P; Influence of Potassium Chloride on Moist CO Oxidation under Reducing Conditions: Experimental and Kinetic Modeling Study; Proc. 1st Baltic Combustion Meeting, Warsaw, Nov. 2005, (pp 129-132).

Huusom, JK; Bonne, DP; Kjølstad, N; Jørgensen, SB. Process Identification Challenges for Nonlinear Model Predictive Control. Proceedings of International Workshop on Assessment and Future Directions of Nonlinear Model Predictive Control, Freudenstadt-Lauterbad, Germany, 26-30 August 2005, pp. 451-458.

Hvilsted, S; Jankova, K.Novel Fluoropolymer Materials. Recent Perspectives by Atom Transfer Radical Polymerization, Proceedings of 17th Winter Fluorine Conference, 2005 (pp 44-44).

Jensen, N; Abildskov, J; Gani, R. Modelling of Acute Exposure Guideline Levels using Group Contribution Methods, Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

Jonsson, GE. Fractionation of macromolecules by dynamic ultrafiltration, Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

Jørgensen, K: Jensen, A; Bach, P; Dam-Johansen, K. Effect of formulation ingredients on drying kinetics and morphology of particles formed during spray drying. Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

Kouskoumvekaki, E; Abildskov, J. Modeling of Active Ingredient Loading in Microparticle Controlled-Delivery Systems. Proceedings of 21st European Symposium on Applied Thermodynamics, Gdanks, Poland, 1-5 June 2005 (pp 116-119).

Lin, B; Recke, B; Knudsen, JN; Jørgensen, SB. Robust Statistics for Soft Sensor Development, Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

Lopez-Arenas, MT; Sales-Cruz, M; Gani, R. Nonlinear behaviour Analysis for Design and Operation of Copolymerisation Reactors, Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

Nordkvist, M; Nielsen, PM; Xu, F; Villadsen, J. Enzymatic carbohydrate transformation for the dairy industry. Proceedings of American Chemical Society Annual Meeting Washington D.C., USA, 2005.

Rasmussen, CL; Rasmussen, AE; Glarborg, P; The Sensitizing Effect of NOx on CH4 Oxidation at High Pressure. – Experimental and Modeling Investigation; Proc. 1st Baltic Combustion Meeting, Warsaw, Nov. 2005 (pp 125-128).

Rasmussen, JK; Jørgensen, SB. Modelling and control of industrial fermentation, Proceedings of 7th World Congress of Chemical Engineering, Glasgow, Scotland, 10-14 July, 2005 (CD-version).

Thomsen, K; Vu, DT; Stenby, M; Jensen, JP; Simonsen, P; Sander, B. Leaching of nutrient salts from fly ash from biomass combustion. Protection. Proceedings from 14th European Conference and Technology Exhibition on Biomass for Energy, Industry and Climate Protection, Paris, France, 2005.

Thrane, LN; Pade, C. Determination of Bingham Rheological Parameters of SCC using On-line Video Image Analysis of Automatic Slump Flow Testing. Proceedings of Nordic Concrete Research: Proceedings Nordic Concrete Research Meeting, Sandefjorg, Norway, 2005 (pp. 92-94).

Thrane, LN; Szabo, P; Geiker, MR; Stang, H; Pade, C. Simulation and Verificaiton of Flow in Test Methods. Proceedings of The Second North American Conference on the Design and Use of Self-Consolidating Concrete (SCC) and the fourth International RILEM Symposium on Self-Compacting Concrete 1: 551-556, 2005.

Villadsen, J. Large Scale BioProcesses – an educational and a technological challenge, 12th Mercosur Conference, 2005

Publications (continued)

Departmental Reports

Andersen, BR. Heat Integrated Distillation Pilot Plant Modelling for Revealing Nonlinear Behaviours, Internal Report, CAPEC-KT, 1-44, 2005

Andersen, BR; Jørgensen, JB; Jørgensen, SB. U-Loop Reactor Modelling for Optimization – Part I: Estimation of Heat Loss, Department Report, 1-40, 2005.

Andersen, BR; Jørgensen, JB; Jørgensen, SB. U-Loop Reactor Modelling for Optimization – Part II: Mass Transfer, Internal Report, CAPEC-KT, 1-47, 2005.

Bonné, D; Jørgensen, JB; Jørgensen, SB. A procedure for guaranteed in Control experimental design, Internal Report, CAPEC-KT, 2005

Gani, R; Jørgensen, SB. CAPEC Research Report 2005, Internal Report, CAPEC-KT, 2005.

Jensen, PA; Sørensen, LH; Hu, G; Holm, JK; Frandsen, FJ; Henriksen, UB. Combustion experiments with biomass fuels and additives in a suspension fired entrained flow reactor - Test of Ca and P rich additives used to minimize deposition and corrosion, Internal report, CHEC-KT, 1-102, 2005.

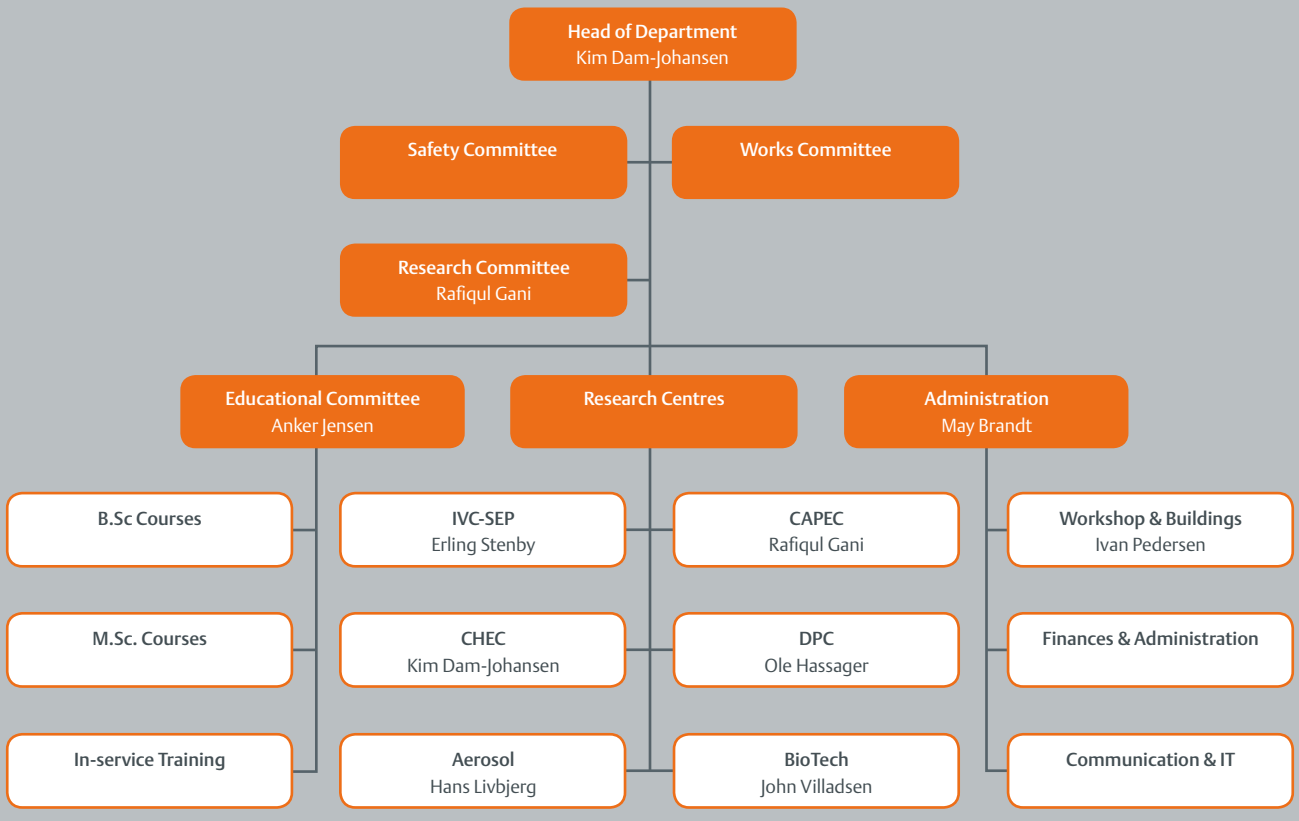
Jørgensen, SB. Operability for Mass and Energy Integrated Process Plants (OPERA), Internal Report, CAPEC-KT, 2005.

Lin, W. NO emissions from combustion of wood and in swirl burners – A literature survey, Internal Report, CHEC-KT, 1-57, 2005.

Zheng, Y; Jensen, AD; Johnsson, JE. SEM-EDX Analysis of exposed SCR Catalysts, Internal Report, CHEC-KT, 2005.

Zhou, H; Jensen, JD; Glarborg, P. Mechanisms of NO Formation and reduction in fixed-bed combustion of straw, Internal Report CHEC-KT, 1-64, 2005

Organization



Advisory Board

The Advisory Board members (From the top, left to right): Lars Bang, H. Lundbeck A/S; Kim Dam-Johansen, DTU; Allan Skov, Cheminova A/S; Per Falholt, Novozymes A/S; Kim Pandrup Christensen, F.L. Smidth A/S and Bjerne Clausen, Haldor Topsøe A/S

Student Committee

Student Committee (from left to right): Peter Tybjerg; Martin Ellegaard Christensen; Stine Justesen; Jacob Brix; Mette Krog Jensen; Martin Hagsted Rasmussen

Staff

Name	Profession	e-mail
Abildskov, Jens	Associate Professor	ja@jkt.dtu.dk
Al-Jibbouri, Sattar	Research Assistant	
Andersen, Poul Valdemoar	Laboratory Technician	pva@kt.dtu.dk
Andersen, Simon Ivar	Associate Professor	
Andersen, Britta Rønde	Assistant Professor	bra@kt.dtu.dk
Andersen, Kristoffer	Trainee	
Andersen, Michael	Ph.D. Student	
Andreasen, Anders	Ph.D. Student	
Andric, Pavle	Ph.D. Student	pan@kt.dtu.dk
Ascanius, Birgit Elkjær	Project Coordinator	bea@kt.dtu.dk
Bagger-Jørgensen, Rico	Research Assistant	
Bech, Niels	Ph.D. Student	nsb@kt.dtu.dk
Beckerslev, Bente	Laboratory Technician	
Beier, Søren	Ph.D. Student	spb@kt.dtu.dk
Bentsen, Bjarne	Assistant	bb@kt.dtu.dk
Biede, Anne Louise	Secretary	alb@kt.dtu.dk
Biran, Suzan	Ph.D. Student	sbj@kt.dtu.dk
Bjerkvig, Jens	Research Assistant	
Blaakilde, Ruth	Laboratory Assistant	rbl@kt.dtu.dk
Boisen, Astrid	Ph.D. Student	
Bonde, Jacob	Research Assistant	
Bonne, Dennis	Postdoc.	
Brandt, May	Head of Administration	mb@kt.dtu.dk
Brandt, Philip W.	Project Coordinator	
Breil, Martin Peter	Postdoc.	mpb@kt.dtu.dk
Brendstrup, Henrik	Workshop Assistant	
Buchardt, Christian N.	Research Assistant	
Bøjer, Martin	Research Assistant	mbo@kt.dtu.dk
Carlsson, Christian Ove	IT-Coordinator	cc@kt.dtu.dk
Castellino, Francesco	Ph.D. Student	frc@kt.dtu.dk
Chakraborty, Debasish	Ph.D. Student	dc@kt.dtu.dk
Chorkendorff, Ib	Professor	ic@kt.dtu.dk
Chrisatis, Theodorakis E.	Assistant Engineer	
Christensen, Lone	Secretary	lc@kt.dtu.dk
Christensen, Henrik	Ph.D. Student	hc@kt.dtu.dk
Christensen, Steen	Ph.D.-Student	sch@kt.dtu.dk
Clement, Karsten Hartvig	Professor	khc@kt.dtu.dk
D´ Anterroches, Loic	Research Assistant	loa@kt.dtu.dk
Dall'Ora, Michelangelo	Ph.D. Student	mid@kt.dtu.dk
Dam-Johansen, Kim	Professor, Head of Department	kdj@kt.dtu.dk
Dang, Tran Thoung	Laboratory Technician	dt@kt.dtu.dk
Davidescu, Florin Paul	Ph.D. Student	fpd@kt.dtu.dk
Degn, Lisbeth	Secretary	ld@kt.dtu.dk
Drews, Joanna Maria	Ph.D. Student	jmd@kt.dtu.dk
Eenschooten, Diane Corinne	Ph.D. Student	cre@kt.dtu.dk
Egholm, Runi Ditlev	Ph.D. Student	rde@kt.dtu.dk
Elmøe, Tobias Dokkedal	Ph.D. Student	tde@kt.dtu.dk
Enevoldsen, Ann Dorrit	Ph.D. Student	ade@kt.dtu.dk
Folas, Georgios	Ph.D. Student	gf@kt.dtu.dk

Staff (continued)

Name	Profession	e-mail
Fosbøl, Philip Fosbøl	Ph.D. Student	plf@kt.dtu.dk
Frandsen, Flemming	Associate Professor	ff@kt.dtu.dk
Fredenslund, Ellen	IT-Coordinator	ef@kt.dtu.dk
Gabrielsen, Jostein	Ph.D. Student	jog@kt.dtu.dk
Gani, Rafiqul	Professor	rag@kt.dtu.dk
Gernaey, Krist Victor Bernard	Associate Professor	kvg@kt.dtu.dk
Glarborg, Peter	Associate Professor	pgl@kt.dtu.dk
Gonzalez, Hugo Edson	Ph.D. Student	heg@kt.dtu.dk
Hansen, Bente	Secretary	bh@kt.dtu.dk
Hansen, Brian Brun	Ph.D. Student	bbh@kt.dtu.dk
Hansen, Jan Horne	Assistant Engineer	jhh@kt.dtu.dk
Hansen, Jørn	Mechanical Engineer	jha@kt.dtu.dk
Hansen, Natanya Majbritt	Ph.D. Student	nha@kt.dtu.dk
Hansen, Thomas Steen	Ph.D. Student	tsh@kt.dtu.dk
Hassager, Ole	Professor	oh@kt.dtu.dk
Hede, Dybdahl Peter	Ph.D. Student	pdh@kt.dtu.dk
Hindiyarti, Lusi	Ph.D. Student	lh@kt.dtu.dk
Hindsgaul, Claus	Ph.D. Student	chi@kt.dtu.dk
Holgersen, Lilian Beenfeldt	Laboratory Technician	lbh@kt.dtu.dk
Hostrup, Hanne	Research Assistant	
Hu, Guilin	Ph.D. Student	gh@kt.dtu.dk
Hua, Ling	Ph.D. Student	lih@kt.dtu.dk
Huusom,Jakob Kjøbsted	Ph.D. Student	jkh@kt.dtu.dk
Hvilsted, Søren	Professor	sh@kt.dtu.dk
Jankova Atanassova, Katja	Associate Professor	kaj@kt.dtu.dk
Jensen, Anker	Associate Professor	aj@kt.dtu.dk
Jensen, Hjørdis	Financial Officer	
Jensen, Niels	Associate Professor	nj@kt.dtu.dk
Jensen, Peter Arendt	Associate Professor	paj@kt.dtu.dk
Johannessen, Jens Tue	Associate Professor	tj@kt.dtu.dk
Johansen, Johnny	Ph.D. Student	joj@kt.dtu.dk
Johansen, Kent	Ph.D. Student	kej@kt.dtu.dk
Johnsson, Jan Erik	Professor	jej@kt.dtu.dk
Jonsson, Gunnar Eigil	Associate Professor	gj@kt.dtu.dk
Juul, Anne Helene	Secretary	ahj@kt.dtu.dk
Jørgensen, Sten Bay	Professor	sbj@kt.dtu.dk
Jørgensen, Kåre	Ph.D. Student	
Kiil, Søren	Associate Professor	sk@kt.dtu.dk
Kiørboe, Lars Georg	Chief Consultant	lgk@kt.dtu.dk
Kjellander, Carina Koch	Ph.D. Student	
Kofod, Annelise Lerche	Adm. Coordinator	alk@kt.dtu.dk
Koldbech, Henning Vitus	Assistant Engineer	hk@kt.dtu.dk
Kontogeorgis, Georgios M.	Associate Professor	gk@kt.dtu.dk
Kouskoumvekaki, Eirini	Assistant Professor	
Kristensen, Morten Rode	Ph.D. Student	
Krogh, Anne Rovik	Ph.D. Student	ak@kt.dtu.dk
Krogshede, Lene	Secretary	lkr@kt.dtu.dk
Kustov, Arkady	Assistant Professor	
Køhler, Rikke	Research Assistant	

Name	Profession	e-mail
Lang, Todd	Assistant Professor	
Larsen, Erik Kjær	Web-editor	ekl@kt.dtu.dk
Larsen, Morten Boberg	Industrial Ph.D.	mbl@kt.dtu.dk
Larsen, Thomas Ølholm	Ph.D. Student	tol@kt.dtu.dk
Kampman, Lennart	Financial Officer	lk@kt.dtu.dk
Laursen, Jens Lolle	Ph.D. Student	
Liljekrans, Kim	Assistant	
Lin, Weigang	Associate Professor	wl@kt.dtu.dk
Lin, Bao	Assistant Professor	bal@kt.dtu.dk
Livbjerg, Hans	Associate Professor	hl@kt.dtu.dk
Lohse, Brian	Ph.D. Student	
Lundgård Jensen, Bente	Laboratory Technician	bl@kt.dtu.dk
Lungaae-Jørgensen, Jørgen	Professor	
Madsen, Birgitte	Research Assistant	
Madsen, Lars Dam	Research Assistant	
Madsen, Robert Emil	Technician	
Madsen, Søren Vestergaard	Assistant Engineer	svm@kt.dtu.dk
Michelsen, Michael Locht	Associate Professor	mlm@kt.dtu.dk
Mikkelsen, Eva	Secretary	eva@kt.dtu.dk
Mitkowski, Piotr Tomasz	Ph.D. Student	ptm@kt.dtu.dk
Mitra, Susanta	Ph.D. Student	
Moiraghi, Laura	Research Assistant	
Mollerup, Jørgen	Associate Professor	jm@kt.dtu.dk
Monsalvo, Matias Alfonso	Ph.D. Student	mmo@kt.dtu.dk
Mortensen, Martin Nordvig	Ph.D. Student	mnm@kt.dtu.dk
Muro Suné, Nuria	Research Assistant	nms@kt.dtu.dk
Møller, Lars Siewers	Technician	lsm@kt.dtu.dk
Nielsen, Jeanne	Trainee	
Nielsen, Jens Kromann	Ph.D. Student	jkh@kt.dtu.dk
Nørby, Carsten	Mechanical Engineer	cn@kt.dtu.dk
Olsen, Erik Vang	Financial Officer	evo@kt.dtu.dk
Olsen, Stefan Møller	Ph.D Student.	sto@kt.dtu.dk
Overgaard, Anne Katrine Kattenhøj	Ph.D. Student	ako@kt.dtu.dk
Pedersen, Ivan Horst	Head of Workshop	ip@kt.dtu.dk
Pedersen, Kim Vestergaard	Ph.D. Student	kvp@kt.dtu.dk
Perriard, Ruddi W.	Laboratory Technician	rwp@kt.dtu.dk
Petersen, Karin	Laboratory Controller	kp@kt.dtu.dk
Petersen, Trine Lütken	Ph.D. Student	tlp@kt.dtu.dk
Poulsen, Jens Henry	Assistant Engineer	jhp@kt.dtu.dk
Ramirez, Jiménez Edgar	Ph.D. Student	
Rasmussen, Christian Lund	Ph.D. Student	clr@kt.dtu.dk
Rasmussen, Anja Egede	Research Assistant	
Rasmussen, Jan Kamyno	Ph.D. Student	jkr@kt.dtu.dk
Sales-Cruz, Alfonso Mauricio	Ph.D. Student	msc@kt.dtu.dk
Schultz, Lars	Research Assistant	
Shapiro, Alexander	Associate Professor	ash@kt.dtu.dk
Sharipour, Graziella Le Bars	Assistant	gs@kt.dtu.dk
Skjøth Ambelas, Anne	Financial Officer	aas@kt.dtu.dk

Staff (continued)

Name	Profession	e-mail
Skjøth-Rasmussen, Martin Skov	Assistant Professor	
Sloth, Jakob	Ph.D. Student	
Soltani, Alinaghi	Assistant	
Soni, Vipasha	Ph.D. Student	vso@kt.dtu.dk
Stenby, Erling Halfdan	Professor	ehs@kt.dtu.dk
Szabo, Kim Chi	Laboratory Technician	kcs@kt.dtu.dk
Szabo, Peter	Associate Professor	ps@kt.dtu.dk
Szewczykovski, Piotr	Ph.D. Student	pps@kt.dtu.dk
Sørensen, Niklas Schacht	Assistant Engineer	ns@kt.dtu.dk
Tecle, Zacarias	Laboratory Technician	zt@kt.dtu.dk
Theil, Vibeke	Secretary	vt@kt.dtu.dk
Thomsen, Kaj	Associate Professor	kth@kt.dtu.dk
Tihic, Amra	Ph.D. Student	amt@kt.dtu.dk
Van Lith, Simone Cornelia	Research Assistant	sl@kt.dtu.dk
Verdier, Sylvain	Ph.D. Student	syv@kt.dtu.dk
Vigild, Martin Etchells	Associate Professor	mev@kt.dtu.dk
Villadsen, John	Professor	jv@kt.dtu.dk
Villafafila Garcia, Ada	Ph.D. Student	
Von Solms, Nicolas	Associate Professor	nvs@kt.dtu.dk
Vu, Duc Thoung	Engineer	duc@kt.dtu.dk
Wang, Yanwei	Ph.D. Student	
Wedel, Stig	Associate Professor	sw@kt.dtu.dk
Yebra Meseguer, Diego	Ph.D. Student	
Yi, Lin	Ph.D. Student	yil@kt.dtu.dk
Yilmaz, Ayten	Ph.D. Student	ayt@kt.dtu.dk
Zeuthen, Frederik Jacob	Ph.D. Student	
Zhelezny, Petr	Assistant Professor	
Zheng, Yuanjing	Engineer	yjz@kt.dtu.dk
Zhou, Haosheng	Assistant Professor	zh@kt.dtu.dk

Guests

Name	Date
Agosin, Eduardo	Guest Professor
Andersen, Natalija	Ph.D. Student
Ferreira, Louisa	Guest Researcher
Forcèn, Patricia	Ph.D. Student
Grenner, Andreas	Guest Researcher
Hupa, Mikko	Guest Professor
Iborra Junquera, Vrani	Ph.D. Student
Karakatsan, Eirini	Ph.D. Student
Le Bert, Brice	Guest Researcher
Pedersen, Jesper Møller	Ph.D. Student
Vahid, Amir	Guest Researcher
Wesselingh, Johannes A.	Guest Professor

Ph.D. completed

Name	Date
Andersen, Michael	02.12.05
Bonné, Dennis	27.05.05
d'Anterroches, Loic	28.10.05
Garcia, Ada Villafafila	25.11.05
Jimènez, Edgar Ramirez	11.10.05
Jørgensen, John Bagterp	28.04.05
Jørgensen, Kåre	06.10.05
Lith, Simone Van	18.11.05
Medvedev, Oleg	31.01.05
Mitra, Susanta	14.06.05
Nygaard, Helle	13.12.05
Papaeconomou, Irene	06.12.05
Suné, Núria Muro	20.09.05
Thaysen, Mads	22.12.05
Yebra, Diego M.	30.08.05

The faculty


Jens Abildskov
Assosiate Professor


Simon Ivar Andersen
Assosiate Professor


Ib Chorkendorff
Professor


Karsten H. Clement
Reader


Kim Dam-Johansen
Professor, Head of Dept.


Rafiqul Gani
Professor


Krist V. B. Gernaey
Assosiate Professor


Peter Glarborg
Assosiate Professor


Ole Hassager
Professor


Søren Hvilsted
Research Manager


Anker D. Jensen
Assosiate Professor


Niels Jensen
Assosiate Professor


Tue Johannesen
Assosiate Professor


Jan Erik Johnsson
Professor


Gunnar Jonsson
Assosiate Professor


Sten Bay Jørgensen
Professor


Søren Kiil
Assosiate Professor


Georgios M. Kontogeorgis
Assosiate Professor


Hans Livbjerg
Assosiate Professor


Jørgen Lyngaae-
Jørgensen, Professor


Michael L. Michelsen
Reader


Jørgen Mollerup
Reader


Alexander A. Shapiro
Assosiate Professor


Nicolas Von Solms
Assosiate Professor


Erling H. Stenby
Professor

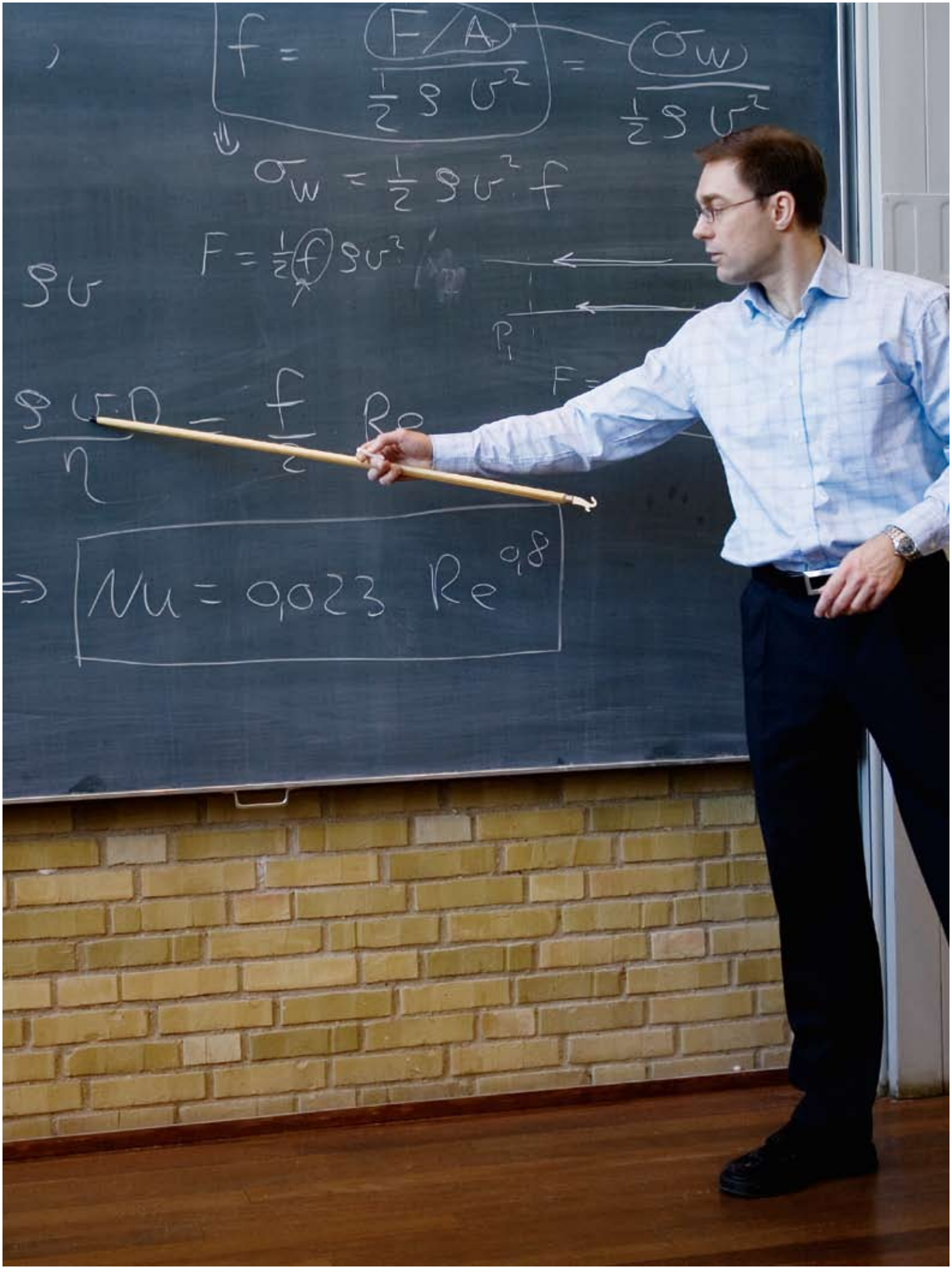

Peter Szarbo
Assosiate Professor

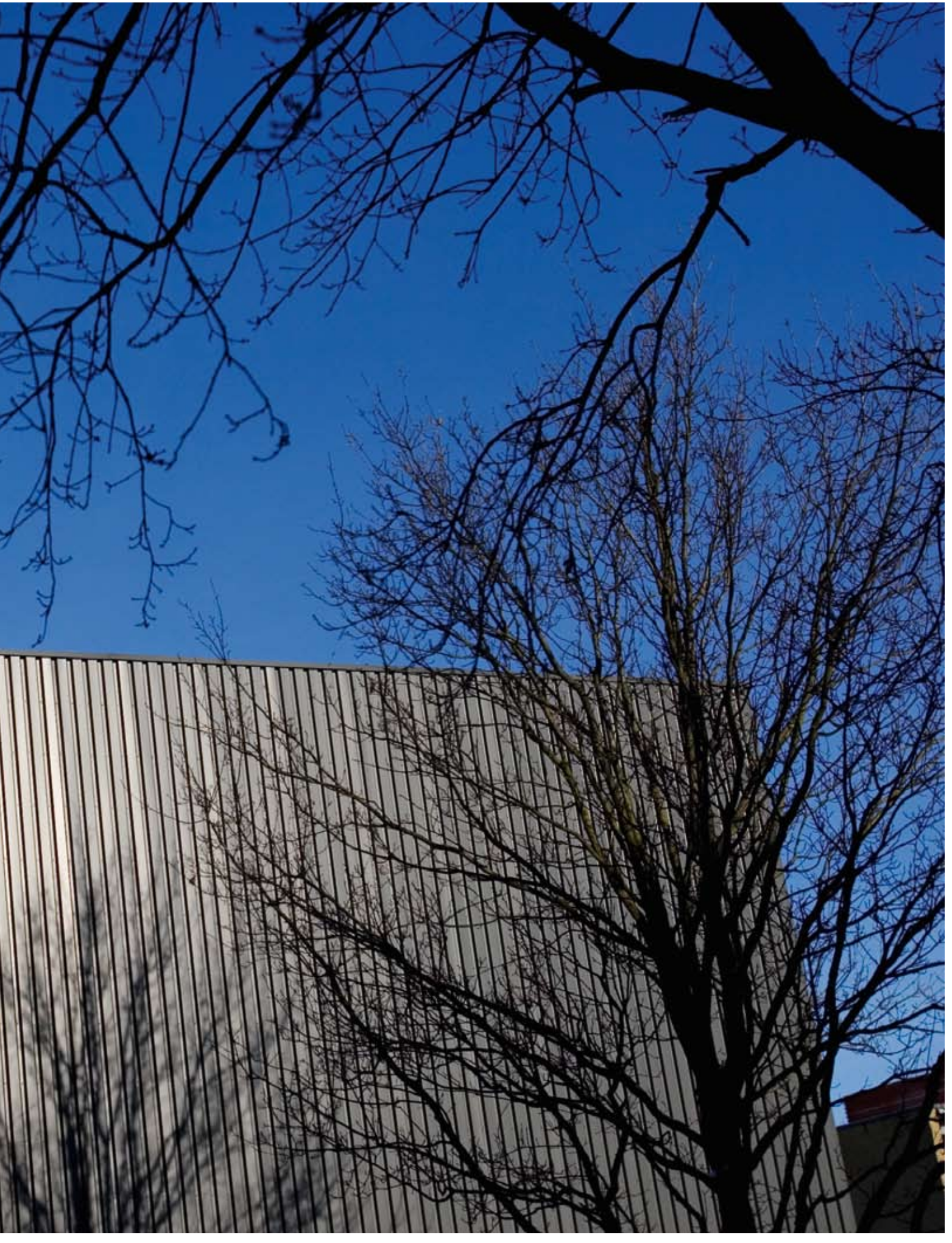

Kaj Thomsen
Assosiate Professor


Martin E Vigild
Assosiate Professor


John Villadsen
Professor


Stig Wedel
Assosiate Professor


f = (F/A) / (½ ρ v²) = σw / (½ ρ v²)
σw = ½ ρ v² f
F = ½ f ρ v²
Nu = 0,023 Re^0,8




Department of Chemical Engineering
Administration, offices, DTV cafeterias, Student House
Departments/centre
Auditoriums
Oticon Hall
Halls of residence/shared facilities
SCION.DTU
Physical Plant
Parking
Bus stop
15
LUNDTOFTE
HJORTEKÆR
Helsingør
Nordvej
Miljøvej
Knudth-Winterfeldts Allé
Rævehøjvej
Studenter-torvet
Oticonsalen
Bygnings-torvet
Lundtoftegårdsvej
Helsingørmotorvejen
Kolonnevej
Henrik Dams Allé
Lundtoftevej
Kemitorvet
Kemitallevej
Anker Engelunds Vej
Villum Kann Rasmussen Kollegiet
Matematik-torvet
Fysikvej
Elektrovej
Richard Petersens Plads
Vandtårne
SCION.DTU Forskerpark
Vagn AA Jeppesens Vej
DPC.DTU
Produktions-torvet
Kollegiebakken
Kampsax Kollegiet
Børneinstitution og gæsteboliger
E47
E55
William Demant Kollegiet
Diplomvej
Akademivej
Ole Nørgaards Have
Ørsteds plads
Asmussens Allé
Niels Koppels Allé
Colbjørnsensvej
Ålandsvej
Til KGS. Lyngby station
16
KGS LYNGBY
KLAMPENBORG
Lyngbygårdsvej
Klampenborgvej
København

Useful information

This Annual Report 2005 may be ordered from the reception at the Department of Chemical Engineering, DTU

Also Available on www.kt.dtu.dk

Department of Chemical Engineering
Technical University of Denmark, DTU
Søltofts Plads, Building 229
DK-2800 Kgs. Lyngby, Denmark

Phone +45 4525 2800
Fax +45 4588 2258
e-mail informationen@kt.dtu.dk
Web www.kt.dtu.dk

Chemistry at work

Combustion and Harmful Emission Control
Phase Equilibria and Separation Processes
Computer Aided Process Engineering
BioChemical Engineering
Danish Polymer Centre
Aerosol Technology