

Two years as the Centre of Excellence

In PCG we combine basic science with process chemistry and technology.

The Process Chemistry Group has now been active as a Centre of Excellence for two years. We still have four years remaining, but by the end of this year the scientific board will evaluate our achievements with respect to the goals the Academy of Finland has set for us.

We recently did a **SWOT** analysis of our Group. The main **Strength** is how we combine basic science with process chemistry and technology resulting in a creative and novel research approach: Molecular Process Technology. Another strong point is the dedication of the team members to work for the common goal. The high quality of the senior researchers is also of significant importance.

The rather short term appointments of the research personnel, due to the structure of mainly project based financing, creates instability in the teams and hurts the long term research goals. This was considered as one of the **Weaknesses**.

The **Opportunities** are many and it is of great importance to make most of them. The increasing importance of biotechnology and biomaterials combined with our knowledge in process chemistry and technology could lead to entirely new concepts of production and novel products. Increasing use of information and communication technology would certainly be beneficial in our areas of research. To give more



Prof. Ari Ivaska is the leader of the Process Analytical Chemistry team within PCG.

responsibility to the senior and junior team members in organization and management of the projects and of PCG activity in general would activate the entire group. We also have the opportunity to become a strong research centre, attracting industries already in Finland and even making Finland an attractive alternative for companies when considering locations for their research and production activities.

One of the **Threats** is that PCG would become too large. The activity might become too broad and less focused. The general image of chemistry and the chemical industry is, at the moment, not positive and the existence and even survival of relevant industry in Finland is in no way guaranteed.

In PCG we have a strong belief in the future of our Centre of Excellence.

Prof. Ari Ivaska

*Member of the PCG Executive Board
e-mail: Ari.Ivaska@abo.fi*



Join the Åbo Akademi Process Chemistry Group?

The European Commission has appointed the ÅA PCG to be a Marie Curie Training Site with 8 fellowship positions in 2002-2005. The training program provides young researchers pursuing doctoral studies in EU Member states the possibility to expand their knowledge of chemistry oriented chemical engineering. Check www.abo.fi/instut/pcg for information about applications and scientific topics.

The Finnish Chemical Industry Innovation Award 2001 to PCG

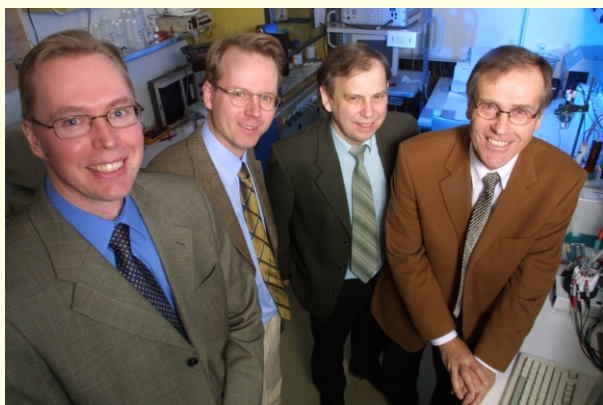


Photo: Juha Rauhkonen

Happy Award winners Johan Bobacka, Tom Lindfors, Andrzej Lewenstam and Ari Ivaska (from left). Jan Öst is missing in the picture.

A step towards intelligent chemical sensors - The Finnish Chemical Industry Innovation Award 2001 granted to sensors based on the solid-contact concept.

Just as our five senses keep us continually informed about our environment, chemical sensors can recognise chemical substances and measure their concentrations. Through the innovative work of a research group within the PCG group, sensors have been made more reliable and easier to use. A significant step has been taken in the development of intelligent chemical sensors. The Finnish Chemical Industry Innovation Award 2001 has been

granted to the group for its innovation.

The employment of **conducting polymers** in chemical sensors is the novel idea recognised in the presentation of the Finnish Chemical Industry Innovation Award 2001. The concept was developed by a group consisting of Prof. **Ari Ivaska**, Prof. **Andrzej Lewenstam**, Doc. **Johan Bobacka**, Dr. **Tom Lindfors** and M.Sc. **Jan Öst**. The Award was officially presented to the Group on 13 November 2001 in connection with the KEMIA Finnish Chemical Congress and Exhibition in Helsinki.

The Chemical Industry Innovation Award is presented annually in recognition of a promising chemical innovation that has practical applications. The Award carries a prize of EUR 10 000. In its decision to reward the Group, the Scientific Advisory Board of the Chemical Industry Federation took special note of the ingenuity of the innovation, the broad potential for commercialisation, the demonstrated profound understanding of chemistry of conducting polymers and co-operation with industry. The objective of the Innovation Award is to encourage research-oriented innovation, to advance commercialisation and to promote new enterprise in the chemical sector.

Major New PCG Projects

- **Ammonore (Advanced nanostructured metal/metaloxo/matrix catalysts for NO_x reduction to nitrogen)**, 1.1.02-31.12.04, financed by EU, six international research partners. Project co-ordinator: J. Heyrovsky Institute of Physical Chemistry (Prague) / Information: Lars-Eric.Lindfors@abo.fi
- **C-TMP Process Chemistry**, 1.10.01-30.9.03, financed by Tekes (National Technology Agency), Kemira, M-real, StoraEnso and UPM-Kymmene. Research part: Helsinki University of Technology/Pulping Technology. Information: Bjarne.Holmbom@abo.fi
- **Distribution and reactions of metal ions at bulk and fiber level in oxygen (peroxide) delignification and chelation**, 1.8.01-31.7.03, financed by Tekes, Andritz, Kemira, M-real, StoraEnso and UPM-Kymmene. Information: Ari.Ivaska@abo.fi
- **Improvement of fuel cell performance**, 1.1.-31.12.02, financed by Tekes. Research part.: Universidad de Alicante, Helsinki University of Technology (HUT), VTT Processes. Project co-ord.: HUT / Information: Mikael.Bergelin@abo.fi
- **Maximum biomass use and efficiency in large-scale co-firing**, 1.1.02-30.6.04, financed by EU, five international research partners. Project co-ord.: VTT Processes (Finland) / Information: Bengt-Johan.Skrifvars@abo.fi
- **Nano Chemistry**, 1.8.01-31.7.04, financed by Tekes. Research part.: Helsinki University of Technology, Tampere University of Technology, University of Helsinki and University of Jyväskylä. Information: Ari.Ivaska@abo.fi
- **Process intensification**, 31.8.01-31.12.03, financed by Tekes (National Technology Agency). Research part.: Lappeenranta University of Technology (LUT), Kemira, Outokumpu and KCL. Project co-ord.: Ilkka Turunen (LUT) / Information: Tapio.Salmi@abo.fi
- **Production and characterization of calcium phosphate materials**, 1.11.01-31.12.02, financed by Tekes. Research part.: Turku Center for Biomaterials, University of Turku (UT) (Biomaterials Research and the Departments of Medical Biochemistry and Anatomy). Project co-ord.: UT / Information: Heimo.Ylänen@abo.fi

Best Chemical Engineering Thesis in Finland 2000-2001

Maritta Kymäläinen's Doctoral Thesis "Fate of Nitrogen in the Recovery Cycle of a Kraft Pulp Mill" was named the Best Thesis work in Finland in 2000-2001. The prize was awarded by the Chemical Engineering Society of Finland on October 4, 2001.

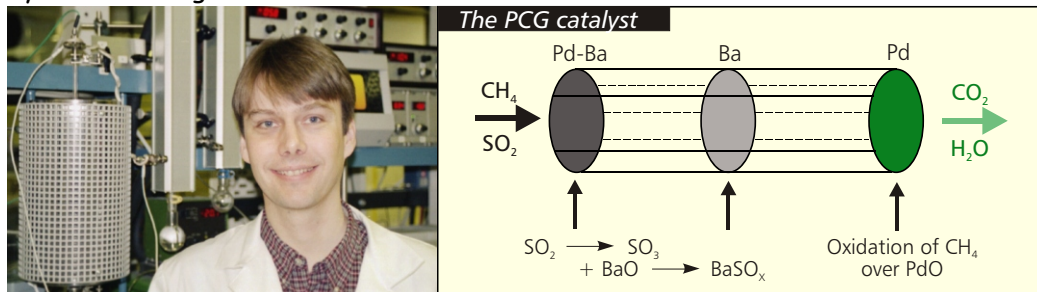
The Finnish Society of Chemical Engineers granted its biannual Prize to Maritta Kymäläinen for her Doctoral Thesis finished at the Åbo Akademi Process Chemistry Group in 2001. The Prize is awarded every second year to the best Licentiate or Doctoral Thesis in Finland during the past two years. This time the Prize was given to two theses, Maritta's being one of them.

Maritta's thesis work deals with the fate of nitrogen species in the chemical recovery process of pulp mills. She identified for the first time the previously unknown nitrogen species in the black liquor recovery boiler smelt. She studied its conversion to ammonia in the white liquor preparation processes, and followed the fate of this ammonia in the rest of the recovery cycle. The work is of vital importance to air pollution control in pulp mills.

Kymäläinen, M., Fate of nitrogen in the chemical recovery cycle of a Kraft pulp mill, Combustion and Materials Chemistry Group Report 01-06, ISBN 952-12-0830-9, Åbo Akademi 2001.

PCG catalyst contributes to cleaner air

by Fredrik Klingstedt



The use of alternative energy resources such as wood residuals, natural- and biogas are becoming increasingly attractive due both to economic factors and low CO₂ emissions. This research recently resulted in a doctoral thesis by Fredrik Klingstedt.

The stable methane molecule is one of the main constituents in the emissions released from both natural gas driven vehicles and the combustion of wood (biofuels). This motivated a joint development of palladium-supported catalysts suitable for these applications. It is widely accepted that palladium catalysts offer the highest activity for the removal of methane

emitted from various sources. Sulphur poisoning and thermal decomposition of palladium, however, limit the use of Pd supported on e.g. alumina.

The researchers of the PCG Kinetics and Catalysis team have within the framework of two EU-funded projects "Use of Natural Gas in Passenger Cars - Components for Bifuel Vehicles" and "Abatement of Emissions from Small Scale Combustion of Biofuels", developed novel, hydrothermally stable, and poison resistant catalysts for exhaust after-treatment.

E-mail: Fredrik.Klingstedt@abo.fi

Visitors

- Dr. Mahesh K. Dalal, *Dishman*, India, 1.10.2001-28.2.2002
- Dr. Pedro Fardim, *Universidade Estadual de Campinas*, Brazil, from 1.3.2000
- Dr. Nicolas Leroy, *EFPG, Grenoble*, France, from 15.3.2002
- Prof. Qin Menghua, *Shandong Institute of Light Industry*, China, 1.5.2001-30.6.2002
- Dr. Li Niu, *Changchun Institute of Applied Chemistry, Chinese Academy of Sciences*, China, from 1.2.1999
- Dr. Tomasz Sokalski, *Warsaw University*, Poland, from 1.2.2000

Recent Doctoral Theses

- Pia Damlin: "Electrochemical Polymerization of Poly(paraphenylen vinylene). An Electrochemical and Spectroelectrochemical Study on Synthesis and Redox Processes"
- Fredrik Klingstedt: "Development of catalysts for exhaust after-treatment of natural gas powered vehicles and biofuel combustion"
- Katariina Rahkamaa-Tolonen: "Investigation of Catalytic NO_x Reduction with Transient Techniques, Isotopic Exchange and FT-IR Spectroscopy"
- Mats Rönholm: "Kinetics and reactor design for oxidation of ferrous sulfate with molecular oxygen in sulfuric acid milieu using an active carbon catalyst"
- Esa Toukoniitty: "Enantioselective hydrogenation of 1-phenyl-1,2-propanedione"

Please check our website for M.Sc. and Licentiate Theses: www.abo.fi/instut/pcg

PCG Scientific and Industrial Advisory Boards

SAB Thomas W. Joyce, Western Michigan University
J.W. Niemantsverdriet, Eindhoven University of Technology
Albert Renken, Swiss Federal Institute of Technology
Marja-Liisa Riekkola, University of Helsinki

Mika Aalto, Tekes (National Technology Agency)
Gustav Björkstrand, Åbo Akademi University
Sipo Vanhanen, Academy of Finland

IAB Karl Ahlblad, AGA
Kari Ebeling, UPM-Kymmene
Håkan Gros, Danisco
Lars Gädda, M-real

Kaj Henricson, Andritz
Markku Karlsson, Metso
Timo Kenakkala, Kemira
Jyrki Kettunen, M-real

Kari Knuutila, Outokumpu
Lars Peter Lindfors
Dynea Chemicals and Sydsvenska Kemi AB
Kari Nurmi, Raisio
Bill Östman, Thermo Clinical LabSystems

PCG Facts and Mission

The Åbo Akademi Process Chemistry Group (ÅA-PCG) studies physico-chemical processes at the molecular level in environments of industrial importance, in order to meet the needs of tomorrow's process and product development. Our particular focus on the understanding of complex process chemistry we call

Molecular Process Technology

The Group consists of four research teams at the Chemical Engineering Faculty of Åbo Akademi University: *Combustion & Materials Chemistry* (Prof. Hupa), *Kinetics & Catalysis* (Prof. Salmi), *Process Analytical Chemistry* (Prof. Ivaska) and *Wood & Papermaking Chemistry* (Academy Prof. Holmbom). In the year 2001, about 170 people (including 40 senior researchers) took part in the PCG activities within 90 research projects with a total funding of approximately 4.9 Million €.

Editor-in-Chief Prof. Mikko Hupa, e-mail: Mikko.Hupa@abo.fi

Editor Dr. Tom Lindfors, e-mail: Tom.Lindfors@abo.fi

PCG Executive Board

Academy Prof. Bjarne Holmbom, e-mail: Bjarne.Holmbom@abo.fi
Prof. Mikko Hupa, e-mail: Mikko.Hupa@abo.fi
Prof. Ari Ivaska, e-mail: Ari.Ivaska@abo.fi
Prof. Tapio Salmi, e-mail: Tapio.Salmi@abo.fi

Coordinating assistant: Maria Ljung, e-mail: pcg@abo.fi
Biskopsgatan 8, 20500 Turku/Åbo, Finland

