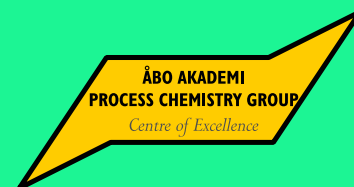


Newsletter



Åbo Akademi Process Chemistry Group

No. 5

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Doctoral Education in Finland

PCG wants to train the graduate students in good scientific skills, project management and communication.

Central parts of the research activities at Åbo Akademi Process Chemistry Group are done within doctoral theses works. At the moment 40 Ph.D. thesis projects are underway in the group.

The doctoral education has recently undergone big changes in Finland with the introduction of national graduate schools in 1995. The purpose of the graduate schools is to improve and support the Ph.D. training by collaboration between universities and laboratories working within similar research areas. One of the major goals is to shorten the average time for a Ph.D. project from the previous 5-6 years or even more, down to four years.

The PCG has actively been participating in several graduate schools. We have had the responsibility of coordinating the Graduate Schools in Chemical Engineering (GSCE) and Environmental Science and Technology (EnStE). From 1998-2002 four universities and 80 students participated in the GSCE, seven universities and about 50 students in EnStE. We also participated in the graduate schools in Materials Research and Pulp and Paper Science.

The graduate school activities typically include annual seminars to review the progress of the students, special courses organized by the different participating laboratories, and also funding and support for travel to conferences etc.

The graduate school system has overall been successful according to the evaluation made last year. All four schools mentioned above received renewed funding for the period 2003-2006.

National and International Collaboration



Prof. Mikko Hupa is the leader of the Combustion & Materials Chemistry team within PCG.

This spring the PCG is also coordinating the first *Nordic Graduate School in Biofuel Science and Technology*, which is part of the Nordic Energy Research activities funded by the Nordic Council of Ministers. The School is based on collaboration between Chalmers University of Technology in Sweden, the Technical University of Denmark, the Norwegian University of Science and Technology and Åbo Akademi University. Some 10 Nordic and five Baltic students are expected to participate in this new school.

At the moment about 30 of our Ph.D. candidates are doing their thesis work within the framework of one of these collaborative graduate schools.

According to our recent strategy work, PCG wants to train our graduate students "in good scientific skills, project management and communication" and to educate "internationally oriented scientists for demanding positions in industry, in research institutes and universities". These National and Nordic Graduate Schools have given us excellent tools to achieve these goals.

Prof. Mikko Hupa

*Chairman of the PCG Executive Board
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Zeolites and Mesoporous Molecular Sieves - Exciting Cages of Molecular Engineering

by Narendra Kumar



Docent Narendra Kumar is a senior scientist within the Kinetics & Catalysis team.

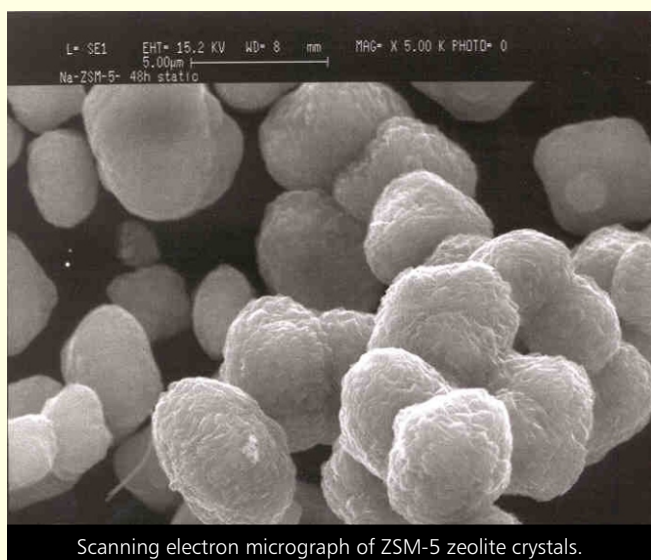
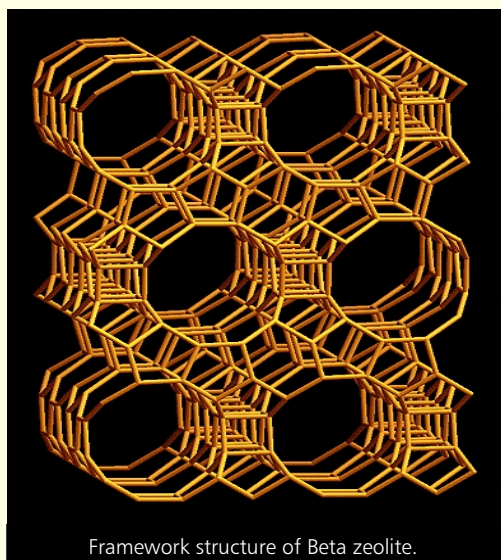
Zeolites and mesoporous molecular sieves are crystalline inorganic materials with three-dimensional framework structures containing uniform pores, channel systems and cavities. Zeolite catalysts are extensively used in the petroleum refinery and petrochemical industry in several processes because of their unique properties of shape-selectivity, tuneable acidity and thermal stability. Most of the world's gasoline is produced using zeolite catalysts. Besides the petrochemical industry, zeolites are potential catalysts for synthesis of fine chemicals and for the removal of emissions from motor vehicles and stationary sources. Zeolites also have potential as sensor materials.

Taking into account the enormous technological and economical advantages of using zeolite

catalysts in chemical industry and their application to environmental friendly processes, it is a profound field of research in several industrial and academic institutions. Zeolite synthesis is one of the few research topics selected for investigation aboard the International Space Station (ISS) to understand the reaction mechanism of zeolite-crystal growth.

The research team in Kinetics and Catalysis has a long tradition and expertise in the field of zeolites and mesoporous molecular sieve synthesis. The research is focused on the synthesis and characterisation of zeolite catalysts and their applications in petrochemical reactions. The influence of synthesis parameters on the physico-chemical and catalytic properties of industrially significant zeolites and mesoporous molecular sieve materials have been studied. In recent years the scope of zeolite research has been expanded to synthesis of fine chemicals. Several kinds of zeolites and mesoporous molecular sieve catalysts have been prepared and studied in the reactions of hydrocarbon transformations, selective hydrogenations of aldehydes and ketones and isomerisation of linoleic acid. Future work will be focused on detailed understanding of reaction mechanisms by using chemical kinetics and quantum chemistry as tools.

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Glass Goes Through Marrow and Bone

The first Marie Curie fellow learned how to make bioactive glass at PCG

At the end of January, after three months of research at PCG, Jacinto Pérez Borrajo travelled back to his research group in Vigo, Spain with new knowledge about bioactive glass in his suitcase.

Borrajo got the opportunity to spend three months at Åbo Akademi University (ÅAU) thanks to PCG, which became a Marie Curie Training Site for 2002-2005. With this scholarship, the European Commission honours the first female Nobel Prize winner in Physics by inviting young PhD students to take part in projects at other European research institutions. Borrajo is the first who used the opportunity to do research with PCG in Turku. He was chosen from a large number of applicants because his research was closely related to the research at PCG, tells Frauke Mueller, the coordinating assistant of the Marie Curie project at PCG.

Jacinto is very satisfied with his stay at PCG where he learned how to make bioactive glass that has many applications including the use in implants. He belongs to a Spanish research group, which develops methods for bioactive glasses to be used on the surface of such implants. Another material is used as the frame material. "We aim to

use the glass in another way than it is used in Turku, and our work still requires quite many years of research in the future", tells Borrajo. "I wanted to come to Turku because PCG has the technical equipment necessary for glass manufacturing that we do not have in Spain. Another reason is that scientists in Turku have long experience of working with bioactive glasses". They were first invented by Larry Hench in the beginning of the 1970s, but the medical applications are a recent development.

The research at PCG has proceeded quite far. Bioactive glass implants have successfully been tested in animals, and tests with humans have even been conducted. ÅAU is participating in many projects developing bioactive glasses for different clinical applications. For example, bioactive implants are used in bone fracture treatments to enhance bone proliferation at places where the native tissue is damaged or needs to be strengthened.

More information concerning current Marie Curie projects at PCG can be found on our home page (<http://www.abo.fi/pcg/mc>). There you can also find more of Jacinto Borrajo's thoughts about doing research at PCG.

The original text by Michael Karlsson has been translated and modified by PCG.



Photo: Michael Karlsson

Jacinto Pérez Borrajo and Frauke Mueller enjoying the Finnish winter outside Axelia - the main building of PCG and the Faculty of Chemical Engineering at ÅAU.

New PCG Projects

- **Multipurpose exploitation of European forest resources: from wood and bark wastes to bioactive compounds**, 1.1.2003 - 31.12.2005, financed by EU, Life programme. Research part: CTP (Grenoble, France), INRA (Nantes, France), University of Westminster (London, UK) and Raisio Group. Information: Bjarne.Holmbom@abo.fi
- **Chemical microanalysis of wood tissues and fibres**, 1.1.2003 - 31.12.2005, financed by Academy of Finland, Wood Material Science Programme. Research part: Wood Ultrastructure Research Centre, SLU, Uppsala. Information: Bjarne.Holmbom@abo.fi

Awards

- Prof. **Mikko Hupa** has been awarded with the *Environmental Prize 2002* at the Environmental Congress of the Finnish Industry. The award is founded by the Finnish environmental journal *Ympäristö+tekniikka* and the Environmental Forum (*Ympäristöfoorumi*), which is a forum for cooperation within the environmental sector in Finland.
- The new *Graduate School in Chemical Sensors and Microanalytical Systems (CHEMSEM)* was launched 1.1.2002. It combines the microfabrication and optical technologies of electronics with modern analytical chemistry (see www.chemsem.hut.fi). At the annual research seminar on December 12th, **Mikael Södergård** was awarded for the best oral presentation with the title "*Conducting polymer-based ion-selective microelectrodes*".



Visitors

- Dr. Ningyu Gu, *Changchun Institute of Applied Chemistry, Chinese Academy of Sciences*, from 15.4.2003
- Prof. Jürgen Heinze, *Albert-Ludwigs Universität, Freiburg, Germany*, 26.2-2.3
- M.Sc. Hermann John, *Albert-Ludwigs Universität, Freiburg, Germany*, 1-31.1
- Dr. Timo Kikas, *Tartu University, Estonia*, from 1.8.2002
- Doctoral student Arnstein Norheim, *Norwegian University of Science and Technology, Trondheim*, 1.1-30.4
- Doctoral student Geir Landsverk, *Norwegian University of Science and Technology, Trondheim*, 17.4-1.5

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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 2002, about 170 people (including 40 senior researchers) took part in the PCG activities with a total funding of approximately 5.8 Million €.

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