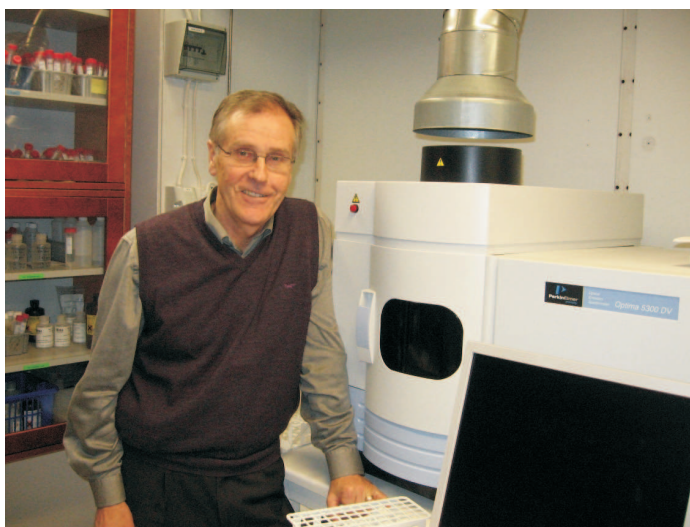


Metals in Pulping and Papermaking Processes

Metal ions are essential in the growing process of trees and are taken up through the roots from the soil and therefore metals will inevitably be carried to the pulping process. Inorganic compounds are minor constituents, less than 1%, of the wood material but are still of importance for the entire paper making process. Metals come in the process also with make up water, with added chemicals and through corrosion of the process machinery.

Closing the water circulation in a pulp mill will result in accumulation of metal ions in the process flows and lead to risk of precipitation of metal salts in different process steps. Therefore management of the metal flows and balances is important in order to minimize the negative and maximize the positive effects the different metal ions may have on the quality of the final product. It is also important to remove the accumulated metals from the process to avoid the negative effects. Reactions of metal ions with bleaching chemicals is an important problem that has to be managed. The effect of metal ions on the quality of fibres and the final paper product, especially in food packaging materials (e.g. Cadmium, lead) have to be understood and mastered.

PCC has in the "Chemistry in Forest Biorefinery" program an ongoing project "Metals in Wood" dealing with the role of metals in the process of paper making from



Professor Ari Ivaska

distribution of metals in living trees through the chemical behavior of metal ions in different process steps to the final product considering also recycling of the waste and the ash produced in the energy productions units. This integrated project represents a new approach to study metal flows and is a unique way to metal

management. The deep knowledge the individual researchers in PCC have in their special fields is combined in the project. Modern analytical instruments and techniques are available for the project and the PCC researchers have long experience in using these techniques.

New Professors and Awards

Academy Lecturer Carita Kvarnström was appointed Professor in Materials Chemistry at the University of Turku from January 2008 and **Academy Lecturer Johan Wärnä** was appointed Professor in Chemical Reaction Engineering from January 2008. **Dr. Daniel Lindberg** received the Harry Elfving Prize for his thesis "*Thermochemistry and Melting Properties of Alkali Salt Mixtures in Black Liquor Conversion Processes*". The prize sum was 8000 EUR and more information on the work was presented in Newsletter No 13.

Carl XVI Gustaf Presented an Award to PCC

The King of Sweden His Majesty Carl XVI Gustaf presented the Marcus Wallenberg Prize to **Prof. Bjarne Holmbom** and **Mr. Christer Eckerman** on October 6. The award was given for the 25th time and the Prize sum is 2 000 000 SEK.

Sustainability of renewable resources is the main focus and the Prize recognizes efficiency improvements, cost improvements, the opening of new markets and the underlying research.

The purpose of the Prize is to recognize, encourage and stimulate pathbreaking scientific achievements which contribute significantly to broadening knowledge and to technical development within the fields of importance to forestry and forest industries.

The Prize is awarded to individuals or groups normally of 2-4. Every year up to 500 organizations around the world are invited to nominate candidates for the Prize.

Prof. Bjarne Holmbom and Mr. Christer Eckerman were awarded for their breakthrough research and innovation creating a platform for new applications of chemical components in wood. They have created an understanding of the fundamental chemistry of spruce tree knots.

They developed technical separation methods to extract tree knots from the pulping process and to isolate and purify chemicals from the tree knots,



The 2008 Marcus Wallenberg Prize Winners Mr. Christer Eckerman and Prof. Bjarne Holmbom from PCC with His Majesty the King of Sweden Carl XVI Gustaf and Mr. Marcus Wallenberg, the Chairman of the Marcus Wallenberg Foundation.

opening the field for many potential applications and uses.

The selective removal of knots from the pulping process brings opportunities for additional benefits by reducing process disturbances, reducing the use of bleaching chemicals and energy, and allowing more consistent quality of the paper products to be produced.

By methodical research of the highest quality, the Laureates have significantly contributed to creating a platform for the forest products industry to improve and broaden its role and commercial prospects with a range of new products and implications e.g. for chemicals, energy, production efficiency and sustainability.

"The awarded research holds promise of adding value and enhancing the image of our business as capable of bringing benefits to society."

"As such it will also serve as a pointer to the future of our business, demonstrating that new ground is still to be explored when it comes to more fully developing the forest products industry to sustainably serve future society," said Marcus Wallenberg, Chairman of the Marcus Wallenberg Foundation at the award ceremony.

Bioraff - Chemistry in Forest Biorefineries

On November 10-11, 2008 in Åbo, a meeting of the research team in the Bioraff project at PCC took place. The event started with a get-together dinner at restaurant Kåren. The participants were industry representatives, research partners, Tekes, Forestcluster Ltd and the PCC board as well as researchers who gave selected presentations. The scientific program touched the themes "Hemicelluloses, Promising Source of Functional Chemicals" (Bjarne Holmbom and Chunlin Xu), "Ash-Forming Elements in Woody Biomass" (Ari Ivaska and Johan Werkelin), "Wood-Derived Sugars, Catalytic Conversions for Chemicals" (Tapio Salmi, Dmitry Murzin, Victor Sifontes Herrera, Bright Kusema), and finally "Information on Top Analytica" by Bengt-Johan Skrifvars. The funding of the Bioraff project by Tekes continues for the time period 2009-2011.

PCC shares J-P Mikkola with Umeå

In Sweden universities are dynamic and far-seeing. **Docent Jyri-Pekka Mikkola** at PCC, Academy Research Fellow and prize winner (Incentive Award by Academy of Finland), applied for a professorship in Technical Chemistry at Umeå University. Approximately 20 persons applied for the position and a couple of them pulled back their application.

After consulting expertise the university decided to employ two professors within the subject, **Dr. Leif Jönsson** from Lund and J-P Mikkola from Åbo. They will both be responsible for chemical processes and products related to the so-called biorefinery concept, which involves production of fuels and chemicals from renewable resources. The meaning of renewable resources in the Nordic countries is forest and woods. Sweden is the world's leading country in the development of the bioethanol process using wood as raw material. An intensive work on research and development is going on, not only in Umeå, but also at the biorefinery that is under construction in Örnsköldsvik. Here, Leif Jönsson's expertise in catalysis by enzymes and J-P Mikkola's knowledge in heterogeneous catalysts and ionic liquids are needed.

However, Åbo Akademi did not want to lose one of its best resources. The Faculty of Technology made a proposal that J-P Mikkola should be appointed as a professor also at Åbo Akademi University. Umeå University and Åbo Akademi University agreed to share the job in such a way that Mikkola spends 80 percent of his working time in Umeå and 20 percent in Åbo, at the PCC. The Chancellor of Åbo Akademi University appointed J-P Mikkola as a joint-professor in Industrial Chemistry and Sustainable Development from August 1, 2008, the same day as he started his professorship in Umeå.

The Installation Celebration took place in Umeå on October 18 in connection with the annual solemnity of the University. A large number of Studia Generalia lectures were given at the celebration and 13 honorary doctors were promoted. Umeå University has realized that chemistry in one of the large fields of the future, especially since humankind is moving from fossil fuels towards renewable resources. This is not only because the supplies of fossil fuels are decreasing, but also due to the global warming.

The major movement to chemistry in Umeå is demonstrated by the fact that eight Professors involved in Chemistry were installed on October 18, 2008. The topic of J-P Mikkola's installation lecture was "Sustainable Industrial Processes for the 21st Century".

The audience followed the PowerPoint show of the new professor with excitement: from the dark oil to the green forest. The way is beautiful on paper but it takes years of research to make the dream come true.

The joint-professor is installed. We expect a breakthrough in the coming years. A bridge between Åbo and Umeå has been built.



Exclusive Interview with Professor Tapio Salmi

Prof. Tapio Salmi at PCC was appointed Academy Professor for the period 01.01.2009-31.12.2013 by the Academy of Finland. Tapio Salmi, the leader of the Laboratory of Industrial Chemistry and Reaction Engineering, is developing biofuels from renewable wood sources to replace fossil fuel products by modelling and enhancing chemical processes.

Who are you Professor Tapio Salmi? Professor in Chemical Reaction Engineering at Åbo Akademi University, born in Pargas on 07.10.1957. I am working at the PCC, which has been appointed a Centre of Excellence by the Academy of Finland.

Doing what? Typical professor work, giving lectures, supervising undergraduate and postgraduate students, writing scientific articles, following the development of the research area by taking part in conferences all over the world, and taking care of administrative issues.

You develop chemicals descending from both oil and the forest. Why have you chosen this particular subject? In fact, the title of the research plan was "continuous intensification of chemical production from renewable resources". The focus in the plan is chemicals from wood, not fuels. We are rich in natural resources, the forest, in which a variety of chemicals is found, for example also health-promoting compounds. The subject is hot due to different reasons, such as the change in our climate. Not only is the energy production moving towards the concept of renewable resources, but also the chemical production. There is also a personal reason for choosing this research subject. During my studies I have been interested in mathematically oriented fields such as chemical, diffusion, and heat engineering as well as organic chemistry and wood chemistry. All these fields are connected to my current research topic.

What does the Academy Professorship mean to you? I am delighted not only for my own sake but also for the entire research team. Nobody can accomplish such interdisciplinary scientific research alone.

GUEST LECTURERS

Prof. Akiyoshi Osaka, Department of Bioscience and Biotechnology, Okayama University, Japan: "*Current Biomedical Materials Projects in Okayama University - Anion-Substituted Apatite and Formation of C-Axis Oriented Apatite Nano-Rods*" on September 4, 2008. Host: Prof. Mikko Hupa.

Prof. Alexander Kuhn, Institut des Sciences Moléculaires, Université Bordeaux 1, France: "*Rational Design of Electrodes for Bioanalysis*" on November 6, 2008. Host: Prof. Ari Ivaska.

Prof. John Mitchell, University of Nottingham, United Kingdom: "*Bridging the Starch Cellulose Divide*" on November 13, 2008.

Prof. J. W. (Hans) Niemantsverdriet, Schuit Institute of Catalysis, Eindhoven University of Technology, Eindhoven, The Netherlands: "*Synthetic Fuels by the Fischer-Tropsch Synthesis: Active and Deactivating Catalysts*" on November 20, 2008. Host: Prof. Dmitry Murzin.

DOCTORAL DEFENSES

Di Zhang: "*In Vitro Characterization of Bioactive Glass*" on September 5, 2008. Opponent: **Prof. Akiyoshi Osaka**, Okayama University, Japan.

Johan Werkelin: "*Ash-Forming Element and their Chemicals Forms in Woody Biomass Fuels*" on September 12, 2008. Opponent: **Doc. Britt-Marie Steenari**, Chalmers University of Technology, Sweden.

Eija Bergelin: "*Wood Resin Components in Birch Kraft Pulping and Bleaching*" on October 10, 2008. Opponent: **Prof. Armando J.D. Silvestre**, University of Aveiro, Portugal.

Hanna Arstila: "*Crystallization Characteristics of Bioactive Glasses*" on November 7, 2008. Opponent: **Prof. Yuanzheng Yue**, Aalborg University, Denmark.

Chunlin Xu: "*Physicochemical Properties of Water-Soluble Spruce Galactoglucomannans*" on November 14, 2008. Opponent: **Prof. John Mitchell**, University of Nottingham, United Kingdom.

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PCC FACTS AND MISSION

A Centre of Excellence in research appointed by the Academy of Finland for the periods 2000-2005 and 2006-2011. The Åbo Akademi Process Chemistry Centre (ÅA-PCC) studies physico-chemical processes at the molecular level in environments of industrial importance, in order to meet the needs of tomorrow's processes and product development. Our particular focus on the understanding of complex process chemistry we call *Molecular Process Technology*.

The Centre consists of four research groups at the Department of Chemical Engineering, Faculty of Technology, Åbo Akademi University:
· Combustion & Materials Chemistry (Prof. Mikko Hupa),
· Kinetics & Catalysts (Prof. Tapio Salmi),
· Process Analytical Chemistry (Prof. Ari Ivaska) and
· Wood and Paper Chemistry (Prof. Bjarne Holmbom).
In the year 2007, about 130 people (including 20 senior researchers) took part in the PCC activities with a total funding of approximately 6 million euros.

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