

# RESEARCH AND TECHNOLOGY FROM GERMANY

March 2004

Science and Technology, Canadian Embassy Berlin, Friedrichstr. 95, D-10117 Berlin

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This edition of our newsletter on new research and technologies in Germany includes such unlikely-seeming inventions and discoveries as a motorbike helmet made of hemp fibres, anti-noise windows that cancel out sounds by reversing the pattern of sound waves, and the discovery that wood can be reshaped without damage in the same way as metal.

New software for reassembling torn pieces of paper into the original format was developed specifically to try to reassemble torn-up security service documents from the former East Germany. But this technology may well have other applications, too.

If you have any queries or would like more information on any of these technologies, please contact the researchers listed below each piece or the Canadian Embassy in Berlin (see address on last page).

## Technologies and Research Highlights



### Landing safely on heated runways\*

In bad weather, pilots rely mainly on good lighting in order to land safely. But in winter, snow and ice can reduce the contrast, so that lighting is needed across the entire airfield - from the runway to the terminal - to make orientation completely reliable.

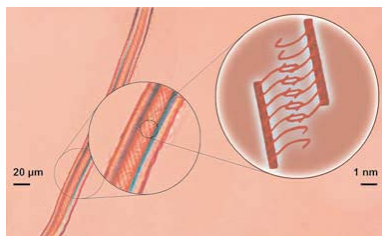
Siemens has developed a new type of airfield beacon using light-emitting diodes (LEDs) that provide thermostat-regulated heat. When needed, the LEDs emit extra heat to melt ice or frost on the beacon. They save energy too: When heating, they use about 25 watts - 15% less than beacons with standard halogen bulbs - and when the heating is turned off, they use about half this amount.

These LEDs emit monochromatic blue light that can be seen clearly even in fog and are designed particularly for use at the edge of taxiways. Other LED beacons are available in green, yellow and red for marking the rest of the airfield. The beacons are sturdy and can be combined with existing lighting: "smart electronics" precisely control the current to the LED, matching the LED's light output to existing quartz-incandescent fixtures at all brightness levels.

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### **Molecular "velcro" makes wood pliable\***



In an intra-European cooperation between Germany, Austria and France, researchers have discovered a molecular mechanism in wood, which allows it to be reshaped without damage. Using x-ray radiation (at the European Synchrotron Radiation Facility), the researchers investigated the molecular changes taking place in thin films of wood and wood fibres when they were stretched.

The deformation is attributable to spiral-shaped cellulose fibrils present in the cell wall of wood cells that are connected matrix of polymers. When a strong mechanical force is applied, the fibrils twist and separate from each other, but once the force is removed, they slip into a new position in the polymer matrix, like a strip of velcro that reattaches itself in a different position. This velcro-effect demonstrates that wood can exhibit a "plastic reaction" similar to that found in metals.

The results were published in the December edition of "Nature Materials".

For more information, please contact:  
Steffen Preusser/Bruno Wiest  
Canadian Embassy Berlin. See contact information on page 10.

### **A motorbike helmet made of hemp?\***

Not just motorbike helmets, but many other unlikely products utilise natural fibres such as flax or hemp. Once the fibres are embed in a matrix of petroleum-based polymers, a lightweight and resilient composite is created.

The German company Invent GmbH is now working on replacing the petroleum-based ingredients with a matrix of renewable materials. Their ultimate goal is to create materials that can be used in today's plastics industry without having to adapt existing industrial processes.

Supported by the Agency for Renewable Resources (FNR), the company and their partners are working on a canoe, in order to investigate the material's moisture behaviour, and on a trade fair stand. The motorbike helmet will follow. With its stringent stability requirements, the helmet presents the greatest challenge. "We intend to produce a helmet that will satisfy all the existing safety requirements, protecting the rider just like a normal helmet," the researchers say. When they succeed, the helmet should be more comfortable to wear because it will be lighter - and cheaper to produce - than its petro-chemical plastic competitors.

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### **Concrete that flows like honey\***

Researchers in North Rhine-Westphalia are investigating the properties of SCC (self-compacting concrete), a new kind of concrete that has viscous properties similar to honey.

"When wet, SCC spreads itself out evenly and self-levels, and while it's spreading, all the air trapped in the mixture is released. So there's no need for loud compression machines. And it doesn't change during processing," experts say.

The concrete's special characteristics are due to several factors: the recipe is very precise - the sand, for example, must always have a specific moisture content - and extra extra ingredients are added to create the special flow characteristics. As yet, it is not completely clear how these extra ingredients work and how they react with other components. The researchers are studying these characteristics on behalf of the German Cement Works Association, and their results will be included in new regulations specifying how this new form of concrete should be manufactured and used.

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### **Artificial tissue from the test tube\*\***



Transplants - whether organs or tissues - have become commonplace, but there are always risks involved. When tissues are taken from another patient, or from an animal donor, there is a high risk that the transplanted tissue will set off an immune reaction, leading to inflammation or rejection. But such complications can be avoided with an autologous, patient-specific transplant. This is achieved by using the relatively new biomedical technique of tissue engineering, in which the patient's own cells are cultivated in the laboratory and used to manufacture the necessary tissue or cellular therapeutic.

The Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB in Stuttgart has now been certified for this type of work: One month ago, it was granted manufacturing approval under the German Medicines Act by the local drug surveillance board in Tübingen. "At the moment, this approval is limited to the manufacture of chondrocytes, or cartilage cells," says Dr. Hans-Georg Eckert, who heads the department for cell systems. The scientists intend to expand their activity to include other types of cell and tissue such as skin, bone, blood and nerve cells."

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### **Nanofilter fishes poisons out of blood\***

Researchers in Baden-Württemberg have developed a new technique for cleansing blood using a filter made of hollow fibre membranes. The filtering effect is due to pores in the membranes that are a few nanometres wide. Poisoned blood plasma enters through these pores and comes into contact with adsorbers that extract the poisonous substances. The blood platelets, which are more sensitive and must not come into contact with the adsorbers, are too big to pass through the pores.

The researchers have already tested the technique successfully on donated blood and are now preparing initial clinical trials on treating patients with blood poisoning. Other possible applications of the technique include filtering out dangerous blood fats (LDL cholesterol) or proteins causing auto-immune diseases.

The new technique represents a considerable advance over existing methods of dialysis, as there is no longer any need to separate blood plasma and platelets before processing.

For more information, please see:  
[www.nanobio.de](http://www.nanobio.de)

or contact Steffen Preusser/Bruno Wiest,  
Canadian Embassy Berlin. See contact information on page 10

### **Sketching in cyberspace\*\***



Modern product development is increasingly taking place within virtual environments. One key technology in this process is "rapid prototyping", which can be used in the very early phases of product development.

An exciting development is a wireless stylus that enables objects to be sketched free-hand inside a virtual space. This new input tool, designed for developing products in cyberspace, was created in collaboration with the Barski Design Studio, Frankfurt. "When children want to move a cursor towards the top of the screen, they lift up the computer mouse," notes designer Olaf Barski. Dr. André Stork of the Fraunhofer Institute for Computer Graphics Research IGD adds: "The cyber-stylus emulates this natural three-dimensional urge."

Rapid technologies allow physical objects to be built up layer by layer directly from 3D CAD model data. They were first conceived about 15 years ago, and the industry has grown rapidly since then. Around 150 small and medium-sized enterprises in Germany use rapid technology processes to supply their customers with a wide variety of product development services.

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### **Dyeing textiles with carbon dioxide\***



CO<sub>2</sub> has long been used for decaffeinating coffee. At a pressure of 200 to 300 bar and a temperature of between 100 and 400 degrees celsius, carbon dioxide becomes a supercritical fluid, with some of the characteristics of a gas and some of a fluid. In this state, it is a superb solvent for many water-repelling (hydrophobic) substances, including the dispersion dyes used for colouring hydrophobic synthetic fibres like polyester and acetate.

Using carbon dioxide for dyeing textiles has important environmental and cost advantages: no polluted water is produced, almost 90% of the CO<sub>2</sub> used can be recycled, and much less energy is needed.

A consortium of researchers, engineers and textile producers are now planning the first large pilot system for dyeing textiles with CO<sub>2</sub>. The system will be used on the premises of companies involved in dyeing textiles so that the process can be demonstrated under typical commercial conditions.

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### **Water compression cooling machines nearly ready to go into production\***

Pilot projects in the University of Essen and in a vehicle manufacturing factory in Dresden are using water as a coolant in compression cooling machines. While CFCs were used in these compressors until recently, "natural" coolants have been introduced because of the ozone-damaging properties of CFCs.

Compression cooling machines using water are often employed to provide basic cooling capacity, in combination with other kinds of coolers. The project in Dresden utilises only water. Compared to an ammonia-based compressor, the machine has to create a volume flow 300 times higher, and attain a compression rate that is twice as large. Despite this, the power created by water cooling machines is almost twice that of those using conventional refrigerators.

Due to water's unique properties, the dimensions and number of rotations needed in the compressor result in huge internal forces. This is why these machines can only be manufactured now: modern materials are able to meet these demands. These compression coolers using water will go into production in the near future.

For more information, please contact:

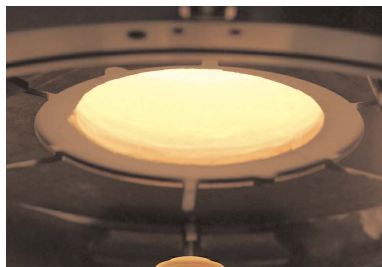
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### Looking into the eye of the furnace\*\*

Ceramic products such as brake discs, insulators and dental bridges are produced by sintering - shaping powders and then firing them in furnaces. Of course, it is crucial to know for just how long and at what temperatures products should be fired.

Researchers at the Fraunhofer Institute for Silicate Research (ISC) have developed special apparatus for examining how ceramic materials behave during firing. "Our first device, little TOMMI, was already able to observe sintering and melting processes without direct contact," says Dr. Friedrich Raether. "That was a major step because it is important not to interfere with the raw ceramic, or glass, part while it is in the oven. The series of measurements needed to identify changes in the shape of the test object require great precision - down to an accuracy of two millimetres." And the newer model, TOM II, can carry out measurements with an even greater accuracy.

Among other applications, the researchers use the data recorded by TOMMI and TOM II to optimise firing processes. This may help in reducing firing times and thus save energy.

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### Noise cancelling out noise\*\*\*

Researchers in the Institute of Technical Acoustics, at the Technical University of Berlin, may be playing their part in reducing the stress caused by the capital's traffic noise. They have developed a new kind of double-glazed window which reduces the amount of noise penetrating the window - by sending out "cancelling" sound waves.

The windows contain special microphones which calculate the pattern of sounds coming in, recalculate them as an "anti-sound pattern" and use special loudspeakers to transmit the "anti-sounds" back towards the source. Currently, the researchers have succeeded in reducing the noise transmitted by an aircraft propeller by ten decibels - in other words, by half.

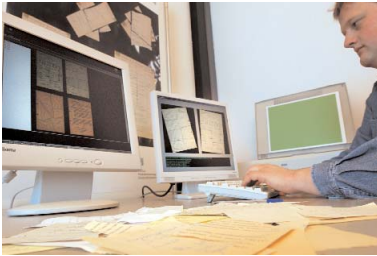
In modern double-glazed windows, the gap between the two panes is too narrow to accommodate the microphones and loudspeakers. So the researchers are working on a third pane which can be added with all the technological equipment already integrated.

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### The Stasi puzzle\*\*

Fourteen years after the fall of the Berlin Wall, Germany is still coming to terms with the unprecedented spying campaign which the



East German Ministry for State Security (Stasi) conducted against its own people. The process of evaluating what actually went on is made more difficult by the fact that Stasi staff shredded huge quantities of documents in late 1989 and early 1990. However, because there were not enough shredders, many documents were simply torn to pieces by hand.

The resulting bags of torn-up information on Stasi informers and victims are being painstakingly reassembled by staff in a new federal German agency. But there are 16,000 bags full of document fragments, and the task would have taken centuries, if done by hand - until a way of automating the process was found. The fragments are sorted into plastic pockets and scanned to create digital images. Then a prototype pattern recognition application, developed at the Fraunhofer Institute for Production Systems and Design Technology, is used to piece the fragments together to form complete pages. First, the fragments are analysed in terms of shape, colour, texture, line spacing, typeface and font style; then similar pieces are grouped together. The software locates potential adjoining fragments using a combination of characteristics, and matches them up in a giant jigsaw puzzle. Piece by piece, each page of the destroyed files is reconstructed and reveals more about what really went on in the Stasi.

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## Upcoming Events

### **CeBIT 2004, World's largest Trade Show on Information and Communication Technologies, Hanover, March 18-24**

[www.cebit.de](http://www.cebit.de)

Canada and the Provinces of Ontario, Québec and Alberta will participate with export promotion group stands. Canada will also be strongly represented at Future Parc, the R&D and innovation exhibit at CeBIT.

The Canadian presence will include 5 exhibitors, research labs and spin-off companies. Dr. Arthur Carty, President of the NRC and Canada's first National Science Advisor to the Prime Minister as of April 1, will attend CeBIT, open the Canada stand at Future Parc and meet with German Chancellor Schröder and German Minister for Education and Research, Edelgard Bulmahn at CeBIT.

Canada will also participate in the Canada - EU Partnering Forum in the Information Society Technologies IST-EC on March 18 and in the Future Talk presentation forum on March 23.

More news on the Canadian participation in CeBIT can be found at <http://www.kanada.de>  
[http://www.cebit.de/top-prog\\_8\\_e.html](http://www.cebit.de/top-prog_8_e.html).

**AMAA Advanced Microsystems for Automotive Application Forum, Berlin, March 25/26, 2004;**

<http://www.amaa.de>

This forum is an international platform for car manufacturers and suppliers of electronics and MST/MEMS components. Topics include:

- safety: all aspects of preventive and protective safety (e.g. accident avoidance, pre- and after-crash actions);
- power trains: online measurement and control of engine and transmission subsystems (e.g. motor management, fuel economy, traction control);
- comfort and HMI: systems to enhance passenger comfort, and human-machine interface issues (e.g. seat, climate control, driver assistance);
- networked vehicles: all aspects of intra-car systems and ambient communication (e.g. internal networks, system architecture, spontaneous networks). (English spoken)

**Agricultural Biotechnology International Conference, Cologne, Sept. 12-15, 2004**

[www.abic2004.org](http://www.abic2004.org).

The conference is intended to showcase both the research and the business side of agricultural biotechnology. In conjunction with Agriculture and Agri-Food Canada, a Government of Canada booth will be organised to present Canadian innovations in this field.

For Canadian companies attending the conference, we are planning partnering meetings and tours of German companies and institutes involved with ag-biotech.

If you wish to participate, please contact Steffen Preusser at the Canadian Embassy in Berlin.

**Hannover Fair, Hannover, April 19-24, 2004**

<http://www.hannovermesse.de/ataglance>

An annual international industrial fair, where environment is one of many themes. This fair is large and attracts a broad cross-section of industries. It has excellent exhibits concerning new innovations, and will see strong Canadian participation again this year.

Among other visitors, innovative Canadian firms will participate in the Hydrogen + Fuel Cells stand in Hall 13 (Energy). The organizers of this stand, Arno Evers, are offering special packages for Canadian participants.

Hannover Messe 2003 had 193,000 visitors of which 28% were non-German. There were 6,154 exhibitors with 2,969 being non-German, 14 of these from Canada.

**HGM2004, Human Genome Meeting (HUGO), Berlin, Germany  
4th - 7th April 2004**

<http://hgm2004.hgu.mrc.ac.uk/>

**5th Global Wood and Natural Fibre Composites Symposium,  
Kassel**

April 27-28, 2004

<http://www.uni-kassel.de/fb15/ifw/kutech/call5.html>



## News

In conjunction with Agriculture and Agri-Food Canada, a **workshop and industry tour on the topic of natural fibres was organised for March 1-5, 2004**. The goal of the mission was to examine the business of fibre separation and fibre processing into high-end products. Speakers from throughout Europe discussed the latest technologies in decortication and what makes a business successful. Also at the conference were processors that manufactured insulation and polymer composites using natural fibres.

The tour included fibre separation plants, felt manufacturers and a visit to a DaimlerChrysler assembly plant. About 25 Canadian representatives from companies, associations and governments participated in the week-long tour.

Contact: Steffen Preusser

Also in conjunction with Agriculture and Agri-Food Canada, a **report on the current status of the biodegradable plastics (or bioplastics) industry in Europe has been prepared**. This report summarises present R&D and industrial activities in Europe, relative costs between bioplastics and petrochemical plastics, the future of bioplastics, and the areas where further R&D are needed to ensure that the production costs for bioplastics decrease.

Applications of bioplastics in the fields of packaging, agriculture/horticulture, automobile, and the electronics and electrical sectors are reviewed. Finally, the report also outlines the major political, environmental and social drivers that are propelling this sector in Europe, including references to the relevant EU directives and white papers.

For a copy, please contact: Steffen Preusser

A **report on the current status of the German biotechnology industry** has also been prepared. For more information, please contact: Steffen Preusser.

Articles marked with \* are based on press releases from 'Informationsdienst Wissenschaft', an initiative by the Universities of Bayreuth and Bochum and the Technical University of Clausthal

Articles marked with \*\* are based on the 'Research News' of the Fraunhofer Gesellschaft.

Articles marked with \*\*\* are based on information from NeMa, [www.neuematerialien.de](http://www.neuematerialien.de).

Please feel free to pass this newsletter on to anyone whom you feel might be interested.

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