

ASIA-PACIFIC

AUSTRALIA

Power generation from wind and water

Electricity generation by wind and water turbines has become far more economical with the development of the Chaplin Energy Wheel (CEW), a device able to produce power up to ten times more efficiently than conventional wind turbines.

Greater efficiency means that the size of the unit and the tower can be reduced significantly. Also, it can function at lower wind speeds than conventional propeller models and will operate even when conditions are gusty. The CEW is unidirectional and when wind direction changes rapidly, it adapts instantly. Apart from this, its design lends itself to underwater power generation in rivers, or where there is tidal movement. The units are placed on the ocean floor and will operate efficiently regardless of water turbulence. The turbines are rated at a minimum 1 kW per square metre, where water flow is two metres per second.

The CEW can be manufactured in modules to meet all power needs and for easy transportation. Stand-alone applications such as electricity for the home, agricultural water pumping and marine uses can be accommodated as easily as power generation for grid distribution. The simplicity of the design and the durability of the materials used in the manufacture of the units combine to provide a cost-effective means of power generation that will last decades, with minimal maintenance.

This technology has the potential to supply electricity to mainstream users and eventually replace coal and nuclear power generation. There are numerous opportunities for joint venture projects both in Australia and internationally. Because capital investment can be recouped quickly, the demand for the CEW technology is sure to be high, wherever an inexpensive and non-polluting power supply is needed. Markets in the Philippines, China, Japan and the Pacific islands have expressed interest in electricity genera-

tion using both wind and water, and are being targeted by CEW.

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CHINA

Breakthrough in PDP technology

China has made a major breakthrough in plasma display panel (PDP) technology, according to the Ministry of Science and Technology. Chinese companies have not only grasped the shadow mask (SM) PDP technology with homegrown intellectual property but have also successfully developed 34-inch SM PDP high-definition and united-colour monitors, said a ministry official. The development of 42-inch display technology is also in process, said the official.

The newly developed SM PDP technology combines low cost, high definition and united colour, and creates a good opportunity for Chinese companies to catch up with the world pace of developing low cost PDP products, so as to significantly improve their competitiveness in global markets.

In recent years, China's colour TV set production has grown rapidly, but low-price cathode ray tube products have suffered from various trade barriers in the world market, including anti-dumping charges.

<http://english.peopledaily.com.cn>

Powerful communication chips

China has developed and marketed the country's first batch of powerful system chips that can be used in communication equipment and terminals, China's Ministry of Science and Technology announced. Ma Songde, Vice-min-

ister of Science and Technology, told reporters that the chip, known as COMIP system chip, will break the monopoly on the Chinese telecommunications market held by a group of overseas companies.

A high-performance embedded central processing unit and a digital signal processor have been integrated into the chip, which is capable of processing up to 500 million instructions per second, said the vice-minister. He said the progress is of great importance for the development of the country's electronic and telecommunications sectors.

The chip was developed by Datang Micro-electronic Technology Co. in cooperation with Zhejiang University and other institutions. The development was funded by the country's high-tech development and commercialization programme run by the ministry.

The Chinese-made chip is more power-efficient than similar foreign-manufactured products. It can be used in complete sets of communication equipment and terminals, according to experts involved in the development programme. The chip has been used in mobile phone sets, videophone sets and other consumer electronic goods launched by Datang, the country's biggest integrated circuit designing firm.

<http://news.xinhuanet.com>

Breakthrough for transgenic cotton

The Transgenic Tech System of Cotton Commercialization was declared a success. Based on this system, 8 new cotton varieties have been developed and more than 32 million mu land has grown insect-resistant transgenic cotton. Transgenic crops have been spreading around the world faster than any other crops in recent years. From 1996 to 2003, its coverage increased by nearly 40 times globally.

In China, transgenic insect-resistant cotton is the major product of transgenic farm produces. In the face of the fierce international competition, the research and industrialization of transgenic cotton has

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made a series of significant breakthroughs, thanks to the government's support. New varieties with intellectual property rights have been invented.

The technical system for efficient, commercialized transgenic cotton, which makes an annual yield of more than 6,000 plants possible, is the result of the efforts of Cotton Institute of Chinese Academy of Agricultural Science. The system brings genes of insect-resistant, anti-sickness and fibre improvement to more than 20 main cotton varieties. In addition, engrafting technology is successfully applied. In this way, more than 90 per cent of transplanted cotton plants can survive and grow.

Experts confirmed that the research is at top international levels. It has made the transgenic insect-resistant cotton cover more areas in China very fast. Dr. Yu Shuxun, Director of the institute, said that this year in China, some 70 per cent of more than 46 million mu land to grow transgenic insect-resistant cotton would use domestically developed varieties. But in 1998, only 3.8 million mu of land yielded transgenic insect-resistant cotton, 95 per cent of which was imported from foreign countries.

At present, transgenic insect-resistant cotton is harvested from more than 70 million mu land. An extra revenue of 140 to 160 yuan per mu is generated for farmers.

<http://english.people.com.cn>

HK scientists develop self-cleaning fabrics

Scientists are in the process of developing self-cleaning nanofabrics through a government-sponsored initiative, which is expected to add value to manufacturers' products and improve their sales.

Scientists at the Hong Kong Polytechnic University have been working on the development of functional fabrics through the Intelligent Production Control Decision-Making System for Apparel Manufacturing Process, a project financed by the Innovation and Technology Fund, established by the Hong Kong government in 2003. The re-

search focuses on the application of self-cleaning nanotechnology at extremely low temperatures.

"By achieving this, we are now able to apply the self-cleaning process to fabrics, plastics or wood. These materials would otherwise be damaged if treated using high temperature techniques," associate professor John Xin said.

The fabrics are coated with 50 nanometres of a titanium dioxide-based chemical. One nanometre is one-billionth of a metre. This layer will decompose organic matter, odours, bacteria and toxic substances, such as formaldehyde, and turn them into carbon dioxide and water when exposed to the ultraviolet energy from sunlight or artificial lighting. "We use a dip-pad-dry process, where we dip the fabric in a solution, pad it to remove excess water and then let it dry. We then use a hydrothermal process and boil the fabric in water for two hours," Xin said.

"The nanolayer is very strong when applied to cotton and is also effective for other materials such as synthetic fibres and wood. The self-cleaning effect lasts almost as long as the garment," Xin added.

The nanolayer can be applied to fabrics using conventional technology and so there is no need for special machinery. The technology can also be used for products like furniture and household items, such as curtains and carpets.

Self-cleaning products are low maintenance and environment-friendly, as less energy and chemicals are required for washing. Nanotechnology is also a low-cost process and does not interfere with the inherent properties of the fabrics, such as softness.

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INDIA Technology for natural sunscreens

At a time when the world is moving towards safer natural personal care prod-

ucts, an indigenous technology has been developed by Indian researchers for sunscreen creams based on natural products, with anti-ageing properties. These sunscreen actives also offer superior protection from harmful ultra violet (UV) radiation, compared to the commercially used sunscreens in the market, claims Prof HM Chawla, a member of the IIT-Delhi faculty who spearheaded the research work.

Prof. Chawla has also been instrumental in setting up Sanmotech (Synthesis and Natural Molecular Technologies), a technology start-up from IIT-Delhi, credited for the research work. Sanmotech researchers have identified and developed a chemical molecule in one of the most intensely researched fields of chemical sciences, for development of innovative and marketable specialty products/processes. Besides, sunscreen actives for dermal applications, this molecule will find applications in molecular diagnostics, adhesive sealants for cell phones and other micro-electronic devices and sensor materials, to name a few.

Sanmotech has applied for a worldwide patent for its discovery. It is now at an advanced stage of discussion with a US company and an advanced materials company from Singapore for fine-tuning its R&D work for commercial applicability.

Explaining the R&D work, Prof. Chawla said that the work involved identification of the molecule called C40309, its synthesis and efficacy testing in a laboratory, as well as real-time conditions, and its formulation. "We are one of the few technology start-ups operating in chemical sciences. The initial thrust has been to develop highly effective sunscreen actives for dermal and other applications."

The choice of sunscreen as the first target is mainly dependent on scientific expertise/acumen and commercial feasibility, Prof. Chawla said. The organic sunscreen market alone is approximately Rs 10 billion and is growing at the rate of 6-8 per cent, especially in Asia. Several leading global players like Siba Specialty, Roche, BASF, Bayer, Hindustan Lever Ltd., among others, are aiming at formulations

based on sunscreen actives. According to Prof. Chawla, the methodology employed unique ultra violet (UV) absorption parameters of some metacyclophane (MMC) derivatives in seeking synergistic protection from harmful UV components of solar radiation, as against currently used UV protectants in presently available sunscreens.

MMCs are relatively new molecular entities, discovered around 1982. These molecules have now become one of the most researched and patented organic chemicals in recent years.

"The typical synthetic UV absorbers have limitations in performance, due to the limited spectrum of activity, skin penetration and allergic responses, and long-term usage issues on product safety. Our USP is to bring in a combination of wide spectrum UV-absorption-low permeability and better performance, along with anti-ageing properties delivered through naturally occurring chemicals which are inherently safer than synthetic analogues," Prof. Chawla said.

According to Prof. Chawla, "by utilizing our earlier work on the chemistry of natural products, we feel better disposed towards providing the first versions of sunscreens with slow releasing anti-ageing attributes. We see in our favour a growing consumer trend that prefers safer natural personal products and an increasing demand for multi-tasking sunscreen actives."

Sanmotech is now geared up for technology transfer and further joint development, to take its novel technology to the market.

<http://www.expressindia.com>

Optical fibre amplifier

In what promises to be a significant slash in monthly cable TV, telephone and internet bills, scientists here have successfully created India's first optical fibre-based amplifier, that comes with a bonus of wider network coverage and super-fast connectivity.

The amplifier, a key component of cable networks, is an assembly of a spe-

cial kind of optical fibre and a series of electronic inputs, and has to be fitted intermittently along cable lines to restore energy loss during transmission, thus ensuring high quality picture, sound and connectivity.

Cable TV service providers and telecommunication companies currently import the optical fibre amplifiers at a cost of around Rs. 500,000 (US\$ 11,000).

"Indigenization of the product would almost halve its price, bringing down the infrastructure costs borne by service providers and benefiting consumers in the process," Dr. H. S. Maiti, Director of the premier CSIR lab Central Glass and Ceramic Research Institute (CGCRI), co-developer of the amplifier, told PTI.

CGCRI, which also holds the patent for the special Erbium-doped fibre used in the amplifier, has developed it in collaboration with Central Electronics Engineering Research Institute (CEERI), Pilani and private partners Cochin-based Network Systems Technology and Optiware Photonics, Hyderabad.

Ready to take on the Indian market, the amplifier has been put on field trials by Kolkata-based multi-service operators RPG Netcomm and Siticable, and Mumbai's Incable. "The 'fibre-to-home' technology will soon become a reality in India, providing consumers high-end all-purpose connectivity through a single fibre optic cable," Maiti said.

<http://www.hinduonnet.com>

JAPAN Organic hydrogen for fuel cells

Dr. Masayuki Shirai, leader of the Organic Synthesis Team, Supercritical Fluid Research Center (SFRC) of the National Institute of Advanced Industrial Science and Technology (AIST), an independent administrative institution, has developed technology for synthesizing decalin, a promising material for hydrogen storage in fuel cells, through the combination of supercritical carbon dioxide, with a supported rhodium catalyst. The process has the

merits of lower temperature, high selectivity, high efficiency, long life, owing to lack of catalyst aging, easy recovery of decalin, and capability of recycling carbon dioxide solvent. It is expected to contribute to the implementation of a hydrogen storage materials synthesis system, to reduce the environmental burden.

The SFRC-AIST has been dedicated to R&D in an environment-conscious organic synthesis process, based on supercritical water and carbon dioxide. The study about the hydrogenation of naphthalene, using supercritical carbon dioxide and a supported rhodium catalyst, indicates that naphthalene can be efficiently hydrogenated, yielding decalin at 60°C, with a 100 per cent naphthalene conversion rate and 100 per cent selectivity. The hydrogenation of naphthalene results in tetralin or decalin with aromatic ring hydrogenated, partly or completely, respectively. In the conventional naphthalene hydrogenation, tetralin can be obtained readily, while it is rather difficult to synthesize decalin at high concentration in a single step of reaction. Decalin is used for hydrogen storage materials for distributed fuel cell and non-aromatic solvent. The conventional naphthalene hydrogenation is carried out at 200°C or higher reaction temperatures, using supported platinum catalysts. Consequently, adverse decomposition byproducts and aromatic polymers are produced to decrease the yield. Besides, it has a demerit of carbon deposition over the surface of catalyst to degrade the catalysis in the course of reaction. The newly developed process lowers the reaction temperature extensively, upgrades the decalin selectivity drastically, and cleans the catalyst surface by the solvent effect of supercritical carbon dioxide, to ensure repeated and long-term use of catalyst. In this way, the process is meritorious in terms of energy saving and reduction of environmental burden.

The conventional method of naphthalene hydrogenation to synthesize tetralin and decalin has been carried out using supported platinum catalysts, and at reaction temperatures higher than 200°C. The process has some demerits, such as decomposition of

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byproducts, including polymers produced at higher reaction temperatures to decrease the yield, and contamination of catalyst surface to reduce the activity and to curtail the life. Moreover, with this process, hydrogenation is halted at the level of tetralin to affect the decalin selectivity markedly. With the newly developed process, using supercritical carbon dioxide and a supported rhodium catalyst, decalin is obtained from naphthalene at the reaction temperature 60°C and 100 per cent yield.

The newly developed synthetic technology is superior to the conventional method in the following ways:

- By using supercritical carbon dioxide, naphthalene is hydrogenated at temperatures as low as 60°C, much lower than the reaction temperature in the conventional technology (higher than 200°C), which prevents the catalyst activity from being degraded; and
- The use of carbon dioxide solvent improves the yield of decalin extensively.

After the completion of the synthetic reaction, the products can be readily isolated, and both catalyst and carbon dioxide can be easily recovered for recycling.

<http://www.aist.go.jp>

Catalyst for optically active compounds

The Japan Science and Technology Agency (JST) developed a new catalyst to synthesize optically active compounds containing nitrogen, such as amino acids, which are important in the area of fine chemicals, including pharmaceuticals. The development was brought about through one of the JSTs basic research programmes (Exploratory Research for Advance Technology (ERATO) type) entitled "Kobayashi Highly Functionalized Reaction Environments Project" (led by Professor Shu Kobayashi of the University of Tokyo).

Among optically active compounds, there are two compounds whose

three-dimensional structures have enantiomorphous interrelationships (like right and left hands). Because only one enantiomorphism of physiologically active materials, such as amino acids, functions in a living body, it is important to obtain only those with a desired three-dimensional structure selectively. The newly developed copper catalyst preferentially produces only one enantiomorphism in the reactions between glyoxylic acid ester and enecarbamates. This technique enables effective synthesizing of optically active compounds containing nitrogen, such as amino acids.

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S&T Today

High-speed sludge composting system

The Japan Science and Technology Agency (JST) recently transferred the results of its researchers, including Professor Masanori Fujita of Osaka University, to S Science Co., Ltd. (headquartered in Tokyo) and qualified it as a success.

The technology is meant for composting sludge and other effluents of sewage plants in a short time, reducing fermentation time from a month, as required in the past, to a week to ten days.

The principle of this system is to mix organic system waste, such as sewage sludge and compost created by the system under high pressure, using a special mixer to improve the water content and air permeability, and to accelerate aerobic fermentation.

The system can compost sludge in a short time, almost without emitting odour, and deodorization equipment is not needed, except for raw material receiving. It is said that hygienic compost production is feasible because fermentation is implemented in a high temperature, sufficient to extinct pathogenic germs, parasite spawns and weed seeds.

For further information, contact:
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S&T Today

KOREA 60-nanometer 8-Gb NAND flash memory

Samsung Electronics Co., Ltd., the leader in advanced semiconductor technology, announced that it has developed the industry's first 60-nanometre (nm) 8-Gigabit (Gb) NAND Flash memory device for data storage media, such as low density mobile hard disks for mobile appliances.

"NAND flash technology development continues to double density growth on an average of every 12 months," said Dr. Chang Gyu Hwang, president and CEO of Samsung Electronics' Semiconductor business. Verifying the New Memory Growth Model he first presented at the ISSCC's 2001 conference, Dr. Hwang said the industry has seen densities grow from 256 Megabit (Mb) in 1999, to 512 Mb in 2000, 1 Gb in 2001, 2 Gb in 2002, 4 Gb in 2003 and now 8 Gb in 2004."

Samsung's advanced 60 nm process technology is two thousandths the width of a piece of human hair, and achieves approximately 30 per cent reduction in cell size over the 70 nm 4 Gb NAND Flash memory developed last year. The result is the world's smallest cell size.

The key to development at such high densities and fine circuitry design is a 3-D cell transistor structure and high-dielectric gate-insulating technology that minimizes the interference level between cells. In addition, by utilizing the most widely used KrF lithography technology bit, cost is reduced by 50 per cent.

Samsung is further enhancing its technology base by introducing its new multi-level cell (MLC) technology in the 60 nm process technology. The new 8 Gb MLC NAND flash memory broadens the company's flash memory portfolio, meeting increasing market de-

mand for efficient and cost-effective non-volatile storage devices. MLC technology also offers designers a competitive choice for low power, small form factor storage solutions that enable low density mobile internal hard disks (HDD) for compact mobile applications.

The 8Gb NAND flash memory will allow designs of up to 16Gb of storage on a single memory card. The 16Gb of memory translates into storage of up to 16 hours of DVD quality video or 4,000 (five minutes per song) MP3 audio files.

According to market research firm iSuppli, the NAND flash market has doubled annually in volume from \$ 900 million in 2001 to \$ 4.2 billion in 2003. iSuppli expects NAND sales to reach \$ 7.2 billion this year and \$ 9.9 billion in 2005. This contrasts with the growth of NOR flash sales, which shows a three per cent CAGR and sales expanding from \$ 6.7 billion in 2001 to a forecasted \$ 7.6 billion in 2005. In line with these market trends, Samsung's NAND flash business has shown strong growth, expanding from \$ 400 million in 2001 to \$ 2.1 billion in 2003.

The company is focused on accelerating production of advanced devices with 2 Gb NAND flash production, having shipped over 10 million pieces per month to date in 2004. Samsung expects to launch mass production of the 4 Gb NAND flash by the first quarter of 2005. This year Samsung expects to double the volume of NAND sales and account for 65 per cent global market share.

<http://www.samsung.com>

Therapeutic gene delivery system

Followed by years of intensive research, a team of South Korean scientists, led by Ji Geun-eog, a professor at Seoul National University, announced that they developed a delivery system of transferring therapeutic genes into the human body by utilizing bifidus for the first time in the world.

"Up until now, we used pathogens to express antibiotic genes and deliver

them into the body, which proved efficient but dangerous. By contrast, the bifidus expression system ensures safety as well as efficiency," Ji said.

Bifidus is a form of friendly bacteria that aids the large intestine to be restored to normal, making the right environment necessary for the intestine to do its work properly. Until the new delivery system was developed, the pathogen was required to be purified in order to deliver genes due to its virulence. However, even though it was put through a purification process, its revived virulence, at times, had the possibility of threat to in-takers.

"The new bifidus expression vector system might be used to carry anti-cancer proteins to the large intestine in the form of yogurt, milk or baby food," Ji predicted, adding, "We developed source technologies with bifidus, arguably the most prominent carrier to deliver genes into the human body."

<http://www.korea.net>

EUROPE

GERMANY

Chip spots DNA electrochemically

DNA chips contain arrays of DNA fragments, or probes, that bind to target DNA strands in order to spot the genetic fingerprints of disease-causing mutations or microbes. Existing methods of reading DNA chips use fluorescent molecules and relatively expensive microscopes. DNA chips, which promise to enable outside-the-laboratory use of DNA detectors, including applications like detecting pathogens at clinics, require a less cumbersome method of finding out which microscopic spots of immobilized DNA probes are bound to target DNA strands.

Researchers from the University of Bochum and Friz Biochem in Germany have devised a microelectrochemical method of reading DNA chips that could be used in portable detectors. The researchers showed that when DNA probes are attached to a gold electrode, a scanning electrochemical

microscope can detect the chemical changes that occur when the probes attach themselves to target DNA strands.

Ferrocyanide ions, in liquid between the microscope's platinum tip, and the gold electrodes enhance the flow of the electrical current between them. DNA is negatively charged and so repels the negatively-charged ions, diminishing the current. When a DNA probe attaches itself to a target strand, the double-strand reduces the current further.

The researchers plan to build a device that aligns an array of platinum tips over an array of gold electrodes in order to detect many types of DNA at once.

<http://www.technologyreview.com>

THE NETHERLANDS

Photonic crystal throttles light

Researchers from the University of Twente in the Netherlands have showed that the spacing of a photonic crystal can be used to control the timing of light emitted by a quantum dot. Photonic crystals are lattice-like materials made from solids perforated with holes or from regularly-spaced rods or spheres. A quantum dot is a minuscule speck of semiconductor material.

The method could be used to make smaller, more efficient miniature lasers and light-emitting diodes, by accelerating light emission and more efficient solar cells by slowing emission, according to the researchers. And it could eventually be used to shield the fragile quantum information contained in quantum computers.

The researchers placed 4.5-nanometre cadmium selenide quantum dots inside photonic crystal cavities that were 240 to 650 nanometres across and excited the quantum dots with laser pulses that lasted only a few trillionths of a second. The laser energy caused the quantum dots to emit light at a rate that depended on the spacing of the photonic crystals, with wider spacings yielding higher-intensity emissions. A nanometre is one millionth of a millimetre. Photonic crystals can simulta-

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neously control many light wavelengths, or colours.

The researchers are working on a photonic crystal laser. A prototype is possible within a year, and commercial lasers could be ready in five years, according to the researchers. It will be five to ten years before the method can be used in solar cells, according to the researchers. Researchers generally agree that quantum computers are 10 to 20 years away.

<http://www.technologyreview.com>

UNITED KINGDOM Quantum key distribution system

UK researchers have built the world's fastest quantum key distribution system, a major step in the move towards transmitting large amounts of unbreakable coded information. The team, led by Dr. Gerald Buller of Heriot-Watt University's school of engineering and physical sciences, has successfully demonstrated a quantum key distribution (QKD) system with a speed of 2 GHz.

The system transmits encrypted information down standard telecom fibre, and the researchers ultimately hope to use it to send compressed video between two points with absolute security.

This could allow it to be used in the defence and banking industries for sending sensitive video footage and for secure video conferencing. The researchers have also built a multi-user fibre system, consisting of a transmitter and 32 receivers, one of the few in existence, and by far the largest network constructed, according to Buller. 'We have taken QKD up to the level of clock rates of GHz, where, typically, people have been using kHz or MHz in the past. This is taking it up by a factor of 1,000, to make it much more practical,' he said.

Quantum cryptography has the potential to provide verifiably secure data transmission, as it uses streams of single photons so sensitive that unwanted observation by a third party causes errors in the code, which can then be detected by the users. However, to date such systems have been relatively

slow, meaning that the amount of information transmitted is low. As the key must be as long as the amount of information to ensure absolute security, the faster the system, the greater the amount of data that can be sent.

"Our ultimate aim is to send compressed video information in pseudo-real time (or real time, but slightly delayed to allow for decryption). That means we would have to send keys on the mb/sec level. At the moment, we are the only people even close to that."

During the experiments at 2 GHz, the researchers were able to achieve bit rates in excess of 1 million b/sec, although this is only possible over distances of 10 km and under, making the technology suitable for local area networks, such as financial districts and defence companies' campuses.

To reach such speeds, the researchers have improved the components used to build the system. In particular, this has meant improving single photon detectors, and the team is using silicon-based detectors operating at short wavelengths of below one micron. They have been working with a team at the Politecnico di Milano, which has developed devices capable of increased speeds, with significantly reduced 'jitter', a phenomenon that reduces bit rates.

Unlike other researchers - including those at the US National Institute of Standards and Technology - who are developing systems capable of transmitting encoded information through 'free space', the Heriot-Watt team is using standard telecom fibre.

While free space systems have the advantage of being relatively easily reconfigured, making it possible to easily switch to a different receiver for example, they can be adversely affected by environmental conditions, including the weather, humidity, and even ambient light. However, sending short wavelength light down standard telecom fibre normally results in propagation difficulties, as the light is split into different modes, all of which have different speeds and propagation rates.

So the researchers have developed a method of splicing special 850 nm fibre fitted to the transmitter and receiver, with

standard telecom fibre in between. By splicing the fibres correctly, it ensures that only the desired mode is excited and propagates down the standard fibre, while other modes are suppressed.

A technique for 'hiding' information within broadband light could provide a cheaper and faster alternative to quantum encryption, Scottish engineers claim. Dr. Andy Harvey, senior lecturer at Heriot-Watt University's school of engineering and physical sciences, has developed a method for optically encrypting information, and is talking to fibreoptics and secure communications companies about commercializing the technology. The system allows information to be transmitted at very high rates, he said.

'We don't have the sexiness of quantum encryption, but we do have the practicality of a system we could put together tomorrow for high data rates.'

The technology also allows secure data to be sent across long distances, he added. 'If you look at quantum cryptography, typically it is limited to tens of km, and you can't put a quantum encrypted signal through an optical amplifier, which would enable you to transmit it across the Atlantic, for example. With our system, the signal can be transmitted through an optical amplifier and it remains encrypted. 'So we have long range, we have high data rates, and we can implement it using off the shelf technology,' he said.

The system uses a transmitter to create an optical signal, which is sent down a fibre into an encryptor, where it is given a specific signature called an optical key. Unless the person receiving the message has this key, all they will see is broadband light coming out of the fibre, said Harvey. However, if the signal is put through a decryptor, which contains a matching optical key, the information can be retrieved.

So unlike other encryption systems, a third party could not even record the coded information and attempt to decrypt it later, he said. "I have to have the key even to record the data, and there is nothing to stop me encrypting that data as well of course to make it doubly secure."

<http://www.e4engineering.com>

NORTH AMERICA

USA

Nanofabrication technique in molecular electronics

Researchers at Northwestern University, USA, have used a scanning tunnelling microscope (STM) to create organosilicon nanostructures on a silicon substrate at room temperature. The technique, dubbed multi-step feedback-controlled lithography, could have applications in molecular electronics.

"We have demonstrated a strategy for intentionally positioning molecules, which is necessary for the construction of nanoscale systems such as molecular transistors or light-emitting diodes," said Mark Hersam of Northwestern.

"Our process works at room temperature and on silicon, which suggests that it can be made compatible with conventional silicon microelectronics," he added. "Ultimately we want to integrate with current technology, creating a bridge between microelectronics and nanoelectronics."

Hersam and colleagues used the STM's localized electron beam to desorb two individual hydrogen atoms from the same row of a hydrogen-terminated Si (100) surface. This process is known as feedback-controlled lithography. Then the scientists introduced 2, 2, 6, 6-tetramethyl-1-piperidinyloxy (TEMPO) free radicals. These attached themselves to the dangling bonds left behind by the desorbed hydrogen atoms.

To date, it has been hard to make nanostructures from multiple species in this way. That is because carrying out feedback-controlled lithography a second time next to the original location can cause the newly adsorbed species to desorb. The Northwestern technique avoids the problem by combining feedback-controlled lithography with the spontaneous growth of a styrene chain.

To achieve this, the team used feedback-controlled lithography to create another dangling bond at a location in between the two TEMPO molecules. The styrene's carbon-carbon double

bond reacted with this dangling bond. The result was a carbon radical on the styrene molecule that removed a hydrogen atom from a neighbouring silicon dimer. In turn, this left a new dangling bond to react with another styrene molecule.

Growth continued until the chain reached the TEMPO molecules. This produced a nanostructure on the silicon surface that contained different types of molecules - the first time this has been achieved at room temperature.

"Previously we were working with single molecules on silicon," said Hersam. "This new process enables us to build more complex structures. Plus, the technique is general and can be used with many different molecules, which increases its potential."

<http://www.nanotechweb.org>

Nanocrystals spark efficient LEDs

Researchers from Los Alamos National Laboratory have found a way to make highly efficient light-emitting diodes from nanocrystals, or tiny bits of semiconductor. The light-emitting diodes can be as small as a few nanometres in diameter; a nanometre is one millionth of a millimeter, or the span of 10 hydrogen atoms. The nanoscale lights use very little power and can be made in different colours, simply by varying the sizes of the nanocrystals.

The microscopic light-emitting diodes could eventually be used in nanoscale optics, including light-based computer chips. Large numbers of the microscopic lights could also be used as ultra-high efficiency lights, including street lighting, according to the researchers.

Nanocrystals are very efficient light emitters, easy to manufacture and durable. The difficulty in using them as light sources is finding a way to electrically excite the crystals to kick off the light-emission process. This is because nanocrystals have an insulating shell of molecules. Previous efforts used organic conductors to excite the nanocrystals, but were not very efficient.

The researchers' method uses a quantum well, or electron trap, to inject pairs of electrons and their opposite charges, holes, into the nanocrystals. Electrons and holes pair up and annihilate each other, and the resulting energy is released as photons. The technology could become commercially viable in three to five years, according to the researchers.

<http://www.technologyreview.com>

Nanowire makes standup transistor

Researchers from NASA Ames Research Center have devised a simple way to make a set of vertical transistors from nanowires. Vertical transistors can be packed more closely than traditional horizontal configurations, and they can also be stacked into three-dimensional arrays. The nanowires measure 40 nanometres in diameter and 1,000 nanometres high. A nanometre is one millionth of a millimeter, or the span of 10 hydrogen atoms. The densely-packed nanowire transistors could be used to make fast, low-power computer chips and memory devices that hold a lot of data.

The nanowire serves as a semiconductor channel that carries current from a source electrode on the bottom of the vertical transistor to a drain electrode on top. An electrode that surrounds the middle section of the nanowire acts as a gate that controls the flow of current through the device, and so can turn it on or off.

The researchers grew the nanowire using a chemical vapour, encapsulated it in a 20-nanometre insulating layer, deposited a 40-nanometre layer of chromium to form the gate, ground the top to expose the nanowire, then added the top electrode.

The researchers' device is made from zinc oxide nanowires, which are appropriate for space applications because they are radiation resistant. The key to using the researchers' method to make transistors for commercial applications is to use silicon instead of zinc oxide.

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