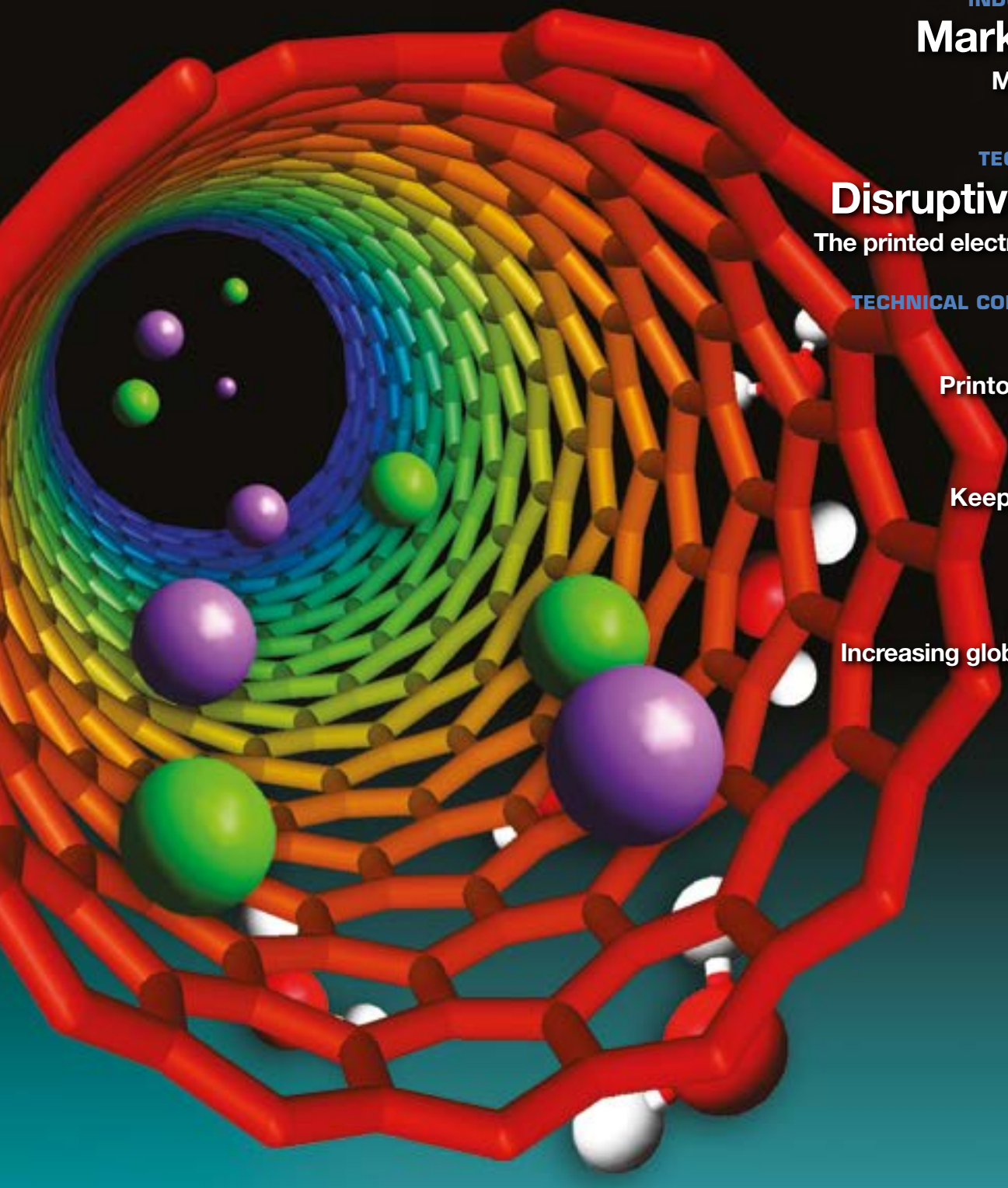
IEC e-tech
News & views from the IEC
ISSUE 05/2013

SUPERSMALL, SUPERFAST



INDUSTRY SPOTLIGHT
Market trends
Mini, micro, nano

TECHNOLOGY FOCUS
Disruptive printing
The printed electronics revolution

TECHNICAL COMMITTEE AFFAIRS
TC 119
Printout for the future

TC 107
Keep safety sky high

IEC WORLD
CEM4
Increasing global energy safety

CONTENTS

4 *Printed electronics, set to revolutionize the electronics industry, will prove a disruptive, yet creative process that will allow the production of new low-cost electronic devices* **5** *The IEC was invited to participate in the GSEP annual summit and hosted a session on energy microgrids for disaster resilience and recovery* **7** *A new brochure showcases IEC work in the energy sector* **8** *IEC TC 107 prepares International Standards to ensure the safety and reliability of avionics products and systems* **16** *IECEE just launched a new service entirely dedicated to industrial automation* **29** *New feedback button on IEC websites.*

Focus of the month
Supersmall, superfast

This issue of *e-tech* focuses on the trend to reduce the size of many systems and devices, which is gathering pace and is driven by cost, energy efficiency and environmental considerations. It is most noticeable in the electrical and electronic domains which provide components that are integrated into other equipment and systems like mechanical products, to make them smaller, more efficient, reliable and cheaper to operate.

Supersmall, superfast

IEC Standardization work makes it possible

Claire Marchand,
Managing Editor e-tech.

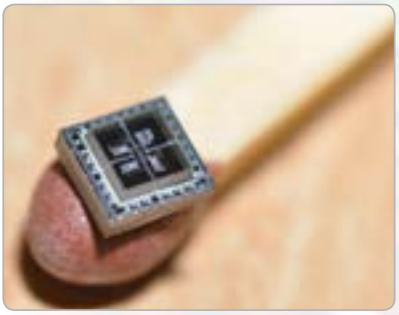
Mini, pico, nano, micro are prefixes that are getting ever more common in the electrotechnology world. They are used to describe components, such as MEMS (micro-electromechanical systems), technologies (nanotechnology), installations (pico hydro-stations) or networks (minigrids).

Benefits for industry and consumers

The advantages of small components, systems and installations are obvious: new technologies such as printed electronics allow more compact equipment that finds its use where space and weight are at a premium, like on aircraft where avionics products are replacing older analogue systems. The use of MEMS has brought forward a new generation of smaller and thinner portable electronic devices, increasing their performance, accuracy and reliability. Many other industry sectors benefit from these technological advances.

International Standards

The trend towards the production of smaller systems and products has been made possible by the work of dozens of IEC TCs (Technical Committees) and their SCs (Subcommittees), whose title often indicates that their work focuses on small components.



MEMS developed by the Institute for System Level Integration (Photo: ISLI)

Micro-hydroelectric system in Bhutan (Photo: Schatz Energy Research Center)

Nano dipole antennas under the microscope. The colors reflect the different transmission frequencies (Photo: LTI)

Disruptive printing

Printed electronics is a relatively new transformational technology

Morand Fachot

Printed electronics is set to revolutionize the electronics industry and many other domains. It will prove a disruptive, yet creative process that will allow the production of new low-cost electronic devices. Equipment, substrates and printing processes are already widely available. An IEC TC was set up in 2011 to prepare International Standards in the field of printed electronics.

The new printing revolution

Printing is no longer just about reproducing text and images with ink on paper or another support. 3D printing, rapid prototyping or additive manufacturing, as it is often called, has seen the creation of various objects by adding successive layers of materials to create a product.

Another form of 3D-related printing, PE (printed electronics), is fast emerging and set to revolutionize many industrial applications. It consists in the creation of electronic devices and components using various printing methods, equipment and material.

This technology makes it possible to produce a wide variety of products that can be used in countless applications. It has other advantages, such as much lower production costs than conventional electronics and it can be applied to flexible or rigid supports (or substrates).

Wide range of materials

PE transforms the way electronic devices are made and employed. Using materials (inks and substrates) that have conducting, semiconducting, non-conducting, electroluminescent, PV or other properties, and different printing methods (e.g. lithography, inkjet, or screen printing,) allows great design flexibility and possibilities.

Both inorganic and organic materials are used for printed electronics. Organic materials can be found in products such as OLED (organic light-emitting diodes) displays used in televisions sets, computer monitors or mobile phones, and OPVC (organic PV cells).

Innovative materials such as carbon nanotubes allow new or enhanced applications for batteries, new types of solar cells, ultracapacitors and electrical circuits.

Engineers throughout the world use printed electronics to design a variety of components and products, such as TFT (thin film transistor), flexible displays that can be unfolded to make up a large television, PV (photovoltaic) cells that fit windows or the roofs of cars or innovative and energy-efficient lighting solutions.

In the short- and medium term, hybrid systems – combining printed, flexible electronics with building blocks containing classical (silicon) electronics will be introduced.

Multiple applications

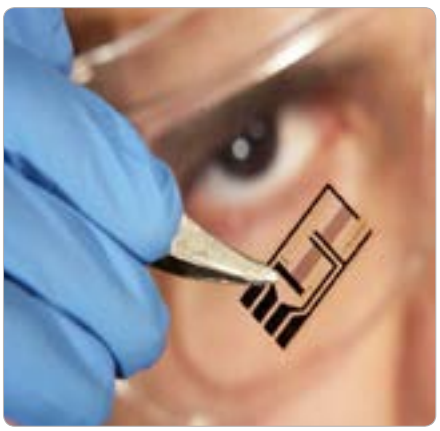
PE are already widely used in RFID (radio frequency identification) tags on product packaging to protect against shoplifting and to identify items during transport. They are also used in the production of flexible electronic circuits which are widespread in products where space constraints are significant, such as in small consumer electronics devices (i.e. digital cameras, mobile phones).

Technologies are being developed that make it possible to print electronic components, such as sensors, transistors, light-emitters, smart tags and labels, flexible batteries to power flexible and printed electronics, memory, etc.

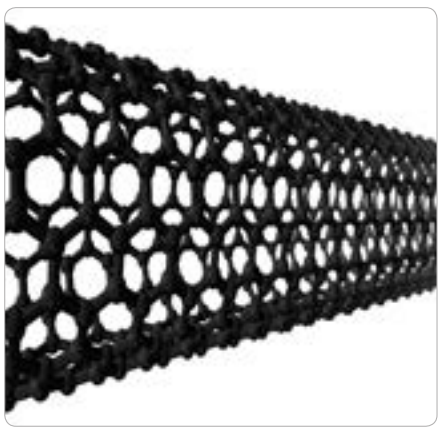
New printed electronics applications are emerging opening up possibilities not envisaged before. One such application is in the domain of printed batteries. US scientist have recently printed a lithium-ion battery the size of a grain of sand that could one day power tiny medical implants as well as other micro electronic devices.

From research to industrial design and to marketable products

New technologies in the printed electronics domain are emerging all the



Printed electronic component



Carbon nanotubes are used to make printed electronic products

time, many are still at the research stage or under development and not ready for commercialization yet.

However, printed electronics are being found in more and more mass-produced items, in particular in the automotive, consumer electronics and pharmaceutical industries, as well as in packaging where smart labels can provide item-level tracking of quality data for goods such as pharmaceuticals and perishable food.

The printed electronics industry currently covers 5 main areas:

- Lighting, including both OLED and electroluminescent (EL) products)
- Organic PV
- Flexible displays
- Electronics and components, including RFID, memories, batteries and other components
- ISS (integrated smart systems) that include smart objects, sensors like MEMS (micro electro mechanical system) and smart textiles.

IEC contribution

The 5 areas that see widespread use of printed electronics are already covered by several IEC TCs (Technical Committees). However, printed electronics industry experts stressed, at their regular trade meetings and events, a need for standardization in a number of PE-specific areas. These include terminology, materials, processes, equipments, products as well as health, safety and environment issues. As a result of this need the IEC's SMB (Standardization Management Board) decided to create TC 119 to prepare standardization work in the field of printed electronics. TC 119 was established in October 2011. It has 11 participating members and 7 observer members. Given the rapid growth of the PE industry in recent years and its prospects in the future the obvious need for PE standardization points to a very dynamic future for TC 119.

Printed photovoltaic panel (Photo: Solamet)

IEC shares vision with energy leaders

IEC President attends GSEP 2013 Washington Summit

Janice Blondeau

At the recent GSEP (Global Sustainable Electricity Partnership) annual summit the IEC was invited to participate in the programme and also hosted a session on energy microgrids for disaster resilience and recovery. The GSEP summit, held in Washington D.C. on 5-7 June 2013, brought together the heads of the largest electricity companies in the world. IEC President Klaus Wucherer represented the IEC at this key international gathering of electric utility leaders.

The GSEP and its annual summit

The GSEP was created in 1992 in the context of the UN Rio Earth Summit, with the aim to promote sustainable energy development through electricity sector projects and training programmes for developing nations. The original GSEP founders, Électricité de France and Hydro-Québec, invited the chairmen of

The GSEP Summit brought together the world's 14 leading electric utilities. (Image: GSEP)

IEC President Klaus Wucherer represented the IEC at the GSEP Summit in Washington D.C.

Smart microgrids bring advantages for both disaster resilience and recovery.

some of the largest electric utilities among G7 countries to create an international group. Today the GSEP brings together the world's 14 leading electricity companies.

The GSEP Washington summit featured exchanges between the GSEP member companies' Chairmen and distinguished guests including former US President Bill Clinton and World Bank President Dr Jim Yong Kim.

During the summit, Wucherer participated in a panel discussion on the impact of emerging technologies and innovations on the current business models. The IEC participated in the summit as an invited guest as did MIT (Massachusetts Institute of Technology), the World Energy Council and EPRI (Electric Power Research Institute).

Keep the electricity on, no matter what

IEC President Klaus Wucherer welcomed participants at the IEC-hosted session which discussed how microgrids may assist energy utilities to resist disaster and to enable faster recovery when disaster strikes. SGCC (State Grid Corporation of China) CEO Liu Zhenya gave the opening address, stating that coordinated development and integration between UHV grids and grids at all levels was the key for constructing a "strong, smart, green" next generation grid. He highlighted that IEC International Standards are fundamental for these innovations to be realised. Glenn Platt of the Local Energy Systems division of Australia's CSIRO (Commonwealth Scientific and Industrial Research Organisation) moderated the discussion.

Recent natural disasters including tsunamis, widespread flooding, hurricanes and bushfires have left millions of people without power and the critical services it assures. Ensuring that the electricity stays on when natural disasters strike is crucial, especially since climate change science suggests the frequency of these disasters is likely to increase. In addition, despite the best efforts of system engineers, major unrelated power outages have occurred when small electrical faults have cascaded into serious network-wide failures.

Energy microgrids in disaster recovery

"Smart microgrids present an accessible and reliable solution for recovery, given their flexibility to resist outages caused by disasters," said IEC President Klaus Wucherer. "They allow energy to be available and distributed to communities where or close to where it is generated. Microgrids could help ensure that when a disaster occurs, the electrical power is kept on, to help life get back to normal for those affected."

For the utility, microgrids may ease the challenge of controlling large numbers of distributed resources by making distributed generation control an internal process, operating within the microgrid.

The role of small-scale renewable energy systems, such as roof-top solar, in disaster recovery and the role that IEC International Standards could play in microgrid operation and disaster recovery were also discussed. On the agenda as well were the interdependencies that can complicate today's electricity networks – such as relationships between communication systems, fuel supplies and distribution system operation.

Discussions also recognized the urgent need to upgrade infrastructure to ensure the reliability of the grid, and the challenges that this brings, such as rising costs and consumers not wanting price increases. Policy makers and utilities will need to look at this in different ways to find new solutions.

IEC and CSIRO working on new White Paper

Recognizing these opportunities and the challenges still to be overcome, in September 2012 the IEC MSB (Market Strategy Board) started working on a MDR (microgrid for disaster recovery) project. A Microgrid Disaster Preparedness and Recovery workshop and meeting was hosted by IEC in early 2013. In cooperation with CSIRO and an IEC MSB member from Japan, the IEC Market Strategy Board is preparing a White Paper on microgrids for disaster recovery, with publication planned for October 2013.

About microgrids

A microgrid is a collection of controllable and physically proximate distributed generator and load resources, with multiple sources of power of which at least one is based on a renewable energy technology.

There are a number of reasons why microgrids are now receiving significant attention. If the wider grid is operational but strained, a microgrid can assist by reducing the load on the wider grid or by exporting power from the microgrid to a surrounding area. As well as power management, microgrids can also help

with voltage and frequency control in such situations.

Microgrids group distinct distributed resources such as generators or loads so that they represent a single generator or load to the wider electricity system. They are also useful in areas not yet reached by the main grid.

IEC work on microgrids

IEC SG (Strategic Group) 3: Smart Grid, developed the Smart Grid Roadmap with microgrids placed within DER (Distributed Energy Resources). *Guidelines for the General Planning and Design of Microgrids* have been submitted as new work proposals in IEC TC (Technical Committee) 8: Systems aspects for electrical energy supply. TC 8 also prepares International systems Standards for equipment, protection schemes, and communication systems.

Clean energy for all

A highlight of the summit was Jim Yong Kim's speech on the role the World Bank can play in advancing universal energy access and the importance of having a coordinated effort across sectors. His intervention stressed the importance of GSEP's UNSE4ALL (the Sustainable Energy for All initiative of the UN) commitment. President Clinton stated that the answer to poverty reduction is access to electricity and that international cooperation is essential to achieve this on a global scale.

The IEC participates in the UN Foundation Energy Access Practitioner Network to address market barriers to achieve universal energy access, as part of the global initiative on SE4ALL.

GSEP

The Global Sustainable Electricity Partnership is an organization of the world's leading electricity companies that promotes sustainable energy develpment through electricity sector projects and human capacity building activities in developing and emerging nations worldwide.

The IEC helps keep the power on

New brochure showcases work in the energy sector

Janice Blondeau

Modern life is unthinkable without electricity – it transforms lives. IEC International Standards cover all facets of electrical energy generation, distribution, storage and use; including manufacturing, Smart Grid, smart cities, smart buildings, and e-mobility. They allow millions of components, devices and systems that use or produce electricity or contain electronics to work safely with each other everywhere in the world. A new brochure shows just how the IEC is working when it comes to energy – you may be surprised!

Wherever there's electric energy the IEC is present

IEC has led the way in establishing International Standards for transmission, connection and use. It provides detailed technical guidance for implementers of emerging systems such as off-grid small-scale sustainable energy initiatives. IEC's primary drivers are safety, energy efficiency and systems compatibility, thus enabling safe and economic use of electrical and electronic goods and services wherever they are needed.

Electricity lights homes, offices and public spaces, drives information and communication technology, enables financial transactions and powers gadgets and mobile phones. IEC work covers the devices that use electricity at home, in the office, in healthcare facilities or public spaces, as well as the components from which they are all built.

The IEC also administers Conformity Assessment Systems with thousands of testing laboratories that certify that components, equipment and systems meet its Standards.

The IEC and energy

The new brochure provides insights, with colourful photos and graphics, of how the IEC and the thousands of experts who participate in its work are committed to bringing reliable and safe electricity to the world, including the 1,3 billion people who so urgently need it. It presents real life examples

How the IEC helps keep the power on is the theme of a new brochure

IEC International Standards and Conformity Assessment schemes are present wherever there is electrical energy. (Photo credit © Norsk Hydro)

Millions of devices, components and their larger systems are covered by IEC work

with reference to the relevant IEC Technical Committees and Conformity Assessment schemes.

Electrical energy... the IEC helps keep the power on has sections on the main areas of the IEC's work – generation, T&D (Transmission & Distribution), storage, components, connectors, cables and switches. Also covered is work in interoperability, safety, EMC (Electromagnetic compatibility), terminology, and the environment and hazardous substances.

The brochure *Electrical energy... the IEC helps keep the power on can be downloaded in PDF format or as a paper version from the IEC Central Office. It is a suitable educational and awareness-building tool which can be used by Technical Committees and National Committees alike. This is a living document, which will continue to be updated as IEC work develops.*

Citius, Altius, Fortius…

The sky's no limit.

Morand Fachot

"Faster, Higher, Stronger" – the Olympic motto could very well reflect the evolution of civil aviation. Planes are flying faster, higher and further than ever, as well as transporting more passengers, nearly 3 billion in 2012, with increasing safety. This has much to do with major advances in avionics, the electronic systems used in commercial, civil and defence aerospace applications. IEC TC (Technical Committee) 107 develops process management standards for avionics.

A huge market

Avionics represent a significant share of the cost of both commercial and defence aircraft, anywhere between 20% and 80% according to the type of plane. Sales of commercial aircraft are booming: no less than 1 460 units of all types were sold at the recent Paris Air Show.

In its Current Market Outlook 2013-2032 for the commercial aviation sector, the Boeing Company estimates that the demand for aircraft (from wide body to regional jets) over that period will exceed 35 000 units with a total value of over USD 4 800 billion.

Flight engineer stations, such as this one, were made obsolete by advanced avionics

From pioneers to international air transport

Commercial air transport started with mail services in Europe, the US and between continents soon after WW1 (World War 1). Services for fare-paying passengers were launched on short-haul flights on a very limited scale in the 1930s. Following WW2, the availability of large fleets of surplus advanced military aircraft, capable of carrying many passengers and freight over longer distances, helped kick-start international air transport. Initially this was on a limited scale due to relatively high costs.

In early air travel, aircraft were equipped only with basic instruments and pilots flew according to mainly visual flight rules.

Safety: a prime concern from the onset

Navigation, one of the most crucial factors in air safety, relied initially on a limited set of instruments that gave pilots indications of speed (airspeed and vertical speed indicators), altitude (altimeter), direction (magnetic and gyro compass) and used attitude indicators that showed the degree of bank (level wings) and pitch (nose up or down).

These instruments were particularly valuable in poor visibility conditions and gave air pressure and indications of magnetic or gyroscopic effects. They were liable to report inaccurate information due to imprecise calibration and adverse atmospheric conditions (e.g. ice might clog the pitot tubes used to determine airspeed) or magnetic effects (geomagnetic storms, changes in geomagnetic fields affecting compass).

Pilots also relied on other methods such as celestial navigation or dead reckoning, where an aircraft's current position is calculated based on previous position, expected plane and wind speeds and other parameters, such as sightings of landmarks. These methods are notably subject to human error.

Other flight instruments such as dials and gauges were also indispensable for keeping pilots and crews informed about essential mechanical parameters on the aircraft, such as fuel levels, engine oil pressure and temperature.

Another important aspect of flight safety, communication with the ground, was introduced with the use of HF (high-frequency) shortwave radio in the 1930s. It is still in use today.

Into the modern age

Although some radio navigation techniques such as RDF (radio detection finding), which determines a position via triangulation, and other radio beam systems, were developed in the 1930s, the main technological innovations for air navigation were launched during WW2. Again, as often in the past, war proved a major technology accelerator, heralding advances in equipment, such as autopilot, which allowed the first transatlantic flight with automatic landing to take place in 1947.

Arguably the most significant innovation that found its way into civilian aviation applications after the war was radar detection. Radars were first installed in ground stations in Britain shortly before WW2 to provide long-range detection and tracking of enemy bombers. They were later fitted into military aircraft to find targets on the ground and in the air.

Another electronics-based device that was developed during the war was the transponder for IFF (identification, friend or foe) system. The SSR (secondary surveillance radar) system used in air traffic control is based on IFF.

These developments were introduced into civil aviation applications along with advances in the use of radio navigation systems using the VHF (very high frequency) band (108 to 117.95 MHz) deployed in VOR (VHF omnidirectional radio range) and led to major improvements in aircraft navigation.

After WW2, civilian aircraft, like their military counterparts from which they were often derived, allowed long-haul transport of passengers and freight. However, the added complexity of their various systems, such as multiple piston and jet engines, hydraulic and electrical equipment, meant constant monitoring of countless dials and gauges under the supervision of a flight engineer.

Safer flights

The use of radars and transponders in aircraft led to the introduction of other systems, such as airborne weather radar, which warns of severe weather conditions ahead of the aircraft, and lightning detectors.

TCAS (traffic alert and collision avoidance system), reducing the risk of mid-air collision, and GPWS (ground proximity warning system), helping prevent a normally functioning aircraft under the control of a properly trained crew from flying into the ground, are further examples of detection equipment that has been gradually installed into aircraft. The systems have greatly enhanced aviation safety. The ICAO (International Civil Aviation Organization) recommends or mandates that these systems are fitted to civilian aircraft of certain categories. Many different IEC TCs (Technical Committees) participate in the development of Standards for these technologies.

Aircraft navigation errors can lead to crashes and other tragic incidents. This was the case when KAL 007, a Korean

Boeing 777 glass cockpit (Photo: Boeing Company)

Pilot using "FlySmart with Airbus" electronic flight bag for Apple iPad devices (Photo Airbus)

Air Lines passenger flight from Anchorage to Seoul, was shot down by a Soviet Air Force fighter after it strayed over Soviet airspace in September 1983. This tragedy, in which 269 died, led US President Ronald Reagan to announce the same month that GPS (Global Positioning System), the US-developed satellite-based navigation system, would be made available for civilian use once it became operational, which it did in 1994.

The electronics revolution

The widespread and parallel introduction of avionics in the military and civilian sectors is a natural development of the integration observed in the aircraft industry. A small number of large companies (some now merged into others), such as Lockheed, McDonnell-Douglas or Boeing in the US, British Aerospace in the UK, Dassault Aviation in France, United Aircraft Corporation (Russia), EADS (European Aeronautic Defence and Space Company), or Embraer (Brazil), develop most of the world's civilian and military aircraft. Most of them participate actively in IEC work. Their engineers frequently develop systems that are installed in both military and civilian aircraft. However, 80% of the avionics market is controlled by a very small number of OEMs (Original Equipment Manufacturers).

The development of avionics has been greatly accelerated by the widespread introduction of ICs (integrated circuits) that resulted in the availability of smaller and more powerful electronic equipment in general, as well as advances being made in other domains. One example is flat displays offering full colour graphics both at night and in full sunlight. Avionics now covers a very wide range of equipment that includes fly-by-wire systems, communications, flight controls, displays, flight management, aircraft sensors, data management, navigation and monitoring systems.

Enter the glass cockpit

As computers and electronic sensors started providing all the information pilots needed, it became more practical to replace arrays of multiple analogue mechanical dials and gauges with electronic displays. In particular, MFDs (multi-function displays) can show navigational, weather and other information from multiple systems if and when required.

Replacing analogue dials and gauges with digital units made it possible to have a so-called "glass cockpit" with a two-man flight deck, eliminating the need for a flight engineer. Furthermore, avionics allows families of aircraft to share the same basic glass cockpit, making it easier for crews to train and fly different aircraft.

Pilots now increasingly use electronic flight bags, the size of a laptop computer or smaller, which replace the traditional carry-on flight bags containing aircraft operating manual, flight-crew operating manual, navigational charts and other paper documents. Tablet computers can also be adapted for use as electronic flight bags.

IEC work crucial for avionics

Although they may be subjected to severe conditions such as the possible negative effects of atmospheric radiation at high altitude, or temperatures that may be outside the range specified for semiconductor devices by their manufacturers, avionics products must still perform reliably and safely during their working life.

IEC TC 107 develops process management standards for these and other issues. Avionics OEMs use increasing volumes of COTS (commercial off the shelf) electronic components, equipment and systems designed and manufactured for other industries in which they have limited control.

Many countries and regions are adopting legislation that restricts or eliminates the use of substances containing lead in most electrical and electronic equipment. As the avionics industry relies on COTS components, TC 107 provides a lead-free control plan that allows manufacturers to check the reliability of the components they use.

TC 107 has also set up a WG (Working Group) to provide guidance for the avoidance, detection and mitigation of counterfeit electronic parts in avionics applications.

IECQ, the worldwide approval and certification system for covering the supply of electronic components and associated materials and assemblies and processes, has a special scheme, ECMP (Electronic Component Management Plan), for avionics products. Other IEC TCs, such as TC 47: Semiconductor devices, or TC 110: Electronic display devices, prepare International Standards for components used in avionics applications.

Contributing to the safety of a whole industry

In addition to new aircraft being equipped with avionics ("forward fit"), the retrofit of newer systems into existing aircraft adds value to the avionics market, which is worth billions of dollars.

IEC International Standards ensure this sector expands whilst offering authentic products that are reliable and safe during their required life.

Small is beautiful

Small electrical and electronic components and devices are found everywhere

Morand Fachot

The trend to reduce the size of many systems and devices is gathering pace, driven by cost, energy efficiency and environmental considerations. It is most noticeable in the electrical and electronic domains which provide components that are integrated into other equipment and systems such as mechanical products, to make them smaller, more efficient, reliable and cheaper to operate. Many IEC TCs are involved in ensuring the success of this trend.

Downsizing

Micro, mini, pico, nano: there are few domains where all these suffixes are used as frequently as in electrotechnology.

They can be found in hydroelectricity production where mini-, micro- and pico-hydro stations are proving more and more popular in places in which large hydropower stations are not feasible for various reasons.

In power generation and distribution, minigrids and microgrids, small clusters of loads and generators linked together and sharing one point of connection to the wider grid, are seen as a groundbreaking solution for providing access to electricity for the 1,3 billion people currently without it. They are being installed in rural areas that are beyond the reach of the main grid. They are also used elsewhere to provide reliability, grid stabilization and renewable integration in both developing and developed economies.

In electronics, downsizing is the rule of the game. This is the result of the growing global demand for small and affordable consumer electronic goods, the integration of miniature electronic components and devices in other systems and the quest for lower manufacturing costs.

The downsizing trend has spawned nanotechnology, the science, engineering and technology of manipulating matter at a nanoscale (i.e. down to 1/100 000th the width of a human hair) to create new and unique materials and products.

Integration

Electronic components are now ubiquitous in applications ranging from packaging, where RFID (radio-frequency identification) is used to identify and track products, to large mechanical systems such as motor vehicles, trains, ships or aircraft.

The miniaturization of electronic components, such as semiconductor devices, and electronic assemblies, as well as the gradual and recent introduction of new techniques and processes such as printed electronics or nanotechnology, have made it easier to integrate the devices into other products – or create entirely new ones.

Work across the IEC

The trend towards the production of smaller systems and products has been made possible by the work of dozens of IEC TCs (Technical Committees) and their SCs (Subcommittees), whose title often indicates that their work focuses on small components.

All electrotechnology products require a power source. Small, mini, micro and nano components and devices often draw their power from either rechargeable (secondary) or disposable (primary) batteries. IEC TC 21 and TC 35 develop International Standards for, respectively, these types of cells and batteries.

Small components and devices also require other parts, such as cables, connectors, miniature fuses, capacitors and resistors. IEC TC 20: Electric cables, SC 32C: Miniature fuses, TC 40: Capacitors and resistors for electronic equipment,TC 48: Electromechanical components and mechanical structures for electronic equipment, as well as many other IEC TCs and SCs develop International Standards to enable the production of such small scale technologies.

Semiconductors have played and will continue to play a decisive role in the miniaturization of devices and systems. International Standards for these are developed by IEC TC 47: Semiconductor

Pico-hydro generators

devices, and its SCs, in particular: SC 47E: Discrete semiconductor devices, and SC 47F: Micro-electromechanical systems (MEMS).

Standardization work by TC 119: Printed electronics, a rapidly expanding area, will open many more opportunities for the production of smaller systems, assemblies and devices.

Ever smaller

Nanotechnology, the manipulation of matter at the atomic scale, is seen as a key technology for the future. Its ultimate goal is to build nanomachines, mechanical or electromechanical devices whose dimensions are measured in nanometres (millionths of a millimetre).

Companies and governments are investing heavily in nanotechnology. The US government, for instance, is allocating nearly USD 1,8 billion in federal funds for the sector in Fiscal Year 2014. Global government R&D investments in nanotechnologies were reported to be around USD 7,7 billion in 2010.

The sector has generated global economic returns of some USD 253 billion in 2009 and is expected to bring in nearly USD 2 500 billion by 2015.

IEC TC 113: Nanotechnology standardization for electrical and electronic products and systems, was set up in 2006 to develop International Standards for the technologies relevant to electrical and electronic products and systems in the field of nanotechnology.

In June 2013 it approved a Nanoelectronics Standardization Roadmap that will provide the foundation for a standardization strategy for nano-electrotechnologies.

The TC is developing and has already published International Standards for the use of nanomaterials such as carbon nanotubes or graphene, as well as for nano-enabled electrotechnical products. Environmental, health and safety issues are at the forefront of its work. This is due to the fact that a number of materials that are, under normal circumstances, harmless for humans, animals or the environment can become toxic at the nano-scale because of their increased ability to cross skin or cell-membranes.

Special conductive ink is used for printed electronics (Photo: DuPont)

Nanochip

Relentless march

The quest for more compact and energy-efficient devices and products in many consumer and industrial applications and goods is driving a strong demand for smaller electrical and electronic components. These are integrated into equipment and systems for which many IEC TCs and SCs prepare International Standards.

Household appliances have become much more versatile and can be programmed more easily than ever before thanks to smaller electronic components. They have also become safer. IEC TC 61, prepares safety requirements for electrical appliances for household and similar purposes. The same trend towards smaller products has been observed in equipment and systems for the audio, video, multimedia and IT domains, including displays, for which TC 100 and TC 110 develop International Standards.

A significant segment of electrical medical equipment relies on microsystem devices that are based on MEMS. The so-called bioMEMS market is expected to increase threefold over the 2012-2015 period to exceed USD 6,5 billion. International Standards for electrical equipment in medical practice are prepared by TC 62.

Small equipment helps take you far away

The automotive sector is a major user of electronic and electrical systems as the electrical content of motor vehicles is growing constantly. Cars contain a wide range of systems that include printed circuit boards and sensors to control lights and wipers, to indicate parameters such as speed, tyre pressure and temperature, or to set off airbags. They offer more security and comfort for road users and contribute to the lower fuel consumption of vehicles.

Small electronic and electrical components and assemblies have also led to major advances in avionics, the electronic systems used on aircraft instrumentation for navigation, communications, and flight management. They have greatly improved flight safety and made it possible to have lighter systems, an important factor in a sector where extra weight translates into significant additional fuel consumption and cost. IEC TC 107 develops International process management Standards on systems and equipment used in the field of avionics.

The integration of smaller electric and electronic components and systems is set to expand into more electrotechnology domains. This trend is made possible by the standardization work of dozens of IEC TCs.

Printout for the future

New IEC TC for new technology

Morand Fachot

Printed electronics is a relatively new technology that uses an additive process to create a variety of electronic components and systems. It is rapidly advancing from research and inventions into production and mass market. Calls for standardization in this sector by the industry led to the creation of IEC TC 119.

Expanding domain

The fast rising global demand for relatively low-cost consumer electronic goods has stimulated the emergence of various technologies to support this market. Producing conventional electronics using silicon-based components is costly and faces some environmental issues making it necessary to find other technologies.

Using additive manufacturing processes some producers have started printing electronic parts and components on rigid or flexible substrates.

Printing techniques are often similar to those used in conventional printing, such as offset, screen printing, flexography or inkjet. Each of these techniques for printed electronics production has been developed over the previous decades with a wide choice of substrates and inks that allow an extensive and expanding range of products. It includes printed circuit boards, flexible displays, PV (photovoltaic) cells, lights, memory, sensors, RFID (radio frequency identification) and NFC (near field communication) systems, to name only a few.

Huge market emerging

The demand for new kinds of electronic goods and the variety of low-cost products made possible by printing electronics and the range of printing techniques and materials point to a very large market.

The research and consulting company IDTechEx expects the market to grow nearly 10-fold between 2013 and 2020 to exceed USD 55 billion.

Over 3 000 companies are currently active in the printed electronics domain, most of them in North America, East Asia and Europe.

Need for standardization

Since the focus has been shifting in recent years from developing printed electronics technologies to manufacturing products, the need for standardization has emerged. A proposal to establish a standardization body for the printed electronics was presented at Printed Electronics Europe 2011, the largest trade event in Europe for the industry. The proposal indicated the IEC was the most suitable organization for the standardization of printed electronics since the technology intends to develop mainly electronic and electric devices. Organizations such as the OE-A (Organic and Printed Electronics Association), the leading international industry association for the industry strongly supported the proposal.

TC 119: Printed electronics, was established in October 2011, it currently has 11 participating members and 7 observer members. Its creation was welcomed by the industry with OE-A stating “The OE-A has been supporting IEC TC 119 from the start”.

Systems approach with other TCs

Since printed electronics emerged from conventional electronics by introducing printing technologies in the industry, the need to cooperate with pre-existing electronics sectors and IEC TCs is obvious. TC 119 earmarked the following IEC TCs concerned:

- TC 21: Secondary cells and batteries
- TC 34: Lamps and related equipment
- TC 40: Capacitors and resistors for electronic equipment
- TC 47: Semiconductor devices
- TC 82: Solar photovoltaic energy systems
- TC 91: Electronics assembly technology
- TC 110: Electronic display devices
- TC 113: Nanotechnology standardization for electrical and electronic products and systems.

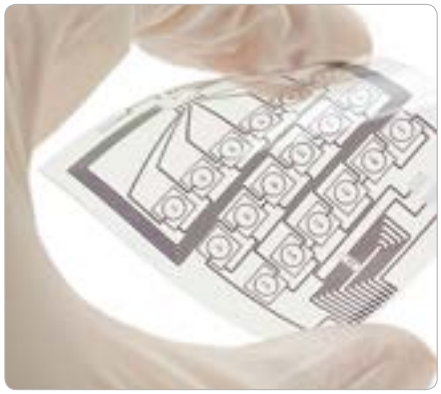
Objectives

TC 119 outlined its objectives for the medium term (3-5 years). They include, among other things:

- developing an international standardization roadmap for printed electronics to define the scope of printed electronics
- promoting and streamlining standardization efforts in the areas where marketing is under way
- identifying standardization needs in the areas where new technologies are emerging
- helping standardize technologies from the research stage.

Multiple domains

To cover the standardization of printed electronics TC 119 is setting up WGs



Flexible printed circuit electronics are produced on...

...machines such as this ESC-ATMAGP screen printer (Photo: Europa-Siebdruckmaschinen-Centrum)...

...using conductive inks (Photo: DuPont)

(Working Groups) to deal with terminology, materials (functional materials and substrates), processes, equipment used for printing processes, printability assessment, parts, devices and products, and health/safety/environment issues.

The fast growing nature of the printed electronics sector, new techniques and materials and the absence of standardization for the industry so far point to a substantial workload for the recently created TC 119.

Keep safety sky high

IEC TC works to ensure electronic systems for aircraft operate reliably

Morand Fachot

The safety of aircraft, even light aircraft, has become increasingly reliant on electronic systems – avionics – designed and manufactured for ADHP (aerospace, defence and high performance) applications. They must be especially robust and reliable. IEC TC 107 prepares standard processes (technical recommend-ations, specifications and the standards themselves) for the industry to ensure this is the case.

Severe environment

Aircraft operate in a harsh environment; they are subjected to extremes of temperature, considerable turbulence and atmospheric radiation. Avionics equipment must be capable of withstanding these as well as of operating reliably for many years.

Supply chain issues

Initially avionics systems primarily integrated parts that had been designed specifically for them. Nowadays avionics manufacturers increasingly use COTS (commercial off-the-shelf) components, subassemblies or top level assemblies. One problem faced by the aerospace electronics industry is its dependence on materials and components that have been developed for other domains.

Another problem that is linked to this is the long lifecycle of avionics (15-40 years) which has to run in parallel with the much shorter lifecycle of the parts and board assemblies (3-5 years) developed by the components industry for other markets.

Specific remit

TC 107 does not prepare International Standards for the components (integrated circuits and assemblies) used in the avionics industry. This task is handled by other IEC TCs. What TC 107 does is to develop standard processes for using and managing these components in meeting the requirements of the avionics industry (cost, lifetime, quality, reliability, safety, performance, etc.). This must be achieved despite the preoccupation of the electronics industry with high-volume applications, rapid change, obsolescence and problems of wear.

TC 107 work focuses on tackling both technical and industrial issues. Technical issues include the impact of temperature, the effect of atmospheric radiation on avionics products and the use of lead-free solder in aerospace and defence electronic systems. Industrial challenges incorporate the availability of components and preventing the use of counterfeit parts.

To deal with these issues TC 107 has set up three WGs (Working Groups), a PT (Project Team) and 2 MTs (Maintenance Teams).

Temperature rising and… falling

Avionics products are used in a very wide range of temperatures. Some systems are subjected to very low outside temperatures at high altitude, whilst others are deployed in a higher temperature environment inside the aircraft.

Traditionally, industries that produce electronic equipment for ADHP applications have relied on the military specification system to supply their semiconductor device standards and upon manufacturers

of military-specified devices to source the parts they require.

Typical ambient temperature ranges at which military specified devices are marketed are -55 °C to +125 °C. The respective ranges for industrial and commercial devices are -40 °C to +85 °C and 0 °C to +70 °C.

Over the years a number of device manufacturers have left the military market, resulting in the reduced availability of devices specified to operate over wide temperature ranges. In the absence of reasonable or practical alternatives, a potential response for equipment manufacturers is to use devices at temperature ranges that are wider than those specified by the device manufacturer.

To address this issue TC 107 has prepared IEC/TR 62240-1, *Process management for avionics - Electronic components capability in operation - Part 1: Temperature uprating.* IEC 62240-1 is a Technical Report that provides information regarding the methods and processes to be implemented when using semiconductor devices in wider temperature ranges than those specified by manufacturers. This is to ensure that the device and the system operate satisfactorily. However, this wider usage should be limited to temperature ranges that do not compromise the applications' performance and reliability.

TC 107 MT 2 work includes the use of semiconductor devices operating outside manufacturers' specified temperature range.

Closer to the sun

Another important factor that affects avionics products is the atmospheric radiation encountered at high altitude. Microelectronic devices may be affected by SEE (single event effect): the response of a component to the impact of a single particle induced by atmospheric neutrons from galactic cosmic rays or solar phenomena.

TC 107, through PT 62396, has developed the IEC 62396 series of documents to assess and accommodate atmospheric radiation effects within avionics electronic equipment via SEEs and to specify guidelines, system design and testing procedures to deal with these.

No more lead please!

Many countries and regions are introducing regulations limiting or banning the use of lead in industrial products. This is a substance that is widely used in electronic solder and electronic piece part terminations, and printed wiring boards. Lead-free tin finishes can be susceptible to the spontaneous growth of crystal structures known as "tin whiskers". These have been known to cause electrical failures.

To meet this challenge, TC 107 WG 1 has developed the IEC 62647 series of documents. They look at the preparation for producing a lead-free control plan and the mitigation of the deleterious effects of tin, as well as at testing and system guidelines.

Availability of avionics-specific components

As a number of manufacturers of ADHP components have abandoned the market, the avionics equipment industry has had to rely on COTS for components and assemblies. TC 107 has produced an ECMP (electronic components management plan) and is preparing an electronic assemblies management plan that will extend to the use of COTS.

Fighting fraud

Avionics systems are high-value products, and as such attract counterfeiters. The counterfeit "industry" is global and booming. It affects all domains, from fashion items to drugs, from toys to electronic goods and is expected to exceed USD 1 500 billion by 2015.

It has an obvious economic impact but may also present very serious risks if the counterfeit goods affect health (counterfeit drugs) or result in accidents (failure of counterfeit mechanical or electronic parts). This is particularly serious for aerospace products. Counterfeit electronics are the second most "valuable" sector of the counterfeiting industry after drugs. Counterfeit products may take the form of recycled parts fraudulently sold as "new" or "unused" components.

TC 107 WG 3 works on guidance for the development of a management plan to avoid the use of counterfeit electronic parts in avionic applications. The plan will maximize the use of authentic parts with correct traceability and conformance documentation.

It will help trusted manufacturers, suppliers and distributors identify and eliminate the use of counterfeit components in avionics products.

Constantly evolving and expanding work

The aerospace industry is a booming sector that employs a growing share of avionics products. TC 107 has 67 experts from 7 participating and 12 observer member countries that develop the wide and always expanding range of technical recommendations, specifications and standards to meet the industry's needs. Its work programme is set to be extremely full for the foreseeable future.

Aircraft operate in harsh conditions that avionics equipment must be capable of withstanding

Focus on industrial automation

IECEE launches INDAT, a new service for products and installations in the automation field

Claire Marchand

The development of automation throughout the 20th century brought enormous changes to the industrial world: some jobs disappeared, others underwent major transformations, new ones were created and, most importantly, the interaction between man and machine was altered forever. In the pre-automation era, machinery had been used to assist workers.

Safety, reliability and quality through automation

The advantages of having automated systems were soon recognized by industry. The systems enabled human operators to be replaced in tasks that involved hard physical or monotonous work, or those being performed in hazardous environments including fires, nuclear facilities or underwater. Automated systems can also undertake jobs that cannot be performed by human beings because of excessive demands in areas such as speed, size, weight or endurance. Automated processes often result in more consistent quality and reliability in the assembly chain.

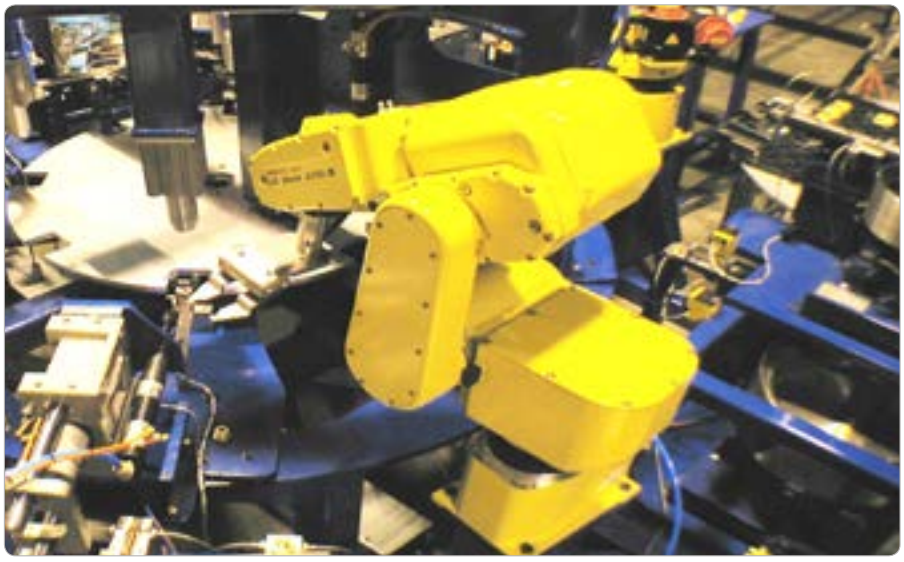
Automation changed the industrial landscape

The rapid evolution of IT (information technology) in the second part of the 20th century enabled engineers to create increasingly complex control systems that integrated fully with the factory floor.

The automotive industry, for instance, has been transformed radically by the development of automation. Over time, the food industry, pharmaceutical and other manufacturing companies have also relied heavily on automation to produce more and at lower cost. Today, most sectors of industry use at least some element of automation.

IEC standardization plays major role

The IEC has a number of TCs (Technical Committees) that prepare International Standards connected with specific areas of industrial automation. IEC TC 65: Industrial-process measurement, control and automation, provides many of the Standards that are relevant for industry. IEC TC 2: Rotating machinery, IEC TC 17: Switchgear and controlgear, IEC TC 22: Power electronic systems and equipment, IEC TC 44: Safety of machinery - Electrotechnical aspects,



Automation combines the use of control systems and information technology applications to provide solutions to different industrial needs

The automotive industry has been transformed radically by the development of automation

and IEC TC 66: Safety of measuring, control and laboratory equipment, all play important roles in this field.

Specific certification for industrial automation

Most of the International Standards developed by these IEC TCs are already integrated within services provided by IECEE, the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components.

However, the complexity and sophistication of today's systems and equipment in industrial plants require a specific approach to safety and security. To provide improved response to industry and market needs, IECEE and its WG (Working Group) 2: Business Development, have produced a new service entirely dedicated to industrial automation. One of the first tasks undertaken by WG 2 was to gather into one product category – INDAT – all the existing IEC International Standards that have a direct bearing on products used in this area.

Safety and functional safety

In industrial plants, overall safety extends further than is traditional with safety: it includes functional safety and has to meet very strict requirements.

Safety can be defined as protection from an unacceptable risk of physical injury or from impairment to the health of people, either directly or indirectly, as a result of damage to property or to the environment.

Functional safety is the part of overall safety that depends on the correct operation of a system or equipment in response to its inputs. If a potentially dangerous condition is detected, either a protective or corrective device or mechanism may be activated to prevent hazardous events arising or some mitigating feature may reduce their consequences.

Neither safety nor functional safety can be determined without taking into consideration the system as a whole as well as the environment with which it interacts.

Cyber security

The security of industrial communications systems is also at stake. TC 65 is currently working on a set of IEC International Standards addressing the security of networks and systems.

Benefits of INDAT

The introduction of the INDAT product category has benefits for industry as well as for IECEE CBs (Certification Bodies) and TLs (Test Laboratories):

- it provides a platform offering progressive support of global recognition and acceptance of industrial automation products
- it allows for the sharing of expertise, knowledge and tools that enable third-party CBs to deliver compliance services pertaining to the functional safety of industrial automation products
- it provides easier and faster market access for industry, eliminates the need for multiple testing and ultimately drastically reduces the costs associated with the global roll-out of products

IECEE facilitates access to market…

A CB Test Certificate is a global passport that allows products to be accepted in all IECEE member countries. It is so well known that global acceptance is a reality, even in countries that are not part of the IECEE community. "One test, one international certificate" opens the doors to the global market.

…through the CB Scheme…

The IECEE CB Scheme provides the assurance that tested and certified products meet the strictest levels of safety, reliability and performance in compliance with the relevant IEC International Standards. It helps reduce costs and time to market, eliminates duplicate or multiple testing and provides a high level of confidence for manufacturers, retailers and consumers alike.

…and the CB-FCS

The CB-FCS Scheme for Mutual Recognition of Conformity Assessment Certificates for Electrotechnical Equipment and Components is an extension of the IECEE CB Scheme in that it also includes factory audits and inspections. It goes far beyond mere product testing by including a complete quality system and surveillance methods at the factory that manufactures a certified product. This is interesting for manufacturers who need to provide proof that products manufactured in a given factory offer a consistent level of quality over time.

The introduction of IT enabled engineers to create increasingly complex control systems fully integrated with the factory floor

IEC International Standards in the INDAT product category

The IEC International Standards listed below are currently available in the INDAT product category. Other Industrial Automation Standards may be proposed and added to the list in the future.

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements*

IEC 61010-2-201, *Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-201: Particular requirements for control equipment*

IEC 60034 series on rotating electrical machines

IEC 60439 series on low-voltage switchgear and controlgear assemblies

IEC 60947 series on low-voltage switchgear and controlgear

IEC 61131 series on programmable controllers

IEC 61204 series on low-voltage power supply devices, d.c. output

IEC 61496 series on safety of machinery - Electro-sensitive protective equipment

IEC 61800 series on adjustable speed electrical power drive systems

IEC 62026 series on low-voltage switchgear and controlgear - Controller-device interfaces (CDIs)

IEC/TS 62046, *Safety of machinery - Application of protective equipment to detect the presence of persons*

Note: This publication is a Technical Specification. The development of IEC 62046 as an IEC International Standard is currently undeway

IEC 62061, *Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems*

IEC 60204 series on safety of machinery - Electrical equipment of machines

IEC 62477-1, *Safety requirements for power electronic converter systems and equipment - Part 1: General*

IEC 62477-2, *Safety requirements for power semiconductor converter systems - Part 2: Power Electronic Converters from 1000 V a.c. or 1500 V d.c. up to 35 kV a.c.* is under development

These IEC International Standards may be available in other IECEE categories as well.

Preventing dust explosions

IECEx certification provides high level of protection

Claire Marchand

When addressing the topic of explosive atmospheres, what immediately comes to mind is the oil and gas or petrochemical industries. Unfortunately the list doesn't stop there. The risk of fire or explosion exists in a variety of other sectors, such as transportation – including aerospace – furniture manufacturing, automotive manufacturing and repair, pharmaceuticals, food processing, grain handling and storage, sugar refineries and coal mining.

A common denominator

What is the common denominator between all these sectors? They all utilize flammable or combustible substances in quantities capable of resulting in concentrations that are potentially explosive, whether on a constant basis,

as a by-product of normal operation or due to the occurrence of an abnormal situation.

Let's have a look at one of the substances found in huge quantities in many Ex industry sectors: dust.

While dust is often the byproduct of a production process and treated as waste, it can also be an important element in the manufacturing of products such food products, pharmaceuticals or pigments. Coal, wood, grain, sugar starch, certain metals, dyes and plastics all generate dust.

The risk of dust explosion exists in the pharmceutical industry...

...in sawmills...

A risk factor

The large majority of industrial dusts are combustible, and dust explosions can occur in any enclosed area. Dust explosions are a frequent occurrence in underground coal mines, but they can happen in any location where powdered combustible material is present.
A publication by German-based company Stahl explains the mechanisms of a dust explosion:
"If a draft of air swirls up a layer of dust in a small area, the dust, along with oxygen, forms a combustible dust/air mix. If this mix is ignited by an ignition source, an explosion is triggered.
The force of the resulting explosion swirls up more dust, which is in turn ignited. This process continues, and under some conditions chain reactions such as these sweep through entire buildings or facilities, destroying them."

Even an extremely thin dust layer in a closed room is sufficient to trigger an explosion when the dust is swirled up and ignited.
Ignition sources for dusts include sparks from electrical or mechanical processes, arcs, open flames, ESD (electrostatic discharge), and electromagnetic waves among others.

Safe manufacturing processes

Because of the hazards associated with the presence of dusts, all equipment – electric cables and motors, enclosures, isolators and vents, lamps and switches, control systems and many, many more – used in manufacturing processes should have the relevant level of dust explosion protection. Failure to do so can result in major industrial accidents and have fatal consequences.

Through its standardization and conformity assessment work, the IEC has a solution for all sectors of industry that are operating in those hazardous environments. The Commission has been at the forefront of Ex standardization for many years, preparing International Standards and establishing a CA (Conformity Assessment) System that provides testing and certification for all types of Ex equipment and related services as well as personnel competence.

International Standards

IEC TC (Technical Committee) 31: Equipment for explosive atmospheres, has a complete series of International Standards, IEC 60079, that cover all specific requirements for Ex equipment

...and in silos for grain storage

and systems, from general requirements to protection levels for apparatus used by all sectors that operate in hazardous environments, such as food processing, pharmaceuticals, sugar refineries, flour mills, grain silos as well as the paper and textile sectors.

TC 31 has also developed the IEC 61241 series of International Standards that focuses on electrical equipment in the presence of combustible dust.

Testing and certifying to IEC Standard

To make sure that the equipment they purchase meets the very strict requirements specified in the IEC 60079 series of International Standards, as well as those put in place by national or regional regulations and legislation, the Ex industry can rely on IECEx, the IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres for testing and certification.

An IECEx certificate provides clear proof of compliance with International Standards, an important assurance for anyone responsible for the safety of those working in such areas.

Repair and maintenance of Ex equipment

Because Ex equipment has a much higher capital cost than the same equipment used elsewhere, repairing it is often more cost-effective than replacing it. The IECEx Certified Service Facilities Scheme assesses and certifies that organizations and workshops that provide repair and overhaul services to the Ex industry do so according to the strict requirements of IEC International Standard 60079-19, *Explosive atmospheres - Part 19: Equipment repair, overhaul and reclamation.* This ensures that unique Ex safety features are not compromised during the repair or overhaul process. The system includes on-site audits prior to issuing the IECEx Certificate and periodic audit reports.

The IECEx Certified Service Facilities Scheme also covers other Ex related services including, installation and inspection of Ex equipment and installations.

High level of safety for Ex workforce

To cover all safety aspects in Ex environments and to complement the Certified Equipment Scheme, IECEx has developed the IECEx Certification of Personnel Competence Scheme for assessing and certifying individuals working in potentially hazardous areas.

The IECEx CoPC (Certificate of Personnel Competence) provides independent proof that the certificate holder has the required qualifications and experience for working on electrical equipment located in hazardous areas and can implement IEC International Standards covering explosive atmospheres.

For the CoPC, competence is defined as “the ability to apply knowledge” rather than simply assessing knowledge. In this sense, the assessment of persons includes assessing their ability to perform certain Ex-related tasks.

MEMS tested and certified by IECQ

Little components do more and are smaller

Aliyah Esmail

In thousands of ways, new and smaller technologies are helping us move forward. From surgical tools that are smarter to toys that let us compete at playing tennis with someone around the world, electronics and their components are doing more than ever before.

Smaller is better

Colossus, one of the first computers, was built by the British in World War II to break coded messages sent by the German High Command to the German armies throughout Europe. It used about 1 800 vacuum tubes to compute data. Bigger and more sophisticated versions were built before the end of the war in 1945.

At that time, this large set of computational machines was processing data as quickly as possible. Today, the equivalent data can be processed on a mobile device with the right programme because the transistors and vacuum tubes have been replaced by MEMS (micro-electromechanical systems) as well as sensors, connectors, resistors, capacitors, semiconductors, LEDs (light-emitting diodes), and OLEDs (organic LEDs).

MEMS are defined by Forbes magazine as the miniaturized version of bigger components. They can be the size of a grain of pollen or a blood cell. And these mini components allow mobile technologies, cameras and video equipment as well as electronic clocks to be ever smaller.

These teeny components are manufactured in the same way as semi-conductors, which make them more exact in their design and they work better using less power. This fabrication process has led to thinner plasma televisions, smaller and lower cost computers as well as cars with lighter weight and better fuel efficiency.

The future of MEMS

As the use and study of MEMS move forward, MEMS are being used in more and more disciplines. The military uses sensor networks for unattended battlefield monitoring. Medicine is using MEMS for cell sorting, smaller and smaller surgical tools with smart sensors and toys are becoming smaller with more advanced sensors.

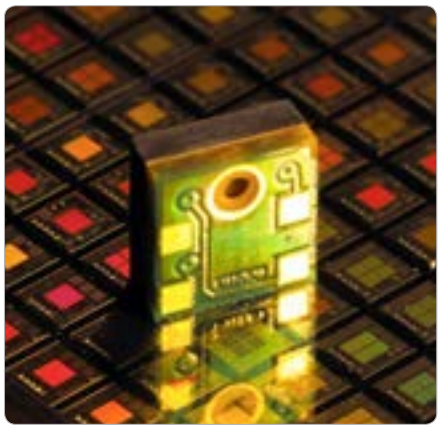
IECQ ensures component safety and reliability

Electronic component manufacturers and suppliers have a very powerful tool at their disposal to ensure that their MEMS, used as components, are safe, reliable and meet the strictest requirements: IECQ (IEC Quality Assessment System for Electronic Components) testing and certification.

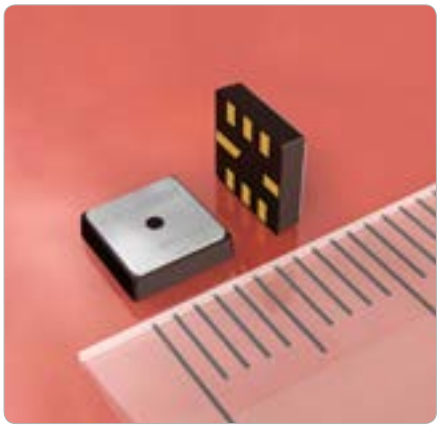
As the worldwide approval and certification system covering the supply of electronic components, assemblies and associated materials and processes, IECQ tests and certifies components using quality assessment specifications based on IEC International Standards.

In addition, there are a multitude of related materials and processes that are covered by the IECQ schemes. IECQ certificates are used worldwide as a tool to monitor and control the manufacturing supply chain, thus helping to reduce costs and time to market, and eliminating the need for multiple

MEMS has led to thinner plasma TV sets, smaller and lower electronics as well as lighter and more fuel-efficient cars



A MEMS chip can be the size of a grain of pollen.



These teeny technologies are manufactured in the same way as semi-conductors

Increasing global energy safety

IEC scope and expertise supports broad roll-out of new energy technologies

Aliyah Esmail

During the Clean Energy Ministerial meeting which was held in Delhi in April, IEC General Secretary and CEO Frans Vreeswijk represented the IEC at the mini-grid development roundtable. He outlined how the IEC can facilitate the broad roll-out of energy technologies, providing truly global reach and state-of-the art expertise. At the same time the new edition of IEC/TS 62257-9-5 for stand-alone lighting kits for rural electrification (prepared by IEC Technical Committee 82: Solar photovoltaic energy systems) was announced by the US Energy Secretary.

Mini-grids could help electrify the world

Mini-grids are enjoying a high level of attention because of their promise to bring electricity to the 1,3 billion people who don't have it and increase the reliability of electrical energy generation. Today, many mini-grids still use diesel generators, but renewable mini-grids or hybrids may be the way forward – most of which are still in the pilot phase.

The IEC is at the core of the whole energy chain. Its work enables all forms of energy generation and transmission. The Commission is a key partner for accessible, safe, interoperable electrical energy infrastructure and as a global technology partner can significantly contribute to the broad roll-out of new energy technologies, including mini and micro-grids.

IEC TC (Technical Committee) 8 has set forth a new plan to work on the creation of guidelines for the general planning and design of micro-grids. (For more information please see *IEC shares vision with energy leaders* in the June 2013 *e-tech*.)

Vreeswijk actively participated in a discussion on mini-grid development. The roundtable allowed practitioners and policymakers to cooperatively identify the obstacles to further scaling up mini-grids and Smart Grids and look at potential solutions to addressing barriers as a key component to achieving universal energy access.

Key challenges identified

Principal problems that have been pointed out with regard to mini-grids relate to their operation and maintenance, control and grid connection as well as the lack of policies to support them.

The IEC can contribute significantly to solving technical mini-grid challenges and stimulate their roll-out. IEC International Standards facilitate the design, installation, control and maintenance of renewable and hybrid mini-grids and can

CEM4 is where energy ministers, industries, academics and non-governmental organizations come to discuss clean energy

Mini-grids have the promise of bringing electricity to the 1,3 billion people who don't have it

also support policy decisions. These Standards can be further improved when policymakers, regulators, investors, insurance companies, equipment manufacturers and installers actively participate in their development.

Active participation in SE4ALL CEM4, the fourth Clean Energy Ministerial, is a part of the UN's (United Nations) focus on energy. In 2011, the UN Secretary General, Ban Ki-moon, made sustainable energy one of his five priorities by launching the SE4ALL (Sustainable Energy for All) initiative. By 2030, the UN has set a goal of universal energy access for all countries, with a clear emphasis on efficiency, energy safety and sustainability.

Governments and private entities need to urgently address broad energy access for a growing population. Failing to do so will result in increased energy poverty that will hinder health, education and economic development for millions, if not billions of people.

Lighting the way

The ability to work and study after dark is often the first step towards a better, more prosperous life. Today up to 10% of average household income in Africa is spent on dirty kerosene lamps that give off limited light, with emissions that endanger the health of children and adults alike.

While solar lanterns have been available for some time now, standardization allows them to be produced in larger quantities, at less cost and of more consistent quality. The new publication announced at CEM4, IEC/TS 62257-9-5 for stand-alone lighting kits for rural electrification, will allow this industry to grow, providing testing laboratories with a means to test and compare light output and other quality measures that will ultimately reassure consumers and enable a broad technology roll-out.

CEM4 looks for answers

CEM4 is one of the few regular meetings that bring together energy ministers, industries, academics and non-governmental organizations to discuss clean energy. Public-private roundtables addressed topics such as: solar PV; reducing soft costs; clean vehicle adoption; power markets in emerging economies; renewables policy and finance; energy management systems; and mini-grid development.

These teeny technologies are manufactured in the same way as semi-conductors

Stimulating national adoption

Facilitating participation in international standardization for Latin American countries

Aliyah Esmail

In April 2013 a workshop and training was held in St Lucia with the aim of reducing barriers and challenges to the adoption of International Standards and stimulating participation in international standardization work in Latin America and the Caribbean. The workshop was organized by the Standards Council of Canada under the CATRTA (Canada-Americas Trade related Trade Assistance) programme.

Standards offer many benefits

When newly industrializing countries adopt International Standards nationally, local industries, including small and medium companies - often the lifeblood of an economy - find it easier to participate in global value chains. They are able to sell their components and products to many more markets around the globe. In turn, this allows countries to develop national economies and add jobs.

National adoption of International Standards also facilitates infrastructure development providing access to a much

National adoption of International Standards with conformity assessment allows governments to more efficiently protect local populations

By participating in the national adoption and implementation of International Standards, countries can have fewer technical barriers to trade

International Standards adoption makes it easier for industries to sell their products to more markets around the world

larger selection of suppliers. It also helps protect long-term investment by facilitating maintenance and repair with standardized products. Built-in safety and interoperability together with conformity assessment allows governments to more efficiently protect local populations. Furthermore, active participation in standardization work allows national experts to access a global network of state-of-the-art expertise.

Barriers to adoption identified

A workshop at the 2011 COPANT (Pan-American Standards Commission) General Meeting, in Bridgetown, Barbados, identified a number of challenges linked to national and regional standardization and conformity assessment systems. Participants pointed to obstacles that hindered the national adoption and implementation of International Standards. As a result they had difficulties to fully comply with the requirements of the Code of Good Practice of the WTO (World Trade Organization) TBT (Technical Barriers to Trade) Agreement.

This Code establishes disciplines for the preparation, adoption and implementation of voluntary standards. It requires that countries use international standards as the basis for national standards, where appropriate. The Code also advocates participation in the work of international standardizing bodies.

Training workshop responds to barriers

To further address the barriers voiced during the workshop in 2011, the Standards Council of Canada under the CATRTA programme organized a follow-up workshop in St Lucia in April 2013. Its goal was to show participating countries how they could become more involved with the work of organizations like the IEC.

A form of participation without the cost

Many of the Latin American and Caribbean countries that attended this workshop participate in the IEC Affiliate Country Programme. Amaury Santos, IEC-LARC (Latin America Regional Centre) Regional Manager delivered a well-rounded training programme to help workshop attendees and their countries to increase participation in the IEC. Santos outlined IEC Affiliate Country Programme advantages and explained how IEC International Standards together with conformity assessment promote the safety of electrical and electronic devices, help protect the environment, and allow them to successfully combat the influx of counterfeit products.

He drew attention to the fact that the Programme offers industrializing countries a form of participation in the IEC without the financial burden of actual membership, allowing them to make full use of the IEC 100% electronic environment.

CATRTA explained

CATRTA (Canada-Americas Trade Related Trade Assistance) programme is a development assistance initiative funded by the Canadian International Development Agency (CIDA) to support regional activities during the 2013 annual general meeting of COPANT (Pan-American Standards Commission).

Countries that sent representatives to this workshop included: Antigua and Barbuda; Bahamas; Barbados; Belize; Commonwealth of Dominica; Grenada; Guyana; Haiti; Honduras; Jamaica; Montserrat; Peru; St Lucia; Saint Kitts and Nevis; Saint Vincent and the Grenadines; Suriname; and Trinidad and Tobago

Frederica Scott Vollrath designs a winner

World Standards Day 2013 poster competition results

Designer Frederica Scott Vollrath whose poster won the WSD 2013 poster competition

World Standards Day 2013 poster

Janice Blondeau

Each year the WSC (World Standards Cooperation) runs a competition to find the poster to provide the visual identity for World Standards Day, 14 October. The theme for World Standards Day 2013 is "International Standards ensure positive change". The winning poster was designed by Frederica Scott Vollrath of Germany.

World Standards Day 2013 ensuring positive change

Vollrath who pockets the first prize of CHF 1 500 is a freelance designer based in Berlin, Germany. Born in the UK, she was raised in Denmark, England and Kenya, where she was home-schooled on a remote field station set in the middle of the African bush.

Winners are grinners

Vollrath graduated with a BA (Hons) in 3D design in 2011 from University College Falmouth, UK where the degree course is based on two central themes, sustainability and community. With subtle humour and an imaginative use of colour, Vollrath's graphic and three dimensional work reflects her commitment to the idea that good design is the key to sustainable living. No stranger to WSD poster design, Vollrath was a runner-up in the 2012 competition.

Social media helps spread the World Standards Day message

The winning poster will be a central part of the promotion and celebration of World Standards Day 2013 around the world. This year's poster competition was promoted via social media. Five finalists were selected by the WSC, and the public was invited to vote online to choose the winner.

Runners-up receiving CHF 500 each are:

- The team of Seuwandi Yapa and Samith Roshan (Philippines)
- Taylor Marquis (Canada)
- Dimitri Monnois (France)

14 October is World Standards Day

The World Standards Cooperation was set up in 2001 to strengthen and advance the voluntary consensus-based International Standards of IEC, ISO (the International Organization for Standardization) and ITU (the International Telecommunication Union).

Download the World Standards Day 2013 Poster on IEC website.

World Standards Day

World Standards Day, 14 October, pays tribute to the collaborative efforts of the thousands of experts worldwide who develop the voluntary technical agreements that are published as International Standards.

Upcoming global event

2013 Hydrogen & Fuel Cell Energy Summit

Claire Marchand

The IEC regularly lends its support to key global and regional industry events allowing them to put forward IEC endorsement on their website and materials.

The conference

This is the case with the 2013 Hydrogen & Fuel Cells Energy Summit which is scheduled to take place in Berlin, Germany, on 30-31 October.

The theme of this year's summit is "Economical and Infrastructural Support for a Sustainable Future Energy Carrier". The event will have a heavy focus on techno-economic case studies of hydrogen and fuel cell technology initiatives/projects around the globe looking at the challenges & obstacles encountered in each project and how they are approached.

Key topics to be addressed include:

- Legal policy and safety status
- Global market overview
- Financial feasibility of hydrogen fuel cells
- Hydrogen production, storage and transportation
- Case studies: Technology deployment
- Technology case studies
- Commercialization of fuel cell vehicles: myth or reality
- Infrastructural development and challenges

The two-day event will bring together key industry stakeholders from all facets of the hydrogen economy, such as hydrogen producers and suppliers, fuel cell and hydrogen storage companies, automotive OEMs (original equipment manufacturers), component manufacturers and industrial end-users, utilities, government officials and regulators, to name but a few.

The conference, which will comprise a series of presentations by senior industry executives and experts, as well as panel discussions, will be a great networking opportunity for anyone active in the hydrogen and fuel cell sector.

Programme and registration

As of 21 June and until the event date, IEC participants benefit from a 15% rebate on the registration fee.

Contact person:
Mohammad Ahsan
mahsan@acieu.net
+44 (0) 203 141 0606

The programme can be downloaded on the IEC website

The topic of hydrogen storage will be addressed during the conference

The commercialization of fuel cell vehicles will also be on the agenda

Meeting expectations

Training sessions in Southeast Asia focus on individuals

Claire Marchand

As part of its strategy to increase awareness of, and enhance participation in standards development work, the IEC made the decision to have regular training sessions for its members, experts and for the community at large. Three broad geographical regions were defined: Asia, the Americas and Europe.

Spotlight on Southeast Asia

The training programme put in place by the IEC has picked up speed in 2013: After Latin America in March, a new series of workshops were held in Southeast Asia in May. Four countries were on the agenda: Indonesia, Singapore, the Philippines and Thailand.

Organized by TISS (Technical Information and Support Services) and conducted by IEC Community Business Coordinator Jan-Henrik Tiedemann, in collaboration with IEC-APRC (Asia-Pacific Regional Centre) Regional Director Dennis Chew, the workshops brought together about 40 participants in each location and received very positive feedback.

Focus on the participants

To kick start each workshop, Tiedemann tested a new feature: the roll call. Participants were asked to introduce themselves, and also to explain what their personal motivation and expectations were in attending this event. This put the focus on individuals rather than on the audience as a whole.

For the organizers it was interesting to see the wide range of interests and expectations brought forward by attendees. Some were very new to standardization and keen to gather any bit of information available, others were veterans of 20 or more years, wishing to find ways of working more efficiently.

Having participants spell out their needs at the beginning of a session helps fine-tune the programme. The training material put together by TISS, which consists of a series of presentations on a variety of topics related to IEC standardization and CA (Conformity Assessment) activities, can easily be adapted to each audience at very short notice.

IEC IT tools for Singapore?

Prior to the workshop, Tiedemann and Chew met with the Director of Standardization at SPRING, the NSB (National Standardization Body) that hosts the Singapore NC (National Committee) of the IEC, to discuss the possibility of having free use of the IEC IT Collaboration Tool Suite at the national level.

Having NCs use the IEC tools is a win-win situation. On the one hand, it helps experts in their national mirror committee work who can familiarize themselves with the IEC 100% electronic environment. Then, when they become members of an IEC TC/SC (Technical Committee/Subcommittee), they require minimal training and are immediately operational.

Spreading the word through social media

The half-day workshop gathered people from various horizons representing national stakeholders. It is interesting to note that two participants learned about the upcoming Asian tour through LinkedIn discussions and contacted TISS to find out whether there would be an event in Singapore. They were redirected to their NC for registration and were present at the session.

SPRING deemed this workshop extremely beneficial and asked if another session could be organized later this year to cover more ground.

The Philippines – focus on CA

This time, the workshop was organized with the strong support of industry and took place in a factory that is assembling short-term housing modules. This gave a different flavour to the meeting, hosted in one of their warehouses fitted with a modular meeting room.

Among participants, several were from test laboratories or chairs of mirror technical committees. While the core presentations on IEC activities remained on the programme, the focus was more on

Dennis Chew during the workshop in the Philippines...

...and Jan-Henrik Tiedemann in Singapore

CA activities, the IECEE System and luminaires in particular.

Following the workshop, participants were to treated to a tour of the testing laboratory at the factory.

Indonesia and Thailand – making their voice heard

Many stakeholders, including manufacturers and government agencies, took part in these two events.

The Thai workshop saw some very lively exchanges between presenters and the audience. Several topics were broached, among them the national adoption of IEC International Standards and the issue of participation in IEC work, especially for NCs with a limited number of experts.

The workshops will move to Europe and the United States in the second half of 2013.

Participants in the Indonesian workshop

Nominations and extensions

Latest nominations

Laurianne Trimoulla

The SMB (Standardization Management Board) has approved one ACOS nomination as well as the extension of the terms of office of existing TC (Technical Committee) Chairmen and one ACEC (Advisory Committee on Electromagnetic Compatibility) member.

New ACOS member

Marcel Chevalier, from France National Committee, has been nominated Expert Member of ACOS by the SMB. He replaces Philippe Juhel who became Chairman of ACOS upon Friedrich Harless's retirement in February 2013. The appointment is effective immediately.

ACOS Expert Member Marcel Chevalier

Marcel Chevalier is currently Quality Leader for Pre-Development Projects at Schneider Electric in Grenoble, France, where he has advanced his career in various departments since 1989. Marcel Chevalier has a background in Mathematics, Computer Science and Statistics. He is an expert in IEC TC 56: Dependability, and IEC SC (Subcommittee) 65A: System aspects of IEC TC 65: Industrial-process measurement, control and automation.

ACOS deals with safety matters which are not specific to one single TC of the IEC. Its task is to guide and coordinate IEC work on safety matters in order to ensure consistency in IEC safety Standards. ACOS produces safety guides and prepares workshops around the world to create great awareness and involve users and regulators on the role of safety.

Extensions

Technical Committees

The extensions of the terms of office of the following IEC TC Chairmen have been approved by SMB:

First extension to term of office for the period 2013-06-01 to 2016-05-31 of Gary R. Johnson as Chairman of IEC TC 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

Third extension to term of office of Dieter W. Bergman as Chairman of IEC TC 91: Electronics assembly technology for the period 2013-06-01 to 2016-05-31.

Advisory Committee

The SMB also approved the extension of term of office of one ACEC member:

First extension to term of office of Martial Patra as member of ACEC, representing IEC TC 22: Power electronic systems and equipment.

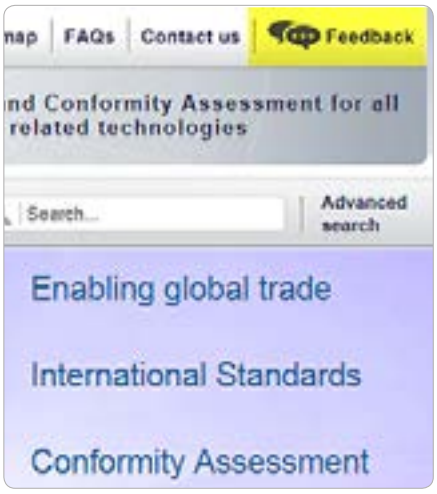
Keeping in touch

Feedback button for better communication with the IEC community

Claire Marchand

Since Monday 10 June 2013, the IEC website has a new functionality: a feedback button, located on the top right hand side corner of the screen. This should make it much easier for all users to ask questions, make comments and suggestions or get support.

The new feedback button is on the top right-hand corner of all web pages



Clicking on the feedback tab...

...opens a popup form

Coupled with a ticketing system

After the launch of the new IEC website in January 2011, some users remarked that there wasn't one central place or address where they could send feedback. TISS (Technical Information Services and Support) planned an IEC ticketing system to allow for better processing and treatment of all requests coming to IEC CO. The ticketing project system was then developed by the IEC IT department. The Web team designed the button and made sure it appeared on all pages of the IEC website.

The system, available internally since mid-2012, was tested extensively to make sure it would perform adequately. Its public launch coincided with that of the feedback button.

How it works

Clicking on the Feedback tab opens a popup form on which users enter their name, email address and the topic they want to draw attention to. They can further specify whether their communication is a question, a suggestion of if they need support, and provide detailed explanations.

To avoid spam, a simple question is asked at the bottom of the form prior to submission.

The submission goes straight into the system where it is automatically attributed a dedicated number and where those monitoring the flux of incoming feedback can then process it and quickly forward it to the person best able to respond – each department at IEC CO has appointed one contact person who will deal with these requests. At the same time the person making the inquiry receives an email message, confirming reception of the request and providing a ticket number. This process allows for speedier answers and better service to users.

Once completed, the response from IEC CO is sent to the initiator of the inquiry and filed in the ticketing system database for future reference. This database will serve as basis for the preparation of FAQs (Frequently asked questions) and last but not least, the IEC can use the statistical data on support requests and comments to better understand where improvements in the IEC Services and tools are necessary.

Keep in touch

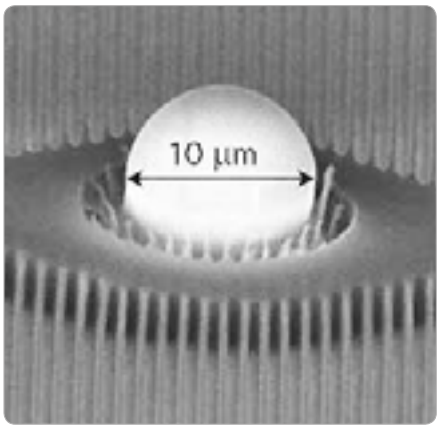
We look forward to receiving your feedback and questions. Your comments and thoughts will help us improve the IEC website and make it a better working tool for you!

Very small yet global

Standardization for nanotechnology set to boost global industry

Morand Fachot

Nanotechnology, the manipulation of matter on atomic and molecular scales, is expected to be one of the key technologies of the 21st century, providing opportunities for the development of new products. The technology's rapid growth requires International Standards for its move into an industrial phase. The Standards address materials as well as so-called gratings, which are objects used in nanotechnology.



Unidentified fine object (UFO) observed on a 200 nm-period grating (Electron micrograph by Rich Aucoin, MIT)

Defining the infinitely small

Nanotechnology covers objects at a nanoscale, which is defined as ranging from 1-100 nm (nanometre). A nanometre is equal to one billionth of a metre (or 10^{-9} m). Standardization in nanotechnology starts at the features and gratings levels.

Features are, in general, three-dimensional objects. They can also be nano-objects and have different shapes, such as a dot, a line, a groove, etc. They might be symmetric or non–symmetric and can be located on the surface of, or within, the substrate ("buried feature").

Gratings are periodically-spaced collection of identical features.

Framing the building blocks

As artificial gratings are the primary building blocks in nanotechnology, it is essential to specify the generic terminology for the global and local quality parameters relating to them.

To do this, IEC TC (Technical Committee) 113: Nanotechnology standardization for electrical and electronic products and systems, has published IEC/TS 62622, *Nanotechnologies – Description, measurement and dimensional quality parameters of artificial gratings.*

IEC/TS 62622 is a Technical Specification prepared within the JWG (Joint Working Group) 2 of IEC TC 113 and ISO (International Organization for Standardization) TC 229.

Covering dimensional and other aspects

IEC/TS 62622 describes different dimensional grating types, such as:

- 1D, in which features are repeated in only 1 direction within the reference plane
- 2D, in which features are repeated in 2, non-parallel, directions within the reference plane
- 3D, in which features are repeated in 3, non-parallel, directions, containing the reference plane.

The document also gives examples of various types and shapes of complex gratings.

Other parameters

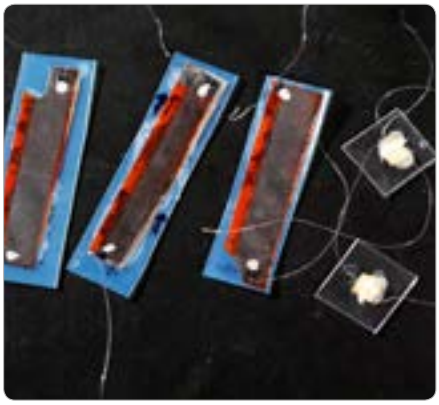
IEC/TS 62622 "is intended to facilitate communication among manufacturers, users and calibration laboratories dealing with the characterization of the dimensional quality parameters of artificial gratings used in nanotechnology."

To do so it details the essential specifications, quality and calibration methods and procedures the industry needs to assess global and local quality and to manufacture the right products.

IEC/TS 62622 also defines general requirements for an adequate documentation and reporting of calibration results.

Challenging work

Measuring and obtaining accurate parameters at such minute scales is extremely difficult and challenging. It requires a precise definition of measurement and assessment specifications and procedures. By doing so, IEC/TS 62622 paves the way for the industry to manufacture nano-enabled systems and goods that will emerge soon in areas including energy production, efficiency and next generation consumer electronics; lighting and other products, so sustaining industries expected to generate some USD 2 500 billion in 2015.



Self-powered nanosensors developed by Georgia Tech (Photo: Gary Meek)

Marine & hydro energy

This issue reviews some of the technologies developed and deployed to gather power from oceans and rivers throughout the world and explains the role of IEC TC 114 and several other TC/SCs that prepare International Standards for these sectors.

Marine energy is emerging as a huge and potentially unlimited source of power. Oceans cover more than 70% of Earth's surface; they are sources of huge kinetic energy from waves, currents and tides, and of thermal energy in the form of heat they collect from the sun. IEC ***e-tech*** reviews some of the technologies that are being developed and deployed throughout the world and explains the role of TC 114, the Technical Committee that prepares International Standards for marine energy converters.

Once gathered, ocean power has to be transferred from the converters to the grid and end users. Many of the systems and parts necessary for this are already available in offshore oil and gas installations and offshore wind turbines. International Standards developed by various IEC TCs (Technical Committees) and SCs (Subcommittees) support this deployment.

On the hydro side, the IEC plays a pioneering role in preparing International Standards for small hydropower, that is installations of up to 15 MW. These can add significantly to the capacities of large and small countries and bring prosperity to communities deprived of electricity.

e-tech

News & views from the IEC

This is a special printout of IEC *e-tech* our electronic publication. You can find a link to *e-tech* on the IEC homepage, or you can access it at www.iec.ch/etech

If you would like to receive our monthly email notice telling you when the latest edition of *e-tech* is available, you can subscribe via the *e-tech* homepage. Click the button “Subscribe” or sign up for an RSS feed.

- Editor in chief: Gabriela Ehrlich
- Managing Editor *e-tech*: Claire Marchand

IEC *e-tech* is published 10 times a year in English by the International Electrotechnical Commission.

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3 rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

T 41 22 919 02 11

Contact: iecetech@iec.ch
For more information visit: www.iec.ch