Electrical Insulation News in Asia

No.16 *November 2009*

IEEJ

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TECHNOLOGIES ALERT

MISCELLANEOUS

PREFACE

Prof. Hitoshi Okubo

Research on High Field Electrical Insulation Techniques

I worked for 17 years in a company laboratory and after that about 20 years at a university, involved in the development of electrical insulation techniques for high voltage electric power equipment. At first I started to develop a numerical technique for electric field analysis, such as the finite element method and charge simulation method. In those days, electric field distribution in power equipment had neither been analyzed nor visualized and at that time I was aggressively struggling to develop them. The successful results have enabled the 500kV GIS and power transformer design and a more sophisticated structure.

In the same term, my research interests have been extended to gaseous insulation for GISs and liquid impregnated composite insulation for power transformers. The discharge in gas, liquids, solids and vacuum are also among my main concerns. It is just at the initial stage of fundamental data acquisition of oil based insulation characteristics, such as volume and area effect. At the same time, we have experienced many electrical insulation failures and troubles in the development of equipment. Through cause analyses, I have learnt a lot and the most important lesson learnt is that electrical breakdown directly leads to the destruction of the main function and causes the fatal failure (FF) of equipment and systems.

On the other hands, partial discharge (PD) measurement techniques could efficiently evaluate the electrical insulation performance of materials and equipment. The time resolution of PD measurement has been drastically enhanced from msec, at that time, to μsec and most recently to sub-nsec resolutions. Nevertheless, we are still confronting difficulties in discriminating the harmful PD from the others. In the future, for high field applications, PD mechanisms are the key technique to be clarified.

One of the most impressive developments I have seen was flow electrification techniques in large power transformers. The phenomenon was only able to emerge after the development of compact structures and sophisticated materials and treatment techniques. That is, the flow electrification phenomena can be defined as the limiting technology against the extrapolated electrical insulation developments so far. In addition, the flow electrification phenomenon is only just one of the existing electrostatic problems but it first appeared under the enhanced high electric field conditions.

In the same way, the charging phenomena around the bulk and interfaces of materials, including gas, liquid, solid and vacuum will be the most important problem of concern in the coming high field applications, from now on. We are now facing at the moment a shift from a “low field conduction” to a “high field conduction” electrical insulation-regime. In addition, in the area of material development, such as future nano-dielectrics, functionally graded materials (FGM), semi-conducting and high/low permittivity materials and even high temperature electrical insulation techniques, the key technology should be “high field electrical insulation (HFEI) techniques”.

Prof. Hitoshi Okubo
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Hitoshi OkuBo

OUTLINE OF TECHNICAL COMMITTEES IN IEEJ

Dielectrics and Electrical Insulation (DEI)

Chairperson: Naohiro Hozumi (Aichi Institute of Technology)
Secretaries: Yasuhiro Tanaka (Tokyo City University)
Yuichi Ashibe (Sumitomo Electric Co. Ltd.)
Assistant Secretaries: Toshihiro Takahashi (CRIEPI)
Takahiro Imai (Toshiba Co. Ltd.)

Annual Symposium of Electrical and Electronic Insulating Materials and Applications in Systems (SEEMAS) and International Symposium on Electrical Insulating Materials (ISEIM) are important activities of TC-DEI. This year we held the SEEMAS, the domestic, in Matsue city, hosted by colleagues of Matsue National College of Technology. As well as the success of the ISEIM last year, this year's symposium was quite sensational.

Fig. 1 indicates that this domestic symposium used to be growing in its scale until the year of 1990. It is remarkable that the symposium maintained its scale even after our "bubble economy" collapsed. The symposium, however, turned into shrinkage after the year of 2000, correlating to the structural change in our economy.

In 2006, the TC-DEI member started to reorganize the symposium. We aimed to promote the linkage between academia and industry, and encouraged the activity of young researchers. It is amazing that the number of participants has been increasing gradually since that time, and finally this year it has recovered to be the same level as the most active time. It is also quite impressive that, although the symposium was domestic, we had ten participants from Korea this year. We recognize that collaboration with Asian researchers is one of hot issues these days.

Nano-composite materials, insulation systems under inverter surges, space charge assessment, asset management regarding to insulation performance, outdoor insulations, thin dielectric films and other topics were discussed. After the symposium, we had the young researcher's seminar.

We will hold the domestic symposium again in 2010. The international symposium (ISEIM) will be held in the autumn of 2010 in Kyoto or vicinity, in cooperation with CIGRE SC-D1 colloquium. We are expecting your participation.

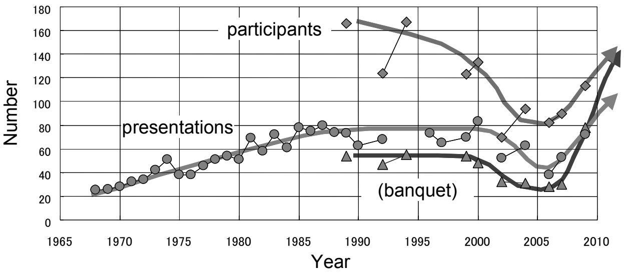


Fig. 1. Transition of attendants at the symposium. The expected transition after 2009 may be too extreme and not suitable to maintain the sense of affinity among attendants.

Fig. 2. The venue of this year's SEEMAS was idealistic that all participants spent three days in the same hall, in which both oral and poster sessions were held. We could freely visit poster booth during the intermissions of oral session.

Furthermore, the TC-DEI runs Investigation Committees (IC's) that organize several technical meetings a year. The investigation committees are categorized into four research areas:

Macro-view of DEI technology related

> Asset Management for Electric Power Equipments Based on Insulation Diagnosis (04/2008-03/2011, Chairperson: M. Ikeda (Nippon Petroleum Refining Co.)).

New materials including nano-materials related

> Nano-Interface Properties of Organic and Composite Thin Films and Device/Sensor Applications (10/2007 - 09/2010, Chairperson: K. Kato (Niigata University)).

> Physics of Organic Dielectrics/Semiconductors and Interfacial Design (04/2007 - 03/2010, Chairperson: M. Iwamoto (Tokyo Institute of Technology))

> Polymer Nanocomposites and their Applications as Dielectrics and Electrical Insulation (01/2006 - 12/2008, Chairperson: T. Tanaka (Waseda University)). Next activity is being planned.

Ageing and diagnosis of electric and electronic equipment related

> Degradation Diagnosis Technology based on Characteristics of Insulation Materials in Electric Power Apparatus (04/2007 - 03/2010, Chairperson: Y. Ehara (Tokyo City University)).

> Partial Discharge Measurement Under Repetitive Impulse Voltage Application (08/2007 - 07/2010, Chairperson: M. Hikita (Kyushu Institute of Technology)). The committee is cosponsored by the TC-DEI and TC of Electrical Discharge.

Basic dielectric and breakdown phenomena related

> Standardization of Calibration and Development of Application on Space Charge Measurement using PEA Method (03/2009-02/2012, Chairperson: Y. Tanaka (Tokyo City University)).

> Surface Properties and Long-term Performance of Polymeric Insulating Materials for Outdoor Use (01/2006 - 12/2008, Chairperson: H. Homma (CRIEPI)). Technical report will be issued soon.

Electrical Discharges (ED)

Chairperson:	Masayuki Hikita (Kyushu Institute of Technology)
Vice-chairperson:	Toshiki Nakano (National Defense Academy)
Secretaries:	Fumiyoshi Tochikubo (Tokyo Metropolitan University)
	Akiko Kumada (University of Tokyo)
Assistant Secretaries:	Yasushi Yamano (Saitama University)
	Mina Sakano (Toshiba Corporation)

The Technical Committee on Electrical Discharge (TC-ED) belongs to the Fundamentals and Materials Society (A-Society) of the IEE Japan. The purposes of the TC-ED are mainly in the wide promotion of the research activities concerning to a variety of electrical discharges in vacuum, gas, liquid and on surfaces of materials and their applications to high technologies..

Several investigation committees, which are the affiliates of the TC-ED, are established every year to survey the up-to-date research subjects. The activities of these committees usually continue for three years. The chairpersons shown in Table 1 currently run five investigation committees. In addition, the investigation committee for the modeling of lightening strokes to structures is planned and will be established this year.

The TC-ED organizes about six domestic technical meetings on electrical discharges every year. In these meetings, about 200 full papers are presented in total from both academic and industrial sides by researchers, engineers, professors and students. The domestic technical meetings are sometimes co-organized by other Technical Committees on such as High Voltage Engineering, Pulse Electromagnetic Energy, Plasma, and Dielectric /Electrical Insulating Materials.

In order to promote the international activities in electrical discharges, “Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering” has been organized by the TC-EC and has been held every two years. The next J-K Symposium is held on the November 5-7 of 2009 in Busan, Korea. The special issue of this symposium will be published in the IEEJ Transactions on Fundamentals and Materials IEE Japan in October of 2010.

The TC-ED also contributes to the organization of a young researcher seminar every year in cooperation with the Institute of Engineers on Electrical Discharges in Japan to encourage the young researchers in the field of electrical discharges. About 40 young researchers and engineers participate in the seminar and discuss vigorously the topics related to electrical discharges for two days.

Table 1 Investigation Committees in TE-ED

Chairperson	Research subjects and established time
S. Matsumoto (Shibaura Institute of Technology)	Present situation of lightening discharge simulation technologies and comparison of the simulation models (established in December 2006)
M. Hikita (Kyushu Institute of Technology)	Measurement of the partial discharges generated by repetitive impulse voltage (established in August 2007)
E. Hotta (Tokyo Institute of Technology)	Generation control and applications of vacuum and low-pressure discharges (established in October 2007)
R. Hanaoka (Kanazawa Institute of Technology)	Discharge phenomena in liquid dielectrics and the technologies of EHD,ER and MR applications (established in December 2007)
M. Amakawa (Central Research Institute of Electric Power Industry)	Technologies of arc and glow discharge applications (established in May 2008)

Electrical Wire and Cables (EWC)

Chairperson: Yasuo Suzuoki (Nagoya University)
Secretary: Kazushi Nakaya (EXSYM Corporation)
Assistant Secretary: Akitoshi Watanabe (VISCAS Corporation)
Hitoshi Nojo (J-Power Systems Corporation)

Technical Committee on Electrical Wire and Cables (TC-EWC) is a committee organized to support the IEEJ Power and Energy Society, and comprises members from universities, power utilities, the JR railway company, Japan Electric Cable Technology Center（JECTEC）and cable manufacturers. The technical committee organizes technical meetings to promote R&D activities in this field and provides an opportunity to present technical achievements. Three technical meetings were so far held in 2009. A technical meeting on deterioration diagnosis and online monitoring system was held as a joint meeting with TC-DEI on February 19 in Tokyo. A symposium on technical trends in measures for age deterioration of electric wires and cables was held on March 19 in Sapporo, Hokkaido. A discussion meeting on environment-friendly technologies for resins was held on August 18 in Tokyo. The technical committee plans to organize 4 more meetings in FY2009.

In addition to organizing such technical meetings, the technical committee supervises investigation committee dealing with subjects relating to electrical wire and cables. During the last several years, Investigation Committee for Technology of Wires and Associated Accessories for Overhead Transmission Lines, Investigation Committee for Accessories for 66kV and Higher Voltage XLPE Power Cable, and Investigation Committee for Technology of XLPE Power Cable and Associated Accessories for Underground Distribution were organized. This year, two investigation committees are in action as listed in Table 1.

Table 1 Investigation Committee in TC-EWC

Research Subject	Chairperson
Technical Trend of Environmental Tests for Insulation Materials of Distribution Wires and Cables	S. Nishimura
Recent Technological Trends in Overseas Power Transmission Cables	M. Hikita

Discussion Meeting on environment-friendly technologies for resins (August 18, 2009, Tokyo)

Plasma Science and Technology (PST)

Chairperson: Ken Yukimura (Doshisha University)
Scientific Secretary: Kungen Teii (Kyushu University)
Scientific Secretary Assistance: Hiroshi Akatsuka (Tokyo Institute of Technology)

The Technical Committee on Plasma Science and Technology (TC-PST) was founded in April 1999. This committee has the basis on the plasma researcher's society that had organized Technical meeting on plasma science and technology in IEE Japan several times every year since about 30 years ago. The field of activity of this committee includes researches and investigations of various plasmas in terms of plasma physical parameters as density, temperature and ionization degree, and application fields as nuclear fusion, plasma processing, and plasma chemistry.

The major activity of this committee is to succeed to organize several technical meeting on plasma science and technology every year. In 2009, four technical meeting were held; in June at Saga University in Saga, in August at Doshisha University in Kyoto, in September at Osaka Prefecture University in Osaka, in November at Tokyo City University in Tokyo. In 2008, five technical meetings were held. At each symposium, about 20 or 30 presentations are made. Presentations by young researchers in bachelor course and master course are strongly encouraged and appreciated.

Every two years, TC-PST sponsored international symposium APSPT (Asia-Pacific International Symposium on the Basics and Applications of Plasma Technology) had been held in Taiwan in collaboration with Japanese domestic societies related to plasma science and technology since 1999. Recently, APSPT-5 was held in Kaohsiung in Taiwan in December, 2007. Aiming at more flexible management, APSPT became sponsorship by the international organization committee from APSPT-4. While many members of TC-PST participate in the international organization committee, TC-PST continues playing a role important as a support organization.

APSPT-6 (http://apspt6.must.edu.tw) will be held at Mingshin University of Science and Technology, Hsinchu, Taiwan, R.O.C. in December 14-16, 2009. Several invited lectures and over 120 contribution papers are going to be presented in this symposium.

TC-PST currently runs two investigation committees as shown in Table 1. Here we introduce their activities. In the committee of the plasma–water applications and their reacting processes involved in liquid interfaces, various types of discharge-plasma applications have been systematically investigated by the experts in this field to deepen the understanding of plasma–water interacting phenomena at liquid surface boundaries. This comprehensive research covers the decomposition of persistent organics, the microorganism disinfection and the material synthesis. In the committee of the kinetic description of low-temperature plasmas with applications to modeling and simulation, with the widespread use of low-temperature plasmas in the field of energy conversion and environmental control, development of numerical models incorporating physical and chemical phenomena play a key role. The goal of this committee is to provide recent advances in plasma kinetic theory and its potential impact on their work. In 2009, authoritative researchers will summarize how they use plasma simulations.

The investigating committees dispersed recently, the plasma ion intensive use process investigation committee, the microwave plasma investigation committee, and the advancement of metal sputtering plasma committee had published their investigation as hard cover books, and it was useful for these books to systematize the newest technology trends of these fields.
(presented by Kungen Teii, Kyushu University)

Table 1. Investigation Committee in TC-PST

Plasma–Water Applications and their Reacting Processes Involved in Liquid Interfaces	3 years from 2008, Chairperson: K. Yasuoka (Tokyo Institute of Technology)
Kinetic Description of Low-Temperature Plasmas with Applications to Modeling and Simulation	3 years from 2008, Chairperson: S. Kambara (Gifu University)

Pulsed Electromagnetic Energy (PEE)

Chairperson: Eiki Hotta (Tokyo Institute of Technology)
Vice Chairperson: Koichi Takaki (Iwate University)
Scientific Secretary: Sunao Katsuki (Kumamoto University)
Scientific Secretary Assistance: Shinji Ibuka (Tokyo Institute of Technology)

Pulsed electromagnetic energy produced by pulsed power, which refers to huge power within an extremely short period of time. The power level reaches 300 TW in the world largest pulsed power machine, Z accelerator in Sandia National Laboratory, USA. The period of time goes down to sub-nanosecond range. Pulsed power is often focused in a narrow space to produce an extremely high power density. Pulsed power is basically produced by means of a rapid energy transfer from an energy storage medium to the load. The pulse power technology and the pulsed electromagnetic energy have greatly expanded their regimes in technological and application fields, based on the state-of-the-art technology of power devices. Trend of the device is shifted from a single-shot huge machine to highly repetitive compact devices.

The research field of the Technical Committee on Pulsed Electromagnetic Energy covers the electric power engineering, plasma and discharge engineering, high energy density physics, accelerator engineering, bio-medical engineering and also pulse power device itself. By the modification of pulsed electromagnetic energy, we can make an extremely high energy density (high temperature and/or high density) state with well defined condition, which can be utilized for generations of high power lasers, intense radiation sources, high current particle beams and also for formation of new materials. The pulsed power technology is also capable of efficiently producing non-thermal equilibrium plasmas. A large volume, atmospheric pressure non-thermal plasmas is utilized for decomposition of toxic gases, ozone synthesis and sterilization. The pulsed power driven underwater discharge plasmas can be utilized for cleaning the water environment. The pulsed power discharges in composite matter are used for the recycling of aggregate in concrete blocks and of electronic parts in circuit board.

Recently, application of pulsed power to biological targets and its applications, which are called “bioelectrics”, has been glowing since 2000, in USA, Europe and Japan. The Investigation Committee on “Biological Effects of Pulsed Electromagnetic Energy and Their Innovative Applications” was established in January 2009. Since bioelectrics has a multi-disciplinary nature, this committee provides a forum to discuss important technical developments, their applications, increased understandings, new trends, and also future prospects in the interdisciplinary field. It is predicted that new knowledge should open an innovative application in wider field such as biotechnology, medical engineering, environmental engineering, agriculture and food processing. Here we introduce a couple of topics in the field of pulsed electromagnetic energy and pulsed power technology.

(1) Highly repetitive pulsed power technology

Industrial use of pulsed power requires highly repetitive and stable operation with the minimum maintenance effort. Also the device is preferred to be small as possible. Recent progress in semiconductor power devices and in ferromagnetic materials enables us to satisfy the requirement for the industrial use. There are various schemes to generate pulsed power. Figure 1 shows 1 J, 70 ns all solid state pulsed power generator, which is commercially available. The voltage and repetition rate can be easily adjusted up to 40 kV and 2 kHz, respectively. A compact Marx generator comes to be operated repetitively by replacing the traditional gaseous switches with fast semiconductor power devices. A fast recovery semiconductor diode is used as an opening switch to generate the ns-long induction voltage. The commercial availability of silicon carbide (SiC) power devices accelerates the industrial use of pulsed power and the expansion of the application field.

(2) Bright radiation source:

Pulsed power driven high energy density plasmas can be bright radiation sources. Pulsed power driven vacuum tin discharge is one of the candidates of the high power extreme ultraviolet (EUV, 13.5 nm) source for next generation semiconductor nano-lithography. In order to achieve the huge EUV power of 200 W, it is required to repetitively produce sub-mm size hot dense plasmas. The repetition frequency is needed to exceed 20 kHz. Also handling the huge thermal load is one of most important issues. Rotating disk electrodes and laser assisted tin vapor jet formation are the most promising technologies to solve the issues, as well as the high rep-rate pulsed power technology.

Fig. 1 Highly repetitive compact pulsed power generator for industrial applications.

(3) Gas treatment:

The sub-10 ns pulsed power is capable of efficiently producing non-thermal large volume plasmas in atmospheric pressure gases since only electrons are given a high energy from the field in the period of time. A large number of high energy electrons collide with neutrals to produce chemically active species such as radicals, ions, excited state molecules. These active species react with harmful components for human health or environment, as the result, the harmful components is decomposed and changes to harmless components. The pulsed power discharge plasmas in the atmospheric gas pressure are used for NOx (nitrogen oxide) removal from combustion exhaust gas, VOC (Volatile organic compound) decomposition and ozone synthesis in addition to the sterilization of medical appliances, surgical instruments and foods.

(4) Food processing:

Low temperature sterilization of liquid using intense pulsed electric fields (PEF) has been studied in the past tens of years to preserve ingredients of nutrition. However, the PEF sterilization is implemented in the limited cases since the PEF shows less effect on bacterial spores. Recent progress in pulsed power technology enables us to kill spores. Figure 2 shows the result of PEF sterilization of *bacillus subtilis* spores both by the 100 kV/cm PEF treatment and by the conventional heat sterilization. The contaminated liquid flows continuously between two parallel electrodes in a treatment vessel. Degree of sterilization, defined as $\log(N_0/N)$, depends on the treatment temperature both in the PEF and in the heat treatments, where N_0 and N are the initial and the surviving bacteria numbers, respectively. The bacterial spores are inactivated only for the temperature exceeding 100℃. The use of PEF lowers the treatment temperature by approximately 10℃, which help preserve ingredients of nutrition and flavor. Also the intense PEF is used to extract efficiently juice from plants. Cell membrane of target plant becomes permeable by applying PEF. This technology has been implemented and applied to sugar beats and grapes.

(5) Biological applications:

Non-thermal intense nanosecond pulsed electric fields (nsPEF) or narrowband burst radio frequency fields seemingly gives a unique stress to intracellular organelles and/or bio-molecules. Applying nsPEF is capable of inducing apoptosis to cancer cells, which will potentially be used for cancer therapy. Figures 3(a) and (b) show microscopic snapshots of intact HeLa cells and those exposed to an intense burst sinusoidal electric field (IBSEF, 2 kV/cm, 100 MHz, 1 ms). The pulsed cells are obviously inactivated. The time for doubling the number for the cells exposed to the field is approximately 35 hours, which is approximately 2 times as long as that of the sham control. Other bio-chemical analysis using fluorescent molecular probes indicates a portion of the cells went dead via the process of apoptosis. Also ns PEF is capable of activating platelet, which can be applied for wound healing. Similarly the nsPEF induced biological stresses or stimuli will potentially be used for agricultural applications, such as seed germination, growth control.

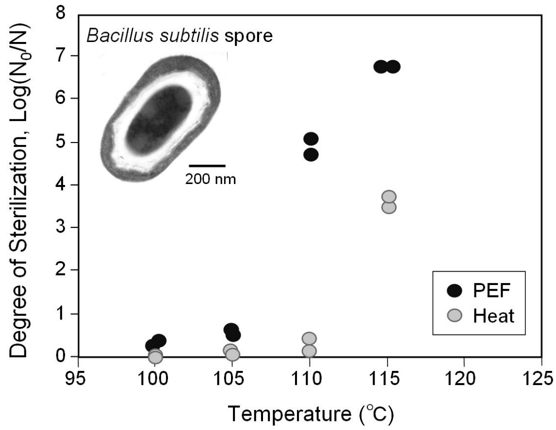
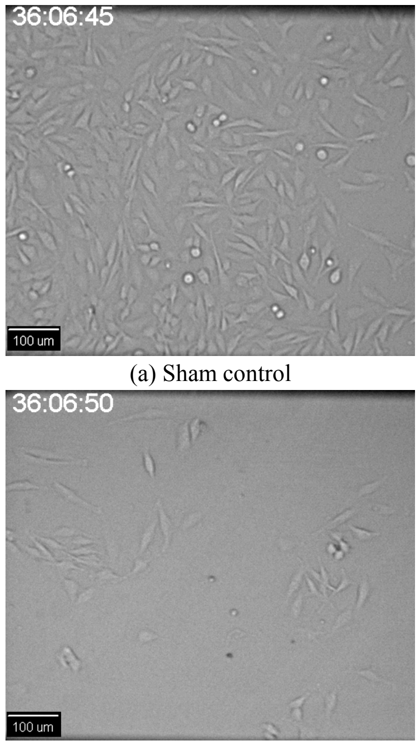


Fig. 2 Comparison between pulsed electric field and thermal sterilizations of *bacillus subtilis* spore in liquid as functions of their treatment temperature. The picture is a transmission electron microscope (TEM) image of spore.



(a) Sham control

(b) HeLa cells exposed to 100 MHz IBSEF

Fig. 3 Microscopic snapshot of cancer cells (HeLa cells) exposed to 2 kV/cm 100 MHz IBSEF, cultured for 36 hours on the slide.

Electromagnetic Compatibility (EMC)

Chairperson: Tsuyoshi Funaki (Osaka University)
Secretaries: Ken Kawamata (Hachinohe Institute of Technology),
Tomoo Ushio (Osaka University)
Yoshinori Taka (Nagoya Institute of Technology)

The Technical Committee on Electro-Magnetic Compatibility (EMC) has a vital role of researching following subjects;

1. Comprehensive understanding of electrical power system and EMC issue,
2. Building up interdisciplinary cooperation among several groups and/or institutes related with EMC problem,
3. Investigations on new and high technology for EMC,
4. Advertisement to the public on EMC issue and key technologies,
5. Introductory advertisement of international EMC standard to the domestic EMC researchers.

For these purposes the committee pays their attention to the causes of electromagnetic interference, the situation of electromagnetic interferences, the novel measurement techniques for EMC, the protection technology for EMC and international and domestic EMC regulations. The committee has been organizing four dedicated research sub-committees to realize the effective activity.

1. Investigation committee on security technology for electromagnetic wave and information.
2. Investigation committee on evaluation technologies for induced electric field and current in a human body caused by non-uniform and transitional electromagnetic fields.
3. Investigation committee on noise immunity for electric and electrical appliances.
4. Investigation committee on EMC technologies for electrostatic discharge (ESD).

These sub-committees basically work independently, and each sub-committee meeting is held every two or three months regularly to announce their investigations and to share the obtained knowledge among sub-committee members. The practical period for the sub-committee activity is two or three years, and they are expected to publish their investigating results as a technical report of investigation committee.

Electromagnetic environment is the field, where electromagnetic phenomena exist. They are electromagnetic fields due to naturally-originated sources like lightning and earthquake, and artificial ones generated from electrical and electronic equipment as well as radiated from power lines or communication cables, and so force. EMC is the capability of electrical and electronic systems, equipment and devices to operate in the above-mentioned electromagnetic environment, without suffering or causing unacceptable degradation as a result of electromagnetic interference. In other words, a system is considered as electromagnetically compatible if it satisfies the following three criteria:

(1) It does not cause interference with other systems;
(2) It is not susceptible to emissions from other systems;
(3) It does not cause interference with itself.

The problems related to EMC had been discussed in the "Special Research Committee of EMC Engineering", which was established in 1997 by IEICE and IEEJ joint venture. The high activity of the committee promoted the establishment of the technical committee on EMC in the Fundamentals and Materials Society of IEEJ. The committee was established to substitute the former committee in April 1999. Then Prof. T. Takuma of Kyoto University was elected as the first chair of the committee. After that, Prof. O. Fujiwara and Prof. Z-I. Kawasaki chaired the committee respectively from 2002 to Apr. 2005, and from May 2005 to Apr. 2008. Currently, Prof. T. Funaki succeeds the chair since May. 2008.

The committee holds some technical conferences. They were June 5th, Nov. 13th, Dec. 19th for 2008, and Jan. 21th, Mar. 6th for 2009. This year, the committee technically co-sponsored the 2009, international symposium on electromagnetic compatibility, Kyoto, which was held Jul. 20th-24th, 2009.

1. Investigation Committee on Security Technology

for Electromagnetic Wave and Information

This committee has started its activity in April 2007. Dr. Shinji Seto of NICT is chairing this committee. The Objectives of the committee activity are followings

1. Surveying the security technology for electromagnetic wave and information, including needs, terminology, and standards,
2. Surveying the eavesdrop by TEMPEST like technology, including current status, documents, threat, and counter measurement,
3. Surveying the attacking by Intentional-EMI, including current status, documents, threat, and counter measurements.

The committee is focusing on establishing secure and safety world with preparing the adequate (not exceed) countermeasure for the prospective electromagnetic threats.

2. Investigation Committee on Evaluation Technologies for Induced Electric Field and Current in a Human Body Caused by Non-uniform / transient Electromagnetic Fields

This committee was established in July 2006 for taking over from the previous Investigation Committee on Electric Field and Current Induced in a Human Body Exposed to Electromagnetic Fields. The mission of the committee is to investigate the methods for calculating the induced electric field and current in a body caused by non-uniform and/or transient electromagnetic fields, and survey articles regarding the related calculation results. This committee also investigates measurement methods, which is indispensable in modeling electromagnetic field source to simulate practical exposure conditions. The committee also investigates the high resolution electromagnetic field measurement method with compact probes. The following subjects are the items of investigation in this committee:

1. Investigation of methods for calculating induced electric field and current in an anatomically-based human body model;
2. Investigation of methods for calculating induced electric field and current in a human body caused by non-uniform and/or transitional electromagnetic field (including the modeling of source and dosimetry);
3. Investigation of measurement method for wideband electromagnetic field from extremely low frequency to intermediate frequency. Especially, focused on simplified and rigorous methods;
4. Investigation of research subjects hereafter.

This committee concluded their investigative action on June 2009. The committee members are now get into writing final report.

3. Investigation Committee on Noise Immunity for Electric and Electrical Appliances

This committee, chaired by Prof. M. Tokuda of Musashi Institute of Technology, was established in Jan. 2008. The mission of this committee is to grasp and analyze the current situation of noise immunity for electric and electronics appliances and to clarify uncertainness of the measurement in immunity test. The investigation subjects are summarized as followings.

1. Standards and regulations on noise immunity for domestic and abroad;
2. Case examples and counter measure to the interference of noise;
3. Techniques for immunity tests;
4. Design and control technology for immunity.

This committee envisions to clarify the difficulties of noise immunity for electric and electronic appliances, and to offer basic data to deal with.

4. Investigation Committee on EMC Technologies for Electro Static Discharge (ESD)

This committee, chaired by Prof. S. Minegishi of Tohoku-gakuin University, was established in Apr. 2008. The mission of this committee is to study the EMC issues accompanied with electrostatic discharge phenomenon, and clarify the factor for its origination and the mechanisms of the generation of wide band noise. The committee is working on the following subjects.

1. Survey the currently recognized terrors of ESD;
2. Measurement method of wide band current and electric field emitted from ESD;
3. Elucidate the mechanism in the occurrence of ESD, physically;
4. Modeling and simulation of ESD.

This committee envisions inspiring the other EMC engineers to recognize ESD problems as a sort of EMC incident.

Light Application and Visual Science (LAV)

Chairperson: Hiroyuki Kamei (Tokyo Institute of Technology)
Secretaries: Takeshi Kinoshita (Keio University)
Susumu Kimijima (Covalent Materials Corporation)

Activities of the technical committee on light application and visual science (TC-LAV) have been covering fields of application of optical engineering and visual science for medical science, devices for visual information processing, light sources from far infrared to extreme ultraviolet, advanced lithography, and etc. Three investigation committees: 'Future Technology of Infrared and Terahertz Waves(IC-FTITW)', 'Ultimate Technology for Lithography (IC-UTL)', and 'Technologies for Next Generation Light Source (IC-NGLS)', are affiliated to this TC and are surveying the technology trend of each field. Two recent topics of light application are introduced.

The first topic is optically assisted ultrasonic velocity change imaging. In recent years, there has been extensive research related to the application of nanoparticles in medical diagnostics and treatment. This is because they show promise as markers of liposomes and dendrimers for transporting drugs. It is thus necessary to monitor the distribution of nanoparticles in living organisms.

Methods for externally detecting the sites where they accumulate using light absorption or light emission have been considered. However, it is difficult for these methods to obtain information of regions deep inside the living organisms, because biological tissue exhibits strong light scattering.

The method of mapping the absorption of scattered light in living organisms by ultrasound scanning has been proposed to image metabolic information in living organisms[1)]. This method detects the ultrasonic velocity changes of medium associated with the near infrared light absorption. It is possible to visualize optical absorption sites deep inside the living organisms, because the ultrasound signal intensity does not depend on the light-scattering coefficient. This method is called "optically assisted ultrasonic velocity change imaging".

The objective of this study is to evaluate the potential as a drug delivery system monitor of nanoparticle using the optically assisted ultrasonic velocity-change imaging method. Gold nanoparticles are minute particles which are harmless to living organisms and exhibit a characteristic optical absorption spectrum due to their localized plasmon resonance. Gold nano-rods is the cylindroids nano particles and their absorption peak wavelength can be controlled by their shape (aspect ratio). The gold nano-rods used in the experiments showed the absorption peak at 820nm.

Figure 1 shows the experimental setup in this study. The center in the picture is the remodeled diagnostic ultrasonic equipment. This equipment is attached "the signal processing board" to transfer RF echo data to the personal computer. The experimental setup was applied to obtain the tomography of the phantom including gold nano-rods as an absorbing material. Figure 2 (a) shows the internal view of the phantom. The phantom was made of the chicken breast meat which contained nano-rods mixed with an agar-gel. Gold nanorods located at 10 mm depth of the chicken meat. The array transducer was set above the chicken meat. The laser diode operating at 809 nm which was close to the gold nano-rods absorption peak was used as a light source. Waveforms of RF signal of ultrasonic array transducer obtained before and after illumination were stored and their partial shifts were calculated by a personal computer. The ultrasonic velocity change images were constructed from the partial shift of waveform of every scan line. Figure 2 (b) shows the B-mode image of the phantom. From the B-mode image, it is difficult to detect the distribution of nano-rods gel. Figure 2 (c) shows the ultrasonic velocity change image which was taken at 30s in the exposure time. The distribution area of nano-rods appears clearly in the ultrasonic velocity change image.

Possibility as a monitor of nanoparticle distribution in living organisms was shown by experimental results. If the present imaging method is used as a drug delivery monitor of the gold nano-rods, it may be possible to obtain spatial information about malignant tumors in deeper regions.

The second topic is double patterning processes using the ArF immersion lithography. Further miniaturization of semiconductor devices is strongly expected to realize more convenient and compact electronic systems. The downsizing limit of devices mainly depends on size limit of patterns replicated by lithography. Specifically speaking, the limit is almost decided by the resolution limit of the lithography tools and processes. According to International Technology Roadmap for Semiconductors (ITRS), patterns with a half pitch of 32 nm is required in 2013. The first lithographic candidate to attain the target is the double patterning processes using the ArF immersion lithography.

The ArF excimer laser wavelength of 193 nm in air becomes 1/1.44 in water. However, the resolution R calculated by the following equation is only 43 nm even if the k_1 factor is supposed to be as small as 0.3.

$$\boldsymbol{R} = k_1 \frac{\lambda}{\boldsymbol{NA}} \quad (1)$$

Here, λ is the wavelength and NA is the numerical aperture of the projection lens. When λ is 193 nm/1.44 =134 nm, and NA is 0.93, R becomes to 43 nm.

To reduce R to less than 32 nm, some other countermeasures are necessary. Double patterning is the method to print narrow-pitch patterns superimposing or transforming original wide-pitch patterns. At first sight, it seems that the method is easily performed by alternatively separating the original patterns into two groups, and printing each group patterns sequentially. However, it is not so easy to successfully print the narrow pitch patterns. Because, pattern widths had to be sufficiently slimmed or narrow to allocate another patterns in the interval spaces, although the pattern pitches were wide. In addition, doubly printed patterns had to be precisely aligned each other. For this reason, the resolution cannot be simply reduced in a half.

Typical double patterning method is shown in Fig. 3. In the first method shown in Fig.3, printed resist patterns are transferred to the hard-mask layer such as silicon oxide film using dry-etching, and another patterns are printed onto the resist over-coated on the hard-mask patterns. Besides this method, a lot of variations are proposed. Really useful methods will be selected hereafter. Several methods may coexist to effectively print different types of patterns, and depending on the serious concern of device-maker companies.

Reference

1) H. Horinaka, H. Matsunaka, N. Nakamura, and *etal.*: "Gold Nanoparticle Distribution Monitor for Drug Delivery System based on Optically Assisted Ultrasonic Velocity-change Imaging", Electronics Letters, Vol.43, No.23, pp. 1254-1255 (2007).

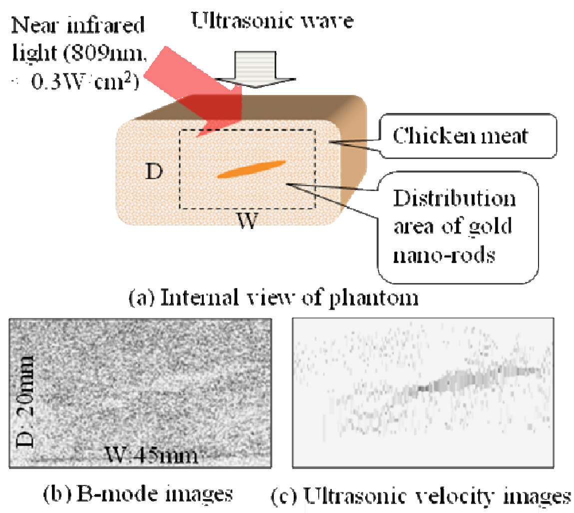


Fig.1 Experimental set-up using the remodeled diagnosis ultrasound equipment.

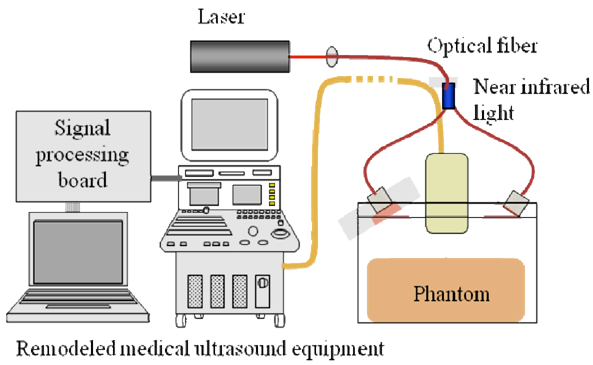


Fig.2 Experimental results of the gold nano-rods distribution in a chicken breast meat.

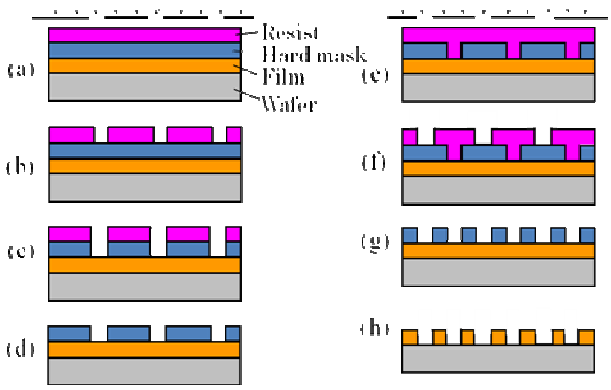


Fig.3 An example of double patterning process.

Metal and Ceramics (MC)

Chairperson: Ataru Ichinose (CRIEPI)
Secretary: Akio Kimura (The Furukawa Electric Co., Ltd.)
Assistant Secretary: Yasuzo Tanaka (International Superconductivity Technology Center)

Welcome to our Technical Committee on Metal and Ceramics (TC-MC) in the Institute of Electrical Engineers of Japan (IEEJ). It is expected the TC-MC to promote the electrical materials and related technologies. Therefore, we have the pleasure to inform activities of the TC-MC and to communicate with each other.

Mission of TC-MC

The metal and ceramic materials are indispensable to electric and electronic fields and in front of advanced technologies all the time. In the twenty-first century, many advanced technologies need promising materials such as new materials or new functional materials for the diversification and renewable society. Therefore, the metal and ceramic materials are significant still more and will play an important role as a pioneer in the future.

As shown in Figure 1, the activities of the TC-MC have been covering mainly electric, electronic and optical materials, and their technologies. Namely their functions are extended such as superconductivity, normal conductivity, semi-conductivity, mechanical strength, heat transfer, thermoelectric, photo-electricity, optical transmission, electrochemical affinity, radio-activity, composites etc.

Furthermore, our activities have been covering data base on their processing technologies and their evaluations in order to fit any applications.

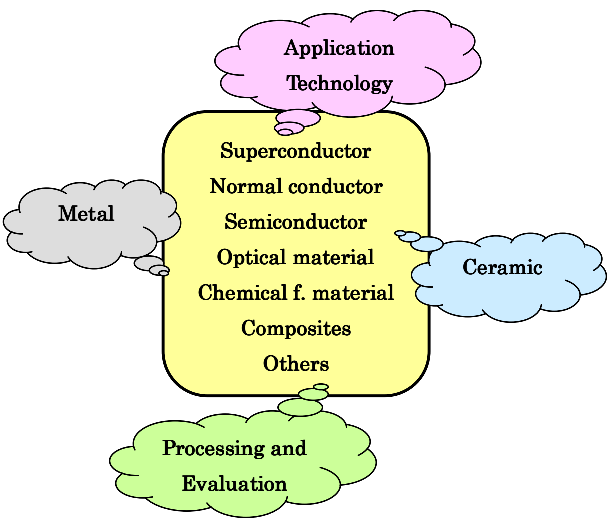


Figure 1 Activity scope of the TC-MC

History of TC-MC

The technical committee on the electrical materials in the IEEJ, predecessor of the present the TC-MC has been already set up in 1979. With several reorganizations of the technical committees, the TC-MC under the Fundamental and Materials Society (called A-Society) has been established in 1999 with other eleven technical committees, Research and Education, Electromagnetic Theory, Plasma Science and Technology, Electromagnetic Compatibility, Pulsed Electromagnetic Energy, Electrical Discharges, Light Application and Visual Science, Insulation and Measurement, Dielectrics and Electrical Insulation, Magnetics, and History of Electrical Engineering.

Recent activities of TC-MC

The activity of the TC-MC is based on the Symposium in the National Convention of the IEEJ, the Study Meeting and the Investigation Committee under the TC-MC. The following introduces the resent Symposiums in the National Convention of the IEEJ and Study Meeting under the TC-MC as shown in Table 1 and Table 2, respectively and the third activities will be found in the next section.

Regularly, the TC-MC meetings are held four times a year. The main topics to be discussed in the regular meetings involve introduction and understand for advanced metal and ceramics, and development of our TC-MC itself. We previously provided new three technologies and related materials such the attractive carbon nano-tube, the fuel cell and the functional diamond except the superconductors.

Recent year, much attention has been paid on an investigation on advanced superconducting materials. The electrode materials for future batteries and fuel cells to be compatible with clean, green, renewable and sustainable society have been also focused.

The investigating R&D committee whose chairper son was Dr. Kumakura issued a technical report entitled "Fabrication and superconducting properties of advanced superconducting tapes and wires". This report won IEEJ outstanding technical report award in 2009. The forum using this technical report as a text book was held at CRIEPI on March 2008.

Activities of investigation committee in TC-MC

At present, there is one investigating R&D committee under TC-MC as shown in Table 3, the name of which is "Structure and composition of advanced superconducting materials". The chairperson and secretary are Prof. Jyun-ichi Shimoyama (University of Tokyo) and Dr. Hiraku Ogino (University of Tokyo), respectively. Regularly, there are four meetings a year.

The meetings discuss fabrication technologies and evaluations on electromagnetic, thermal and mechanical properties mainly for Nb_3Al conductors, Bi-based oxide superconductors, MgB_2 conductors and Y-based oxide superconductors. Most expecting investigation results are fabrication technologies to obtain the high performance and its possibility at a viewpoint of microstructures and chemical composition for various superconducting materials such as Nb_3Al conductors, Bi-based oxide superconductors, MgB_2 conductors and Y-based oxide superconductors. And their cost performances as the practical superconductors and their applied technologies to such as persistent current mode-coils, cables, transformers, fault current limiters and so on. The committee is planning a study meeting related with the advanced superconducting materials on March 2010.

Table 1 Symposiums in the National Convention of the IEEJ

Theme	Date	Site
High magnetic field characteristics and indications for magnetic application of the High-Tc superconducting wires	2008.03.19	Fukuoka Institute of Technology
Development and problem of the high-efficiency solar cell	2009.03.19	Hokkaido University
Metal and ceramic materials in energy strange systems (Planning)	2010.3.	Meiji University

Table 2 Study Meetings in TC-MC

Theme	Date	Site
Development of advanced superconducting wires and their future problems	2008.03.14	CRIEPI
Recent research progress in structure, composition and characterization of advanced superconducting materials	2010.3.	Suspense

Table 3 Investigation Committees under the TC-MC

Research Subject	Chairperson (Affiliation)	Period	Remarks
Wire and conductor forming of sperconducting materials	Shirabe Akita (CRIEPI)	2001.10-2004.09	Close
Fabrication technologies and characterization of advanced superconducting materials	Hiroaki Kumakura (NIMS)	2004.10-2007.09	Close
Structure, composition and characterization of advanced superconducting materials	Jyun-ichi Shimoyama (University of Tokyo)	2008.10-2011.09	Open

Instrumentation and Measurement (IM)

Chairperson: Kazuo Tanabe (CRIEPI)
Vice- Chairperson: Yoshitaka Sakumoto (JEMIC), Akihito Otani (Anritsu)
Secretaries: Terumitsu Shirai (JEMIC)

The Technical Committee of Instrumentation and Measurement of IEEJ was set up in Jan. 1980, succeeding the Committee on Electronics Instrumentation and Measurement. The field of instrumentation and measurement technology is very wide and has a long history. The activity of our committee is always influenced by the technological trend in the era. The early activities of this committee have mainly focused upon the presentation and discussion of studies and researches in the fields of electrical standards and precise measurement in various electrical fields. It is the reason that our committee is now categorized in the society A (Fundamentals and Materials) of IEEJ. Technological contents in our committee have, however, gradually shifted to various electrical and electronic fields.

Annual activities in the technical committee of instrumentation and measurement have roughly introduced as follows.

i) The general meeting of the committee is held four times every year for discussing the various activities of the committee. Fifteen members including chairperson, two secretaries, and an assistant-secretary constitute the committee.

ii) The workshops for the presentation and discussion of studies and researches take place almost every month in principle as a main activity of the committee.

iii) The visit of various professional facilities is planned to carry out once or twice a year.

The actual subject issues in the workshop are the presentation and the discussion of extensive electronic instrumentation and measurement technologies including;

Ultra-high speed measuring method employing optical technology
Electro-magnetic measurement for ensuring EMC
High precision measurement in frequencies and time domain for radio-controlled watches, GPS, and navigation
Application of SQUID and MRI to bio-measurement
Bio-electronic measurement applicable to the welfare field in society shifted to the aged
Magnetic measurement related to magnetic sensors
Resolving factors causing uncertainty and development of its reducing method for establishment of electrical standards

The workshops mainly take place at Tokyo area, and sometimes in Saga and Miyazaki (Kyushu Island), in Osaka and in others. The themes of presentation in the workshop are usually focused on the electromagnetic measurement, the remote control instrumentation, the application of optical measurement, the biological electronic measurement, the time and frequency measurement, the application of magnetic measurement and so on, but in several workshops, miscellaneous subjects are acceptable to present and discuss there.

The number of annual presentation in the workshops is around 70 titles. The workshop is supported by IEEE IM and sometimes by other organization.

Recently, the committee planed a special volume on "Measurement Technology for Safety" and then the volume including eight papers was published on August 2009. The titles and authors are as follows;

Research into Warning Time Optimum Control for Level Crossing with a Continuous Type Train Location Detector using Crossed Inductive Wires (T. Matsumura & T. Ono)
Real-Scale Measurement Results for Audible Noise from AC Overhead Transmission Lines and Prediction Formula in Heavy Rain (K. Tanabe)
Development of Isolated Travel Sensor for High-voltage Switchgear (A. Shiratsuki, T. Mori, H. Kohyama, H. Nakajima, T. Nakashima, T. Oka, & K. Sumi)
Flame Imaging for Safety Surveillance (T. Fukuchi)
An Error Estimate of the VHF Broadband Digital Interferometer (Y. Nakamura, T. Morimoto, T. Ushio, & Z. Kawasaki)
Continuous Measurement of Amplitude Probability Distribution and Applications to Pulses of Low Occurrence Frequency (S. Arakawa, S. Ronte, T. Otsuka, H. Aso, & M. Uchino)
Suppression of Clutter near Port by S-Band Radar (S. Ishii & S. Sayama)
Weathering State Independent Rock Type

Classification using Textural Features (E. Momma, H. Ishii, & T. Ono)

Our committee website (http://202.235.159.197/~aim/) also assists to understand our activity.

Written by **Dr. Kazuo Tanabe (Central Research Institute of Electric Power Industry, CRIEPI)**, Chairman, e-mail: tanabe@criepi.denken.or.jp

The visit of SPring-8, which is a large synchrotron radiation facility which delivers the most powerful synchrotron radiation currently available and located in Harima Science Park City, Hyogo Prefecture, Japan, by the committee members October 2, 2009

IEC and CIGRE Japanese National Committees Related to Electrical Insulating Materials

IEC TC15 Japanese National Committee

Chairperson: Yoshiaki Yamano (Chiba University)
Secretary: Yoshio Wakashima (Japan Electrical Safety & Environment Technology Lab.)
Associate Secretary: Akihiro Kawaguchi (Japan Electrical Safety & Environment Technology Lab.)

The task for IEC TC15 is to prepare international standards including specifications for solid electrical insulating materials alone and in simple combinations. This includes coatings which are applied in the liquid state but cure to solids, such as varnishes and coatings.

TC15 establishes definitions, general requirements and specification sheets for individual types of materials. The standards include test methods and guidance where these are required for the specifications. The current activities of TC15 are carried out in 5 working groups (WGs) and 4 maintenance teams (MTs), and more than 160 standards are published and 23 projects are working in progress.

Japanese national committee for TC15C held three meetings in last year. Over 30 documents for standardization have been sent from IEC Central Office, including CD, CDV and FDIS, all of which were circulated to the member of the Japanese National committee and discussed. Totally more than 80 reports or documents including voting results, compiled comments and reports concerning to the management were circulated.

For the activities on the WGs in TC15, the experts from Japan participate in MT3 (Plastic films), WG5 (flexible insulating sleeving), WG7 (resins and varnish) and WG9 (Cellulosic materials).

Japanese national committee is participating to the standardization for new insulating materials as well as the conventional ones to develop the international standardization in the field of insulating materials.

TC15 meeting has been annually held. The meeting of this year was held on May in London. 6 members from Japan participated to MT/WG meetings and the plenary meeting.

IEC TC112 Japanese National Committee

Chairperson: Noriyuki Shimizu (Meijo University)
Vice Chair: Tatsuki Okamoto (CRIEPI)
Secretaries : Hiroaki Uehara (Kanto Gakuin University)
Hiroya Homma (CRIEPI)

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies. The IEC has 94 Technical Committees (TCs) and 80 Subcommittees (SCs). TC 112 was established in 2005 May by the merger of SC 15 E “Insulating Materials - Methods of Test” and “TC 98 Electrical Insulation Systems”.

The title, the scope and the horizontal safety function of Technical Committee 112 (TC112) at the present time are as follow.

Title: Evaluation and qualification of electrical insulating materials and systems

Scope: To prepare International Standards covering methods of evaluation and qualification for electrical and electronic insulating materials, and electrical insulation systems.

Horizontal Safety Function: Test methods for resistance to tracking.

The participant members and the observer members are 21 countries and 7 countries (as of September 1, 2009) respectively. Japan is one of the participant members. TC112 has 80 publications.

The chairman of TC112 was recently changed. The new chairman (from October 1, 2009 to September 30, 2015) is Mr. R.C.Wicks (USA). The secretary is Mr. B.Goettert (Germany).

The TC112 Japanese National Committee (JNC) was established in October 2005. The 42 experts from universities, research institutes and industries serve as the members of the TC112 JNC. The officers are as follows:

Chair: Prof. N. Shimizu (Meijo University)

Vice Chair: Dr. T.Okamoto (Central Research Institute of Electric Power Industry)

Secretaries : Prof. H. Uehara (Kanto Gakuin University) and Dr. H.Homma (Central Research Institute of Electric Power Industry)

TC112 has 8 working groups WG1-8. It should be mentioned that the three convenors of WG2, WG7 and WG8 are from our JNC. Corresponding to these WGs in the international area, JNC has also 8 WGs in the domestic area. WGs are shown in Table 1 below with names of covenors and chiefs in Japan.

Table 1 WGs in TC112 and Convenors and Chiefs in JNC

WG.	Title	Convenor / Chief in JNC
WG 1	Thermal Endurance	Prof. G.C. Montanari, Italy / Mr.N.Nakamura
WG 2	Radiation	Prof. H.Kudo, Japan / Prof. H.Kudo
WG 3	Electric Strength	Prof. K.Stimper, Germany / Prof. K.Kimura
WG 4	Dielectric / Resistive Properties	Mr. H.Haupt, Germany / Prof. E.Watanabe
WG 5	Tracking	Dr. J.Winter, Germany / Dr. H.Homma
WG 6	General Methods of Evaluation of Electrical Insulation	Prof. J.Smit, Netherlands / Mr.T.Sakano
WG 7	Statistics	Dr. T.Okamoto, JP / Dr. T.Okamoto
WG 8	Various Material	Prof. N.Shimizu, JP / Prof. N.Shimizu

Some projects are working to establish new standards under WGs. Currently TC112 has 4 PWI (preliminary work item) projects. Two project leaders (PLs) are from our JNC.

-Electrical insulating materials and systems - Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses

WG 3 PL: Prof. K. Kimura (Japan)

-Calibration of space change measuring equipment

WG8 PL: Prof. Y. Tanaka (Japan)

Fig1 and 2 shows the delegates from the JNC to the TC112 plenary meeting, which was held in Milan, Italy, September 2009.

Fig. 1 The delegates from the JNC to the TC112 plenary meeting, which was held in Milan, Italy, on September 11, 2009.

From the left hand side,
Prof. Y.Tanaka, Mr. T.Sakano, Prof. K.Kimura, Dr. T.Okamoto (standing) and Prof. N.Shimizu.

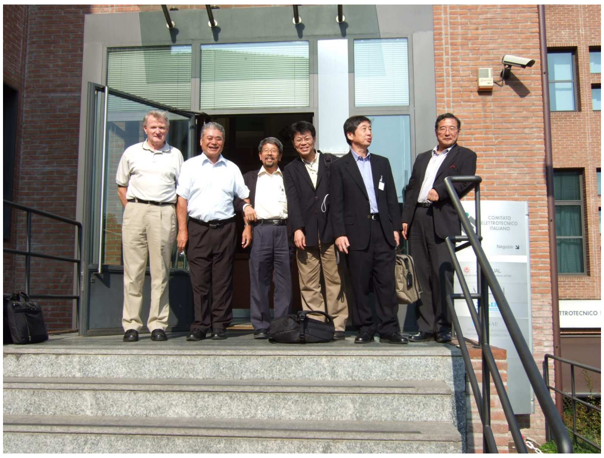


Fig. 2 The delegates at the entrance of the building of the “Comitato Elettrotecnico Italiano”.

Dr. J.Densley from Canada at the most left hand side. Other 5 gentlemen are the same Japanese delegates with Fig.1.

CIGRE SC D1 Japanese National Committee
(Materials and Emerging Test Techniques)

Chairperson: Masayuki Nagao (Toyohashi University of Technology)
Secretary: Toshio Shimizu (Toshiba Corporation)
Naohiro Hozumi (Aichi Institute of Technology)
Assistant Secretary: Tsuguhiro Takahashi (CRIEPI)

CIGRE (International Council on Large Electric Systems) has 16 Study Committees (SC) belonging to each of following 4 categories: A (Equipment), B (Subsystems), C (Systems) and D (Horizontal). Among them, our SC D1 has a horizontal character and contributes to other CIGRE SC's. Last year SC D1 changed the theme to "Materials and Emerging Test Techniques" from "Materials and Emerging Technologies", because “Emerging Technologies” are too wide and are considered not to be only for SC D1. This theme change adjusted the matching of the theme and our main field of activities in better direction. The activity of CIGRE SC’s is principally research oriented one, while some of them are closely related to the activities of IEC Committees which publish and maintain the International Standards in the field of the Electrotechnology.

SC D1 has now following 5 Advisory Groups (AG): CSAG (Customer and Strategic related), AG D1.01 (Insulating Liquids), AG D1.02 (High Voltage Testing and Diagnostic), AG D1.03 (Insulating Gases) and AG D1.04 (Insulating Solids). Previous AG D1.05 (Capacitors) became Working Groups (WG) D1.05 and AG D1.06 (Emerging Technologies) was disbanded. In 2009 CIGRE SC D1 Budapest meeting, SC D1 has started 2 new WG’s: WG D1.27 (Material Properties for New and Nonceramic Insulation) chaired by Prof.Kindersberger and WG D1.28 (Optimized Gas-insulated Systems by Advanced Dielectric Coatings and Functionally Graded Materials) chaired by Dr.Hama. SC D1 now consists of 5 AG’s and 15 WG’s: the above new WG’s as well as the 13 existed following WG’s: WG D1.01 (Liquid Impregnated Systems for Transformers), WG D1.05 (Capacitrs), WG D1.07 (Solid Insulating Materials for Rotating Machines), WG D1.15 (HTSC-Material Applications & Cooling), WG D1.17 (HV Asset Condition Assessment Tools, Data Quality and Expert Systems), WG D1.18 (Emerging Technologies in Power Systems), SCTF D1.19 (Solid Insulation Endurance under Repetitive Transient Voltages), SCTF D1.20 (Water Tree Detection in XLPE insulation), WG D1.23 (Diagnostics and Accelerated Life Endurance Testing of Polymeric Materials for HVDC Application), WG D1.24 (Potential of Polymer Nanocomposites as Electrical Insulation for Highly Stressed Insulation Material in AC and DC Application), WG D1.25 (Application Guide for PD Detection in GIS using UHF or Acoustic Methods), WG D1.26 (Basic Principles to Determinate Methane Content of Cross-linked Solid Insulation of MV and HV Cables) and WG D1.33 (High Voltage Test and Measuring Techniques).

The preferential subjects for the 2010 SC D1 Paris group meeting are PS1: New materials for improved efficiency and sustainability of AC & DC power equipment (Nanomaterials, biodegradable materials, New gas compositions, Recyclable materials, Innovative polymers, HTSC), PS2: Challenges for testing and diagnostics (New requirements for ultra high voltage, Interpretation of diagnostic results for condition assessment, New test and monitoring methods), PS3: Endurance of materials especially in harsh electrical and physical environments (Off-shore applications, Repetitive transients, load cycling, thermal overload, nuclear environment). From Japan, following 3 papers are accepted: “Endurance of polymeric insulating materials in nuclear power plants and needs for condition monitoring of electrical cables” by Y. Ohki, et al, “Application of new solid insulating materials and new gas compositions to future advanced gas insulated systems” by H. Hama, et al., “Experimental research on the feasibility of biodegradable polymeric insulating materials” by Y. Ohki, et al.

The next 2010 meeting is scheduled to be held during CIGRE Paris meeting in Paris, France on August 22-27, 2010. In this 2010 Paris meeting the chairman of SC D1 will be changed from Prof.Gockenbach to Prof.Kindersberger. The 2011 SC D1 meeting was decided to be held in Kyoto, Japan in conjunction with SC A2 (Transformer)

The Japanese National SC D1 has usually 3 or 4 meetings a year.

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RESEARCH ACTIVITIES AND TECHNICAL EXCHANGES IN ASIAN COUNTRIES

Conference Records

14th Asian Conference on Electrical Discharges (ACED 2008)

Bandung, Indonesia, 23-25 November 2008

The 14th Asian Conference on Electrical Discharges (ACED 2008) was held in Bumi Sangkuriang, Bandung, Indonesia, November 23-25, 2008. 101 participants from 12 countries attended the conference as shown in table 1 with their paper number. During the conference 84 papers were presented in oral or poster sessions. The plenary lectures were given by Prof. Masayuki Hikita from Kyushu Institute of Technology, Japan, Prof. Guan Zhicheng from Tsinghua University, Shenzen, China and Prof. Rainer Patsch from University of Siegen, Germany.

The topics of papers presented in the ACED 2008 are Electrical Discharge Phenomena and their applications, Discharge Measurement and Testing, Discharge, Aging and Insulation Diagnosis, Electrical insulation and materials, outdoor Insulators and Lightning and Electromagnetic compatibility. The paper number for each topic is shown in table 2.

During the meeting of International Steering Committee chaired by Prof. Hidaka from Japan it was concluded that the 15th Asian Conference on Electrical Discharges (ACED 2010) would be co-organized by Xian Jiaotong University and Chongqing University of China in Xi'an 2010. At the closing ceremony Prof. Guan Jun Zhang from Xi'an Jiaotong University call for participation for ACED 2010 in Xi'an.

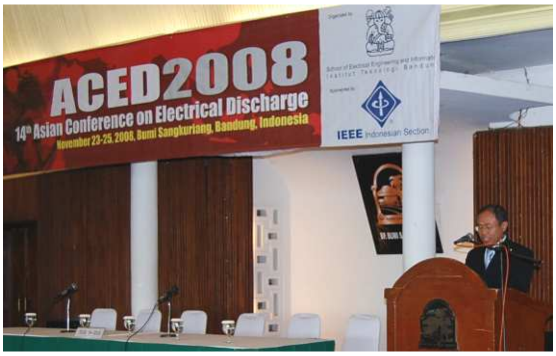

Fig. 1. Prof. Djoko Santoso, the Rector of ITB delivering an opening speech

Fig. 2. Prof. Hidaka addressing an opening speech

Table 1. Participants and paper number from each country

No.	Country	Number of Participants	Number of Paper
1	Indonesia	60	24
2	Japan	16	17
3	China	7	15
4	Malaysia	5	7
5	Korea	7	5
6	Others	6	16
Total		101	84

Table 2. Topics of papers presented in ACED 2008

No.	Topic	Number of Paper
1	Electrical Discharge Phenomena and their applications	16
2	Discharge Measurement and Testing	17
3	Discharge, Aging and insulation diagnosis	14
4	Electrical Insulation and materials	10
5	Outdoor Insulators	13
6	Lightning and Electromagnetic compatibility	14
Total		84

Fig. 3. Prof. Hikita delivering an invited speech

Fig. 5. Prof. Patsch, Dr. Suwarno and Prof. Sinisuka at a break time

Fig. 4. Prof. Guan Zhicheng at plenary speech

Fig. 6. Dance performance at dinner party

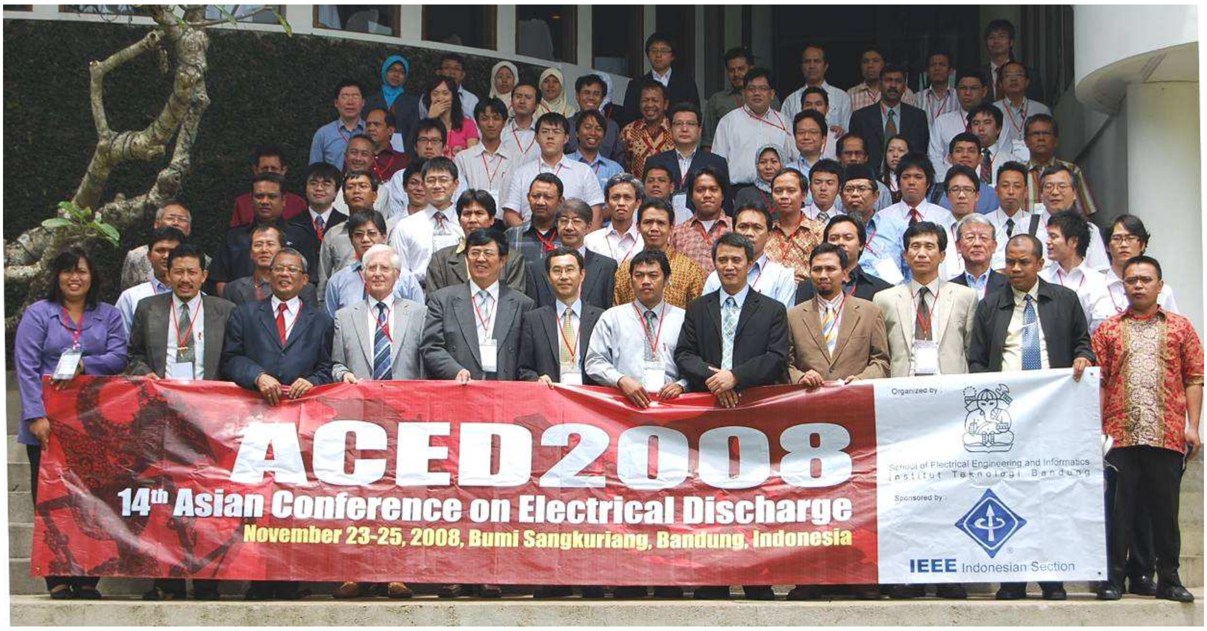

Fig. 7. All participants of the ACED 2008

Prepared by: **Prof. Suwarno**
Bandung Institute of Technology
Indonesia

CIGRE Workshop on Test Techniques and Procedures for HTS Power Applications

Naoki Hayakawa (Nagoya University, Japan)

CIGRE Workshop on Test Techniques and Procedures for HTS Power Applications was held in Nagoya University on May 13-15, 2009. This Workshop was hosted by CIGRE SC D1 WG 15 “Superconducting and Insulating Materials for HTS Power Applications” (Convenor: Prof. Hitoshi Okubo, Nagoya University). The number of participants was 88 (Japanese: 69, foreigners: 19) from 11 countries (Japan, USA, Germany, China, France, Italy, Netherlands, Brazil, Australia, Egypt, Korea). The purpose of this Workshop is to exchange the latest world progress in HTS power applications and their test techniques with 4 plenary lectures and 19 presentations on cable, power equipment, common test techniques, fault current limiters. The program and PDF files of plenary lectures and presentations can be downloaded from http://www.okubo.nuee.nagoya-u.ac.jp/CIGRE/. Figure 1 shows a group photograph of the Workshop participants.

In the afternoon on May 14, the meeting of CIGRE SC D1 WG 15 was held with 24 participants from 10 countries (Figure 2). The session chairmen of the Workshop gave a short summary of the highlights in their session. Following the summary, a discussion on present and future links from WG D1.15 to other CIGRE WGs (A1: Rotating Electrical Machines, A2: Transformers, A3.23: Fault Current Limiters, B1: Insulated Cables) and activities continued. There was consensus that strong links between the different CIGRE WGs are meaningful and should be further established. After the meeting, a banquet was held in a Japanese garden, Tokugawaen (Figure 3).

Figure 1

Figure 2

Figure 3

The last day on May 15, a technical tour was held. Due to worldwide infection of new type influenza, the original schedule to visit Chubu Electric Power Company and Sharp Corporation was changed to visit laboratories of Nagoya University and excursion to historical Inuyama area. In Nagoya University, 23 participants from 9 countries visited a high voltage laboratory at cryogenic temperature (Figure 4), a demonstrator of superconducting fault current limiting transformer (SFCLT), a test equipment for HTS film and coated conductor. In Inuyama area, they visited a national treasure in Japanese tea house, Urakuen (Joan), and the oldest national treasure in Japanese castle, Inuyama Castle (Figure 5)

Figure 4

Figure 5

Prof. Naoki Hayakawa
Nagoya University
Japan

International Conference on Electrical Engineering (ICEE 2009 Shenyang, China)

Yoshizumi Serizawa
Central Research Institute of Electric Power Industry, Japan

1. Introduction

The International Conference on Electrical Engineering 2009 (ICEE 2009 Shenyang) was held from the 5th to 9th of July 2009 in Shenyang, China. ICEE is held annually in Korea, China, Japan and Hong Kong through collaborative work with the related academic institutions from these countries and region. ICEE 2009 Shenyang was the 15th annual conference, and the fourth one in China, followed by those in Beijing (1996), Xi'an (2001), and Kunming (2005).

ICEE 2009 was organized by the Chinese Society for Electrical Engineering (CSEE), and co-organized by the Institute of Electrical Engineers of Japan (IEEJ), the Korean Institute of Electrical Engineers (KIEE) and the Hong Kong Institution of Engineers (HKIE), in cooperation with China Electric Power Research Institute (CEPRI). The theme of this year's conference was *Towards a Safe, Reliable, Sustainable, Intelligent Power System*.

2. Venue and Statistics

Sunrise International Hotel (Fig. 1), the conference venue, in Shenyang accommodated more than 400 participants on sunny and mild days in the midst of summer in Northeast China. Details of these participants and published papers are summarized in Table 1. Other than the four organizing countries and region, there were participants from Canada, Chinese Taipei, Germany, Iran, South Africa, Thailand and UK. Due to the global economic crisis and swine flu, some delegates were not able to attend.

Fig. 1 Sunrise International Hotel

Table 1 Statistics of ICEE 2009 by Country/Region

Country/Region	Participants	Published Papers
China	166	111
Japan	108	85
Korea	94	71
Hong Kong	15	12
Others (7)	25	30
Total	408	309

3. Opening ceremony

At the opening ceremony (Figs. 2 and 3), Dr. Ruomei Li, Secretary General of CSEE, Chairperson of the Organizing Committee, opened the ceremony, and Mr. Feng Chen, Executive Vice President of CSEE, addressed a welcome speech, followed by addresses by Professor Kouiki Matsuse, President of IEEJ, by Dr. F. C. Chan, Vice President of HKIE, and by Professor Soo-Hyun Baek, President of KIEE.

The following five keynote speeches were presented.

- "Toward International Standardization of 1100 kV Ultra-High-Voltage Technologies" by Professor Kunihiko Hidaka, President of Tokyo Branch, IEEJ (Fig. 4)
- "Challenges of Power Transmissions in China" by Professor Liang Xidong, Deputy Director,

Fig. 2 The opening ceremony

Fig. 3 Welcome speech presenters; from left, Mr. Chen, an interpreter, Prof. Matsuse, Dr. Chan, Prof. Baek

Academic Working Group, CSEE
- "Demand Response Programs in Korea" by Professor Jong-Keun Park, President-Elect, KIEE
- "Technical and Commercial Roadmaps of Electric and Hybrid Vehicles" by Professor C. C. Chan, Past President, HKIE
- "Smart Grid: Challenges and Opportunities" by Dr. David Sun, Chief Scientist, AREVA T&D, USA

4. Conference Sessions

Reflecting the recent discussions for the future low-carbon and sustainable society, the following three panel sessions were conducted for more than three hours, each.

- Smart Grid, 6 presentations
- Renewable Energy, 9 presentations
- Distributed Generation, 7 presentations

A total of 288 papers were presented in 16 oral sessions (134 papers, Fig. 5) and 3 poster sessions (154 papers, Fig. 6).

Followings are the topics of these sessions.

A. Fundamentals, Materials & Education
- Electrical Materials and Process
- Semiconductor Technology
- Electronic Materials
- Education and Training for Electrical Engineers

B. Power Systems
- Power System Planning and Scheduling
- Power System Protection, Operation and Control
- EHV & UHV Engineering and Insulation Technologies
- Transmission & Distribution Systems and Apparatus
- Power System Stability and Reliability
- Power Market and Power System Economics
- Power System Modeling, Simulation and Analysis
- HVDC and FACTS
- Electromagnetic Transients Evaluation
- Smart Grid
- Disaster Prevention and Control

C. Electronics, Information & Control Systems
- Communication Systems
- Intelligent Systems and Approach
- Information Technology Application
- Control Theory and Application
- Knowledge Management

D. Environment, Renewables & Energy Efficiency
- Power Plant Heat Rate Performance
- Renewable Energy and Distributed Generation
- Thermal Generation System Measurement and Control
- Power Plant Pollutant Emission Control and Clean Development -Mechanism (CDM)
- CO2 Capture and Sequestration (CCS)
- Hydrogen Energy and Fuel Cell
- Energy Storage Technology

E. Electrical Machines, Power Electronics & Industry Applications
- Electrical Machines
- Electric Drives and Application
- Electrical Traction Systems and Control
- Electromagnetic and Applied Superconductivity
- Industrial Process Control and Automation
- Inverter and Converter Technology

F. Sensors & Micro-machines
- Diagnosis and Sensing Systems
- Micro Machines
- MEMS - Micro Sensors and Structures

Fig. 4 Prof. Hidaka at the key note speech

Fig. 5 Oral session

5. Social programs

The Welcome Reception, the Banquet, and technical tours were conducted.

The Welcome Reception was held at the conference hotel, where all participants enjoyed get-acquainted talks and reunions as well as Chinese foods and beverages.

At the Banquet also held at the conference hotel, full-course dinners were served, along with the

Fig. 6 Poster session

performance of local songs, comedies and dances in Northeast China (Figs. 7 and 8). Before the closing of the Banquet, Professor Seung-Jae Lee, Chairperson of ICEE Korea Committee, KIEE, made an announcement about the next ICEE, which is scheduled to be held in Korea next year. He announced that ICEE 2010 will be held on July 11-14, 2010 at Paradise Hotel in Busan, Korea, and displayed a video showing information about the city. Finally, the ICEE flag was handed over from the president of CSEE to the president of KIEE (Fig. 9).

The following technical visits were conducted.

a) TBEA Shenyang Transformer Group Co. Ltd. (Fig. 10)

Fig. 7 Banquet

Fig. 8 Performance by local dancers at the Banquet

Fig. 9 The ICEE flag handed over from Mr. Yanchang Lu, President of CSEE to Prof. Baek

b) The Site of 2006 Shenyang International Horticultural Exposition (Fig. 11)

6. Remarks

ICEE Representative and Working Group Meetings were held during the conference. The four organizing institutes agreed that ICEE should act as an independent entity working with joint efforts of the four institutes to acquire internationally-recognized citation indexes, and that it is very necessary to publish an ICEE journal to improve paper quality of ICEE and thus enhance international image of ICEE. The work to initiate the journal publication will start from ICEE 2010.

We hope that the next ICEE annual conference to be held in Busan, Korea in 2010 will be successful with your participation.

By **Dr. Yoshizumi Serizawa**
Chairperson of ICEE Japan Committee, IEEJ
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Fig. 10 Technical visit to TBEA Shenyang Transformer Group Co. Ltd.

Fig. 11 Technical visit to the site of 2006 Shenyang International Horticultural Exposition

International Conference on the Properties and Applications of Dielectric Materials(ICPADM 2009)

Chairman of ICPADM 2009
Qingquan Lei (Harbin University of Science and Technology, China)

The 9th International Conference on the Properties and Applications of Dielectric Materials (ICPADM 2009) organized by Harbin University of Science and Technology (HUST) was held in Harbin, China, from 19th to 23rd of July, 2009. ICPADM 2009 provides a perfect opportunity and platform for colleagues and experts in the field of PADM to meet each other, to share experience and to discuss the new progress and challenges facing us in the near future.

Short Report on ICPADM 2009

ICPADM was first held in Xi'an, China (1985). The latest three ICPADM were respectively held in Xi'an, China (2000), Nagoya, Japan (2003), and Bali, Indonesia (2006). It was one of important conferences in the field of dielectric and electrical insulation. ICPADM 2009 has given you a challenging platform to see the recent progresses in electrical insulation, related measurement technology, dielectric and their applications.

With the fast progress of society and electric power industry, the concern about the application and development of dielectric, electrical insulation and related measurement technology is increasing more and more. 271 people (not including about 10 exhibitors and 30 accompanying person) have registered for ICPADM 2009, they are from industry, government, research and academic institution of 20 different countries and areas around the world. The total figure is about 320. The number of persons from China is about 190, and Japan 18, Indonesia 11, the forth is UK 6, Korea 6, and next is Austria 5, Germany 5. Also, others are from, Canada, India, Italy, France, Netherlands, USA etc.

ICPADM 2009 had very various scopes from electrical insulation in power apparatus, new and functional dielectric materials to test and measurement techniques etc. At this international conference, there were 417 abstracts initially submitted of which 39 were rejected and 378 accepted. Further attrition occurred due to concerns over the H1N1 virus leading to 311 full papers related to various fields of dielectric and electrical insulation to have been published in the proceeding.

In the plenary session, we were so lucky to invite those famous experts and professors to give us some wonderful presentations about their respective fields. All of these proceeded successfully. The content of plenary session is shown in Table 1.

Table 1 Invited Lecture Program of Plenary Session

Speaker	Affiliation	Title
Prof. Qingquan LEI	Harbin University of Science and Technology, China	The Multi-time space hierarchy in the structure and movement forms of nanodielectrics, and some deep thoughts on it
Prof. C. Laurent	Université Paul Sabatier, France	Knowledge-Based Model ling of Charge Transport in Insulating Polymers: From Experiments to Model Optimization
Prof. Y.Ohki	Waseda University, Japan	Suppression of Packet-like Space Charge Formation in LDPE by the Addition of Magnesia Nanofillers
Prof. Qiming ZHANG	University Park, USA	Polyvinylidene Fluoride based polymeric dielectrics for high energy density capacitor application
Prof. Weijiang CHEN	State Grid Corporation of China	The development and innovation of china's power grid

Figure 1_L All Participants (continued to the right page)

In the next two day's discussion and communion, conferees fully exchanged their ideas and productions in the form of oral an d poster. According to the papers that have been received, the main topics of ICPADM 2009 were as follows:

1. Electrical Insulation in Power Apparatus and Cables (Solid, Liquid and Gaseous insulation)
2. Monitoring and Diagnosis of Degradation in Insulation Materials and Systems
3. Aging and Life Expectancy
4. Dielectric Phenomena and Applications
5. Partial Discharges, Treeing and Tracking Phenomena
6. Electrical Conduction and Breakdown (Solids, Liquids and Gases)
7. Surface and Interfacial Phenomena
8. Nanotechnology and Nano-dielectrics
9. Space Charge and Its Effects
10. Test and Measurement Techniques
11. New and Functional Dielectric Materials (Ceramics, Biological Materials, Soft Matter, Thin Film and Multi-layer Dielectrics)

Figure 2 Prof. H. Orton, the IAC Chair, makes a welcome speech in the Welcome Banquet

The statistics of the contribution for the hot topics on ICPADM 2009 are: (1) Electrical Insulation in Power Apparatus and Cables, 47 (2) Partial Discharges, Treeing and Tracking Phenomena, 41 (3) Nanotechnology and Nano-dielectrics, 37 (4) Test and Measurement Techniques, 35 (5) Space Charge and Its Effects 25, etc.

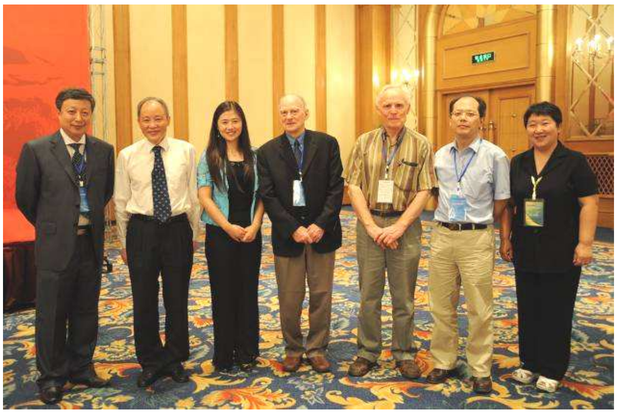

Figure 3 Prof. Hong Zhao, Prof. Qingquan Lei, Ms Baokun Pang Prof. H. Orton, Prof. R. Fleming, Prof. Yewen Zhang and Prof. Xiaohong Zhang (from left to right) in the Reception

Figure 4 Prof. Xiaohong Zhang, Prof. Hong Zhao, Prof. T. Tanaka, Prof. G. C. Montanari, Prof. Yewen Zhang and Prof. Zhicheng Guan (from left to right) in the Reception

Figure 1_R All Participants (continued to the left page)

The papers contained in the proceeding will be presented in 12 sections, including 3 plenary talks, 19 keynote lectures, 82 oral reports and some post presentations. In memorial of LIU Ziyu and M. Ieda, two greatest leaders who have made major contribution to our filed, 2 memorial lectures was given by Prof. C. Laurent and Prof. Y. Ohki. The six keynote lectures about hot topics were presented in parallel sessions as shown in Table 2.

Figure 5 Plenary Session

Figure 6 Raising Questions （Prof. R. Patsch）

Figure 7 Prof. Hong. Zhao, Prof. G.C.Montanari and Prof. H. Orton (from left to right) are discussing question

What is more, to share experiences in nanodielectric, Partial Discharges, Treeing and Tracking Phenomena and Space Charge and Its Effects, three panel discussions about the area were arranged specially. Some questions to prompt contributions to these sessions were given. The organizers particularly welcome the contributions and experts from related fields.

Speaker	Affiliation	Title
Prof. G.C. Montanari	DIE-LIMAT, University of Bologna, Italy	The Multi-time space hierarchy in the structure and movement forms of nanodielectrics, and some deep thoughts on it
Prof. T. Tanaka	Waseda University, Japan	Tree Initiation Time Evaluation of Epoxy/Silica Composites by Partial Discharge Detection
Prof. Rainer Patsch	University of Siegen, Germany	Measurement of the Dielectric Properties of Paper-Oil Cables and the Cellulose-Oil Insulation System of Power Transformers
Prof. LI Shengtao	Xian Jiaotong University, China	Dielectric Relaxation Phenomena of Ultrafine $BaTiO_3$
Prof. N. Amyot	Hydro-Québec (IREQ), Canada	Large Hydro-Generator Endwinding Spacing Limits for the inhibition of External PD
Dr. G. Chen	University of Southampton, UK	Anomalous Phenomena in Solid Dielectrics under High Electric Fields

Figure 8 Oral Session

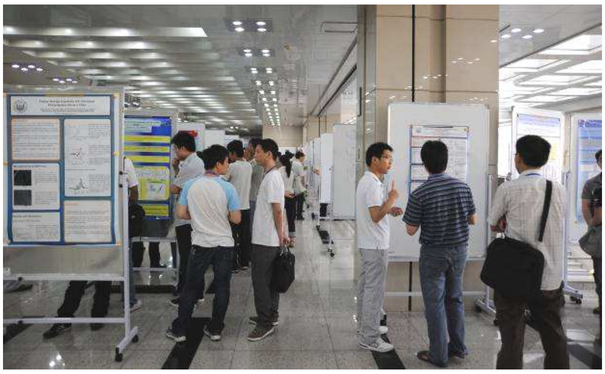

Figure 9 Poster Session

ICPADM 2009 was sponsored by IEEE Dielectrics and Electrical Insulation Society (DEIS) with technical co-sponsorship by China Electrotechnical Society and Chinese Society for Electrical Engineering, National Natural Science Foundation of China and Heilongjiang

Province. The conference gained essential sponsor from some manufacturers. The half-day technical tour was included in the conference package as well as two optional tours. The technical tour included two venues, the Harbin Embraer Aircraft Plant and the Harbin Electric Machinery Works.

Figure 10 Prof. R. Patsch and Dr. Ch. Weindl are to the front of a poster

Figure 11 The technical tour visiting the Harbin Electric Machinery Works

Figure 12 An evening at the dancing on ice

Figure 13 Cranes hovering over Zhalong National Nature Reserve

Figure 14 IAC members are in the Closing Banquet

Figure 15 IAC members, ICPADM2009 OC members and volunteers from HUST are in the Closing Banquet

As the chairman of ICPADM 2009, I really hope that conference was a beneficial and enjoyable experience for all participants and you have had a nice stay in Harbin. Further, I would like to give my most heartfelt thanks to all delegates from all over the world and the member societies for the efforts they have given to assist in this scientifically successful conference.

Prof. Qingquan Lei
Chairman of ICPADM 2009
Harbin University of Science and Technology, China
Lei_qingquan@sina.com

International Conferences to be held in Asia

ICEE 2010 (International Conference on Electrical Engineering)

Dates: July 11-14, 2010
Venue: Paradise Hotel, Busan, Korea
Chairman: Prof. Seung Jae Lee (Myongji University)
Theme: The Smart & The Green in Electrical Engineering
Organized by KIEE
Co-organized by IEEJ, CSEE, HKIE

Since 1995 the International Conference on Electrical Engineering (ICEE) has been a premium forum for sharing knowledge and experience among the most innovative electrical engineers worldwide. The Korean Institute of Electrical Engineers (KIEE) is proud to announce that the 16th ICEE will be held from July 11th through 14th in 2010 at Paradise Hotel in the beautiful city of Busan, Korea. With the theme of innovation and Convergence in Electrical Engineering & Technology, the ICEE 2010 is co-organized by the Institute of Electrical Engineers of Japan (IEEJ), Chinese Society for Electrical Engineering (CSEE), and Hong Kong Institute of Engineers (HKIE).
It is a great pleasure for the KIEE and co-organizers IEEJ, CSEE, and HKIE to invite prospective authors to submit papers to the conference.

Key dates:
Abstract Submission: December 31, 2009
Acceptance Notification of Abstract: Feb. 1, 2010
Manuscript Submission: April 1, 2010
Acceptance Notification of Paper: May 1, 2010

Secretariat:
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Room 901, Science & Technology Building,
635-4, Yucksam-Dong, Kangnam-Ku, Seoul
135-703 KOREA
Tel:+82-70-8222-3371, Mobile:+82-10-9156-3571
Fax: +82-2-3412-8723
E-mail: secretariat@icee2010.com
URL: http://www.icee2010.com

CMD 2010 (International Conference on Condition Monitoring and Diagnosis)

Dates: September 6-11, 2010
Venue: Shibaura Institute of Technology, Tokyo, Japan
Chairman : Prof. Hitoshi Okubo (Nagoya University, Japan)

Strategic maintenance and replacement of aged power equipment are key technologies to keep high reliability of power transmission and distribution economically. CMD2010 deals issues on various aspects of aged, replaced or new power equipment, such as condition monitoring, insulation diagnosis, failure phenomena based on electrical, mechanical, chemical and thermal causes, sensing technology, and asset management techniques. Thus, CMD2010 will be a precious chance for you to discuss above topics with a lot of researchers and engineers gathering from all around the world. It is sponsored by IEEJ and technically co-sponsored by IEEE Dielectrics and Electrical Insulation Society and CIGRE.
The conference venue is located in the Tokyo Metropolitan area, around 30 minutes train and walk from Tokyo station. Tokyo is a world well-known city as the capital of Japan with more than 400 year-history, and has a lot of interesting places such as beautiful and historical gardens, new cluster of tall buildings, centers of unique cultures, and so forth. You will find new aspects of Tokyo in attending CMD2010.

Key dates:
Abstract Submission January 31, 2010
Acceptance Notices of Abstract: March 31, 2010
Manuscript Submission May 30, 2010

Secretariat:
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C/o Electric Power Engineering Research Laboratory,
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Tel: +81-46-856-2121, Fax: +81-46-856-3540
Email: secretary@cmd2010.org
URL: http://www.cmd2010.org/

ACED 2010 (Asian Conference on Electrical Discharge)

Dates: November 7 -10, 2010
Venue: Xi'an, China
Chairman: Yan-Ming Li (Xi'an Jiaotong Univ.)
Organized by State Key lab of Electrical Insulation & Power Equipment, Xi'an Jiaotong Univ.
Co-organized by State Key lab of Power Transmission Equipment & System Security and New Technology, Xi'an Jiaotong Univ.
Supported by National Natural Science Foundation of China (NSFC), Chinese Society of Electrical Engineering (CSEE), China Electrotechnical

Society (CES)
Sponsored by China Xian Electric Group (XD), Northwest China Grid Company Limited, Shaanxi Electric Power Company

The 15th Asian Conference on Electrical Discharge (ACED 2010) will be held at Xi'an, China, on November 7-10, 2010. This is the 15th conference of a series that had its last venues in Bandung, Indonesia (2008), Hokkaido, Japan (2006), Shenzhen, China (2004), Seoul, Korea (2002), Kyoto, Japan (2000), Bandung, Indonesia (1998), Bangkok, Thailand (1996), Xi'an, China (1994), Oita, Japan (1993) and Singapore (1992). The purpose of this conference is intended to provide a forum for researchers, scientists and engineers to exchange ideas and discuss recent progress in properties, phenomena and applications of electrical discharges. The organizing committee cordially invites you to participate in the conference.

Key dates:

Abstract Submission:	March 31, 2010
Acceptance Notification of Abstract:	April 15, 2010
Manuscript Submission:	June 30, 2010

Secretariat:
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URL: http://www.aced2010.com

Activities of Laboratories

Laboratory of High Voltage Engineering and Department of Electrical Power Engineering at Hasanuddin University

Salama Manjang
Hasanuddin University (UNHAS), South Sulawesi, Indonesia

1. Introduction

The department of Electrical Power Engineering at Hasanuddin University (UNHAS) was established in 1963. The main reason of the creation of this faculty was for giving the chance to every civil for get the higher education in electric engineering department and to giving a way for student to get many important position in electrical workplace together with the development of industry in East region of Indonesia, Especially South Sulawesi.

The first lecture is mutated from Bandung Institute of Technology (ITB) and Gajah Mada University (UGM) Where the other lecture is continue their study on ITB or UGM. In 1970, they sent back to teach in UNHAS until now. Electrical Engineering Study Program keep developing and creating many qualified bachelor in Sulawesi and outside Sulawesi. Even if the amount of bachelors were not fulfilled public needs. These Bachelor are working on many energy and power working places.

In 1980, the needs of bachelor in telecommunication and electronic was increased. To Anticipating this thing, Electrical engineering study program divided to be three sub program, Electrical power engineering, Telecommunication of engineering and control and electronic engineering, At first time, Electrical Engineering only have 6 lectures to handle 60 students. About 25% of prestigious students was sent to ITB to doing some practical work and finishing their script project. And half of them have been recruited by faculty.

After faculty of engineering placed on new campus in 1985, electrical engineering study program have many laboratories and lecturing facilities that can handle above 100 students each year. Hasanuddin University include 14 faculty members of the department engage in research in wide range of areas, in order to provide superior graduate education and research in the interdisciplinary fields of Electrical Power Engineering at the UNHAS. Being organized by five research groups including High Voltage Engineering group, the activities of our department focus on Insulating performance in power systems, power cable, aging of new material (polymeric material insulation), liquid and gas insulation materials.

About 600 undergraduate students, 200 Master students and 4 PhD students are enrolled in the Department every year. The department is managed by Dr. Zahir Zainuddin,M.Sc., who is currently Head Department Electrical Engineering of UNHAS.

2. Research activities of the Laboratory of High Voltage Engineering

High voltage engineering field is an integral part of the work of the department. The laboratory of High voltage engineering is a graduate research and undergraduate teaching laboratory. The staff involved in the laboratory comprises 4 professors and assistant professors. At present, 6 Master students and 3 PhD students are working toward their Master and Doctor degrees in high voltage engineering discipline. The main research fields in the laboratory include:

- Protection of equipments in power system against direct and induced strikes, insulation coordination, grounding system in transmission line and substation
- Electromagnetic field under high voltage transmission line and its effect on human body
- Ageing process in insulating materials and prediction of life expectancy, insulator behavior and pollution flashover in different environment.
- Insulation diagnostic method and insulation condition monitoring.

3. Facilities

3.1. Over Voltages in Power System

As the laboratory of High Voltage Engineering play as a sub-discipline for Electrical Power Engineering, the main activities of the laboratory cover most of aspects relating to break down voltages with insulation coordination in different environment. Various studies in modeling switching and lightning over voltages by using EMTP and MATLAB in Electrical Power Engineering of Indonesia have been done in the laboratory, the influence of network structure such as the length of transmission lines, grounding system and surge arresters on the magnitude and frequency of over

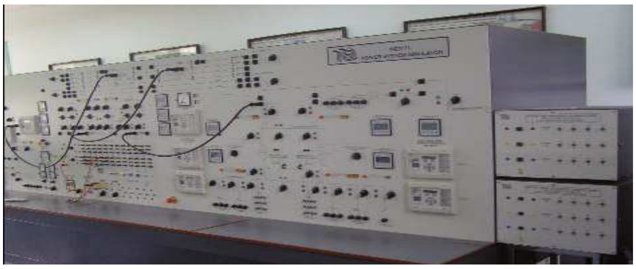

Figure 1: Power System Simulator NE 9171

voltages is also considered. The modeling results could be verified in physical simulation by using Power System Simulator (PSS- NE 9171). The simulator allows simulating most of cases in switching over voltages with different structure of the power network.

3.2. Dielectric behavior of insulation under high stress

Two high voltage testing transformers of 2kVA with rectifiers provide AC and DC voltages up to 100kV in order to study potential distribution along a set of insulator and the corona effect in over head lines. The field distribution within bulk material and along surface insulators has been modelized by using finite element method (FEM). These activities allow understanding the mechanism of pollution flashover in polluted areas in order to develop remedies method for such areas. Moreover, physical properties of liquid dielectrics can be characterized by other facilities available in the laboratory such as liquid breakdown testing kit, viscosity meter kit and flash-point measuring kit.

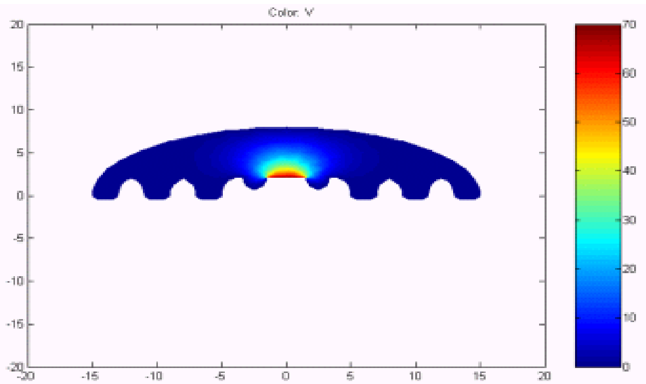

Figure 2. Simulation of Voltage Distribution on the Surfaces of Suspension Insulator With Voltage Stress 70 kV by FEM

3.3. Study Of Insulators Pollution Intensity at 150kV

Analysis of Pollution Intensity need the calculations performed, it was obtained that ESDD and NSDD values of pollutant in Jeneponto substation were 0.0782 mg/cm^2 and 0.6905 mg/cm^2, respectively. From Table 5, it was obtained that the ESDD value was 0.0728 mg/cm^2, pollution level of Jeneponto substation insulator, according to its saline content, falls into **moderate contamination level** (between 0.06 – 0.1 mg/cm^2). When viewed from NSDD value of 0.6905 mg/cm^2, the pollution level of Jeneponto substation insulator according to its insoluble pollutant content, can be categorized as fairly high.

From the average measurement value, a relationship graphic was made between voltage and leakage current in insulator.

For both of test insulators show in figure 3, the maximum average value of leakage current was obtained in wet polluted test condition (by spraying of Jeneponto substation), that is 1.33 mA.

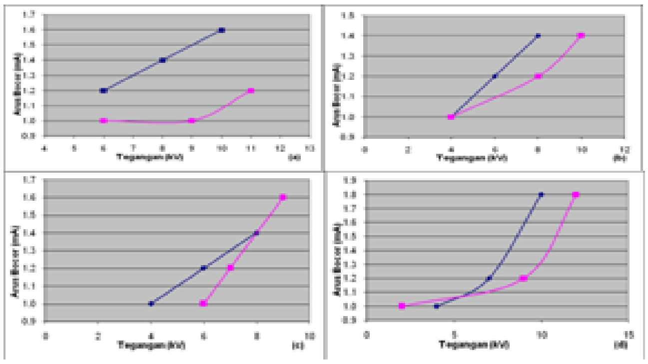

Figure 3. Relationship between voltage and leakage current of insulator (a) dry-clean (b) wet-clean (c) dry polluted (d) wet polluted

3.4. The Radial Distribution of Temperature in XLPE Cable an Analysis the Finite Element Numerical Method

Information at Figure 4 explaining that temperature distribution cable of XLPE which presented in colour variation . Visible that distribution temperature not flattened from centre to external shares. At boundary condition 305^{o}K (Figure 4), highest temperature there are at conductor (colour of orange), while temper-ature of lower there are ground (blue colour). As which seen at Figure 4, for the giving of current 640 A, highest temperature which yielded at conductor equal to 342.9849 ^{o}K (69.9849 ^{o}C) and temperature of lower equal to 305 ^{o}K. This matter is caused by the existence of influence to passed to boundary condition is ground temperature equal to 305^{o}K and conductor Cu is the source of heat. Current boundary able to be given only until 800 A at boundary condition 305 ^{0}K,

If have exceeded current boundary of cable of XLPE have not earn to be justified technically because

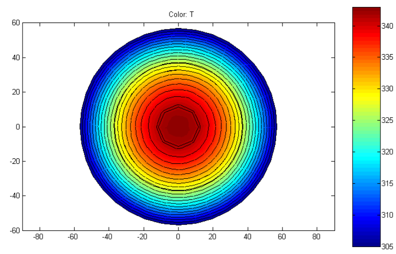

Figure 4. Contour distribution cable temperature of XLPE at 640A all layer with ground tempera-ture 305^{0}K.

insulation layer temperature of XLPE have exceeded dot work maximum which permitted that is temperature 90°C.

For the comparison of conductor layer temperature distribution obtained result of that temperature at compared to heated conductor of insulation layer of XLPE so also to sheath PE and layer soil covering cable.

4. Current research project

4.1. Electrical Breakdown In Liquid Insulation Under Ac High Voltage

The objectives in the studies have made regarding the breakdown characteristic of composite insulation structure of (a) pressboard - transformer oil and (b) Perspex - transformer oil under uniform electric field conditions with power frequency voltages (pressboard being a hydroscopic material and Perspex a non hygroscopic material).

The output from research result is the characteristic breakdown from composite liquid insulation structure. Comparison breakdown voltage age transformator oil with breakdown voltage new transformator oil. The time estimate to breakdown from some type of insulation liquid.

Figure 5: Conductivity Measuring Device for Oil Insulator

4.2. Study Breakdown Behavior of Gas Insulation

In this study to investigate certain aspects of the gas insulation. The physical mechanisms associated with the development of an electrical breakdown in gases are of principle significance of all type of breakdown. This research aims to analysis the influence parameter such as pressure, spacing, humidity, dust and gas composition to breakdown of gas insulation. The experiment was carried out in various conditions of gas pressure, voltage strength and some kind gases insulation. The measurement of the breakdown voltage of air gap with needle-plane configuration without and with a barrier was performed under ac 50 Hz ac. A high voltage testing transformer with an output voltage 0 to 100 kV was used as the high voltage supply. The measurements of a high voltage were performed by means of high voltage electrostatic voltmeter. Conductivity measuring device for gases insulator is shown in Fig.5.

Figure 6: Conductivity measuring device for Gases Insulator

4.3. Voltage Stability Calculation in the South Sulawesi System Using Continuation Load Flow Method

The research study voltage stability in the South Sulawesi power system by using continuation load flow method. One of excellence of continuation load flow method is condition remain to good at critical point. This research aims to analyze the voltage stability of the South Sulawesi system. The results from this simulation can be perfected and will be useful for researchers in this field.

6. Conclusion

As a home of nation wide renowned of researcher and graduate student in Indonesia, the Department of Electrical Power Engineering and Laboratory of High Voltage Engineering at UNHAS is pleased to share the experience and facilities with the researchers and people in the community of Electrical Power Engineering and High Voltage Engineering. Therefore, we welcome enquiries and interest of professors from over the world, and warmly invite them to visit our department and laboratory in order to enhance our scientific collaboration.

7. Acknowledgment

The author wish to thank Professor Masayuki Nagao, Toyohashi University of Technology, for giving the opportunity to introduce about the department of Electrical Power Engineering and High Voltage Engineering Laboratory at Hasanuddin University.

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China Corner

The 354th XSSC on nano-dielectrics

Prof. Shengtao Li
Xi'an Jiaotong Univ.,
Xi'an, China

The 354th XSSC, with the purpose of providing a forum for the presentations and discussions of the latest advanced research in the field of "multi-hierarchical structures of nanodielectrics and their macro-properties", was held on 23-25 June 2009. It is the 354th in a series of Xiangshan Science Conference (XSSC). The XSSC was sponsored by the Ministry of Science and Technology of China (MOST) in 1993 and aims to promote the exchange of ideas on the frontiers of science field. The XSSC is named after its holding place - Xiang Shan, which is a famous scenic spot in the northwestern suburbs of Beijing. Such conference, as one of the most renowned scientific conferences in China, now shows a great impact on the science and technology and attracts more and more attentions from the international scientific world. Many reputed researchers have high evaluated the XSSC and appreciate its "free atmosphere", "multi-disciplinary environment" and "great contribution to innovations".

The commute of 354th XSSC

The 354th XSSC covers a broad range of nano-dielectrics and their applications, including 1) Size effect of low-dimensional nano-dielectrics and its applications in micro-electronic field; 2) Multi-scale effect on interfaces and hierarchic of nano-dielectrics; 3) Relationship between Micro-structures, macro-properties and energy storage performances of nano-dielectrics; 4) Spatio-temporal hierarchic on short-time breakdown to long-time damages evolution of nano-dielectrics. Following the tradition of XSSC, the 354th was presided over the committee which is composed by 5 reputed chairmen: Prof. LEI Qingquan from Harbin University of Science and Technology, Prof. LI Shengtao from Xi'an Jiaotong University, Prof. ZHU Jinsong from Nanjing University, Prof. NAN Cewen from Tsinghua University and Prof. ZHANG Yewen from Tongji University. Prof. LEI gave the keynote for the whole conference while other chairman gave invited talks to emphasize each respective theme.

Prof.LEI Qingquan in keynote

During the 3 days conference, over 40 researchers from 29 institutes participated in the discussion on specific topics. They come to an agreement on the current statue on application of nanodielectrics. Because of the great enhancement to the electrical properties, nano-dielectrics become a hot issue for applications. Aging can strongly affect the stability and reliability of nano-dielectrics and consequently manifests itself an important problem. Among various factors such as mechanical force, high temperature, electromagnetic field, radiation and chemical pollution et al, electromagnetic field is a key fact. To overcome the electromagnetic aging, we often apply compound nano-dielectrics. However the mechanism is still under study and becomes a big challenge to the whole field. Furthermore, they also proposed several constructive proposals. They suggested that we should start from the key national projects while follow the international frontier in nano-dielectric field; and we should involve the research on the multi- hierarchical nano-dielectrics into the crucial program on science and technology.

Group photo of 354th XSSC

The 354th XSSC enhance the communication on the frontiers of nanodielectrics and is sure to bring some inspirations leading to novel development for applications.

Appendix 1: Condensed schedule of 345th XSSC

Speakers	Department	Report Subject
Keynote report:		
LEI Qingquan	Harbin University of Science and Technology	The multi-hierarchical structures and movement of nano-dielectrics
Topic 1: Size effect of low-dimentional nano-dielectrics and its applications in micro-electronic field		
ZHU Jinsong	Nanjing University	Size effects of low-dimentional nano-dielectrics
WANG Chunlei	Shandong University	Simulation of small-scale ferroelectrics physical properties
ZHANG Wei	Fudan University	High-k and low-k materials in nano integrated circuit
LI Guorong	Shanghai Institute of Ceramics Chinese Academy of Sciences	Size effect of inorganic, organic and composite dielectrics
Topic 2: Multi-scale effect on interfaces and hierarchic of nano-dielectrics		
NAN Cewen	Tsinghua University	Multi-scale effects of nano-composite dielectrics
HAN Zhichao	Institute of Chemistry Chinese Academy of Sciences	Some physical and characterization aspects in the multi-Scale research of multi-Component, multi-phase polymers
LI Jiangyu	University of Washington, American	Electrostatic interaction and depolarization behaved in nano-dielectric super lattice
ZHU Jianguo	Sichuan University	Mechanism to enhance the dielectric properties of multi-layer nano-ferroelectric thin film.
Topic 3: Relationship between Micro-structures, macro-properties and energy storage performances of nano-dielectrics.		
ZHANG Yewen	Tongji University	The micro-structure and space charge behavior of dielectric.
ZHAO Hui	Heilongjiang University	How one-dimensional nanoelectrodes works in super-capacitor.
JIANG Yadong	University of Electronic Science and Technology of China	Relationship between ultrathin composite membrane structure, dielectric, piezoelectric properties of organic polymer.
T. Tanaka	Waseda University, Japan	Nanodielectrics: fundamental and applications.
Topic 4: Spatio-temporal hierarchic on short-time breakdown to long-time damages evolution of nano-dielectrics		
LI Shengtao	Xi'an Jiaotong University	Evolution from short-time breakdown to long-time damages of nano-dielectrics.
G. Chen	University of Southampton, UK	Space charge formation and conduction in nanodielectric materials.
SHI Jing	Wuhan University	Micro and mesoscopic characterization of electrical ageing on nano-dielectric.
LI Liang	Huazhong University of Science and Technology	Dielectric behavior of nano-dielectric materials at pulse high-intensity magnetic field.
Other 12 talks		

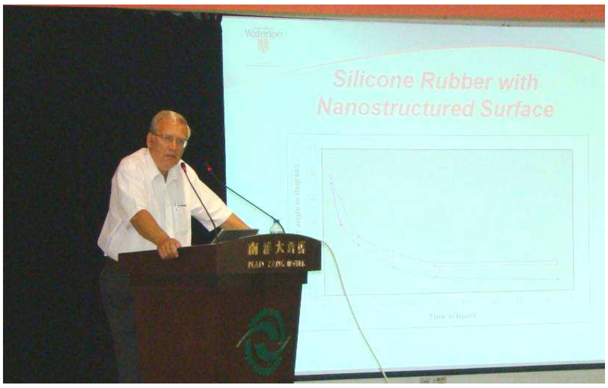
2009 Lecture Series for Graduate Students (LSGS 2009) in Xi’an

Lecture Series for Graduate Students (LSGS, 2009), host by State Key Laboratory of Electrical Insulation and Power Equipment of Xi'an Jiaotong University, was held from July 25th to August 1st at Xi'an, China. Such program is approved by the Ministry of Education and in a series of “Graduate Innovative Education Project” which is organized by the Graduate School of Xi'an Jiaotong University

LSGS 2009 focus on the "Technical Development in Power Equipments and Their Insulation" issues, which is a good extension of "Properties and Application of Dielectric Materials"; the theme of LSGS 2007.

The LSGS 2009 invites the several reputable specialists in industry from different countries, e.g. Japan, USA, France, Canada, England, Holland and et al. The 8-day meeting, containing 28 lectures (75mins/lecture), covers a broad range of the latest knowledge, advanced productions and new trends in the field of insulation research. Such lectures not only provide the graduate students an opportunity to explore a specific scientific concept in-depth but also make great contribution on education issues on innovation.

All the 167 participants, including 112 graduate students from different universities, 27 researchers from various institutes, 22 engineers from industry and 6 from other fields, highly evaluate the LSGS 2009 and believe that exchanging ideas with exports can give young students inspirations and consequently induct the novel innovations.



Prof. Edward Cherney from Canada

Dr. Leslie T Falkingham from England

Mr. Yukiyasu Shirasaka from Japan

Professor Shengtao Li
Deputy director of State Key Laboratory of Electrical Insulation and Power Equipment,
Xi'an Jiaotong University, China

Topic	Specialist	Country
User Concerns and Challenges for Improving Polymer Insulator Technology for Transmission Lines	Prof. Edward Cherney	Canada
Environmentally friendly insulation materials for Switchgear systems	Mr. Ian James	England
HV-AC Cable applications in a changing world	Mr. Willem Boone	Holland
High Voltage Switching Phenomena That Must Be Considered In GIS Application, Operation and Design	Dr. Susumu Nishiwaki	Japan
Vacuum Interrupters	Dr. L. T. Falkingham	England
Power Capacitor Technology contributing to the Power Quality and the Ecology	Dr. Muraoka Takashi	Japan
Insulation in Space Environment	Dr. Virginie Griseri	France
The Property of ZnO Elements Required from the Application to Various Surge Arresters	Mr. Toshiya Imai	Japan
Demonstration Tests of 500m Long HTS Power Transmission System with High Efficiency	Dr. Tatsuki Okamoto	Japan
Power Transformer, it History, Developments and Recent Technology	Mr. Y. Shirasaka	Japan
Insulation Technology and Development of Large-scale Apparatus	Mr. Pi Rugui	China
Technical Developments in Power Equipment and their Insulation	Prof. Edl Schamiloglu	USA
Device of Pulsed Power and High Power Microwaves and their Insulation	Prof. A.A.Neuber	USA

Korea Corner

High Power High Voltage Testing & Evaluation Division at KERI

Dr. Maeng-Hyun Kim
Executive Director
KERI, Korea

1. Introduction

Since its establishment in 1976, Korea Electrotechnology Research Institute (KERI) has been carrying out R&D on electrotechnology and testing and certification services on power apparatus as the non-profit independent research and testing institute.

Today, KERI has more than 550 scientists, engineers and technicians for its purpose and is ready to serve its clients at home and abroad. High Power High Voltage Testing & Evaluation Division presented here is one of its major activities which KERI is providing for both domestic and foreign manufacturers and utilities.

As an independent third-party organization for testing and certification accredited globally by SINCERT and IECEE as well as KOLAS and KAS, which have world authority, High power High voltage testing & Evaluation Division has pro-vided its customers worldwide with the testing, certification, inspection, and reliability assessment services for electrical apparatus and equipped with the most advanced testing facilities, and globally recognized for technical capabilities. Our service offerings are fully compliant with IEC, IEEE, JEC, and ANSI standards, and its covering products are: circuit-breakers, GIS and switchgears, switches and many types of fuses, transformers, surge arresters, insulators, bushings, power cables and accessories, secondary batteries and electric motors, and so on.

KERI main buildings

2. Activities of High Power High Voltage Testing & Evaluation Division

2.1 High Voltage Testing Department

- Type tests and acceptance tests for MV and HV electrical equipments
- Dielectric tests
- DC voltage tests
- Temperature rise tests
- MV and HV class power cable and accessories tests
- Surge arrester tests
- Environmental tests in artificial pollution testing building
- Motor and inverter tests
- Battery tests

2.2 High Power testing Department I

- Type tests and performance tests for MV and HV electrical equipments
- Short-time withstand current and peak withstand current tests
- Direct short-circuit tests on MV and HV electrical equipments
- Mainly active load switching tests
- Capacitive and inductive current switching tests
- Synthetic making and breaking tests on high voltage circuit-breakers
- Power arc tests on switchgear, arresters and insulators
- Short-circuit withstand tests on power transformers

2.3 Certification & Reliability Assessment Department

- Product certification services of electrical apparatus by SINCERT & KAS
- Research on the development of standard measuring system for the high voltage and high current measurement traceability, precision and accuracy
- Quality system audit services of electrical apparatus by Korean national standards
- Reliability assessment of electrical components

3. Testing Facilities and Capabilities

3.1 High power tests

- Direct short-circuit tests : 18 kV 110 kA/24 kV 50 kA/ 40.5 kV 31.5 kA
- Synthetic short-circuit tests : 550 kV 63 kA Full-pole

Short-circuit generator

- Load switching tests : 36 kV 1000 A, 362 kV 1000 A Full-pole
- Short-time withstand tests : 150 kA(3phase), 200 kA(1phase)
- Power arc tests : 18 kV 63 kA

Synthetic testing facilities

3.2 High voltage tests

- Lightning/Switching impulse voltage tests: 4200 kV/ 2400kV
- AC withstand voltage tests : 1100 kV 2 A
- PD tests : 1100 kV 60Hz, 30 KHz - 400 kHz
- RIV tests : 1100 kV 60Hz, 10 kHz - 30 MHz
- Temperature Rise tests : 3phase, 10,000 A
- Cable tests : 80 kV 3000 A, 9 Feeders
- Surge Arrester tests : 4×10us 200 kA, 8×20us 60 kA
- DC voltage tests : 400 kV 10 mA
- Electric motor and Inverter tests : 90 V - 720 V(LV), 800 – 7200 V(HV), 2 MW

Impulse and AC voltage testing facilities

Arrester testing facilities

4. Epilogue

KERI now owns a 4000 MVA short-circuit generator, 550KV 63 KA synthetic short-circuit current making and breaking testing facilities, 550 kV synthetic capacitive current testing facilities, 120 kA short-time current withstand testing facilities as well as 4.2 MV impulse voltage generator, 1100 kV AC voltage generator, 300 kV artificial pollution, 200 kA surge arrester, and power cable testing facilities.

Furthermore, KERI will carry out its responsibility and role as a globally reputable testing laboratory and certification body on the basis of an outstanding infrastructure, technical professionalism, and transparent and systematic operations.

KERI www.keri.re.kr

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India Corner

Central Power Research Institute, India – a Brief Profile

Mr. Suhas S. Bagalkotkar
Central Power Research Institute, India

Central Power Research Institute (CPRI), India was established in the year 1960 by Government of India. The mission of CPRI is

- to provide prompt services to manufacturers and utilities in quality assurance by Testing & Certifying the products delivered to power sector
- to provide assistance to power sector in improving efficiency and reliability in all spheres of activity
- to update and upgrade Technology to meet the growing needs of the power sector

The headquarters of CPRI is located at Bangalore. Laboratories catering to several specialized areas needed by the equipment manufacturers, power utilities and end users spread across the county are at Bangalore, Bhopal, Noida, Nagpur, Hyderabad, Kolkata and Guwahati.

CPRI has been serving the Indian Power sector as a national laboratory for undertaking applied research in electrical Power Engineering besides functioning as an independent National Testing and Certification Authority for electrical equipment and components. CPRI has facilities and expertise on par with other International Test Houses.

At CPRI, all test and measuring equipment are well maintained and calibrated. The facilities are recognized and accredited by national and international bodies. The details are as given below:

- Accreditation by NABL, the national body under Government of India accredits Test Houses for all engineering disciplines
- Member of Short Circuit Testing Liaison (STL) group
- Accreditation by INTERTEK-ASTA, UK which will facilitate Indian industry for export abroad
- Certification for ISO 9001 – 2000 by NVT-KEMA for Research & Consultancy activities
- Approval by Underwriters' Laboratories (UL) for testing of products to meet the requirements of Indian manufacturers for exporting equipment to North America
- Approval by Canadian Standards Association for testing products which is very essential for export of products to Canada.

TESTING ACTIVITIES AT CPRI:

CPRI has excellent facilities for Testing & Certification of:

- High Power Short Circuit tests
- High Voltage tests
- Seismic tests
- Transmission line and component tests
- Insulation
  Solid dielectrics – Cables, Insulating materials
  Liquid dielectrics – Transformer Oil
- Power Systems
- Material Technology
- Domestic appliances
- Tests on Energy meters & Relays

In addition to other important test facilities, CPRI has state of the art test facilities for power system insulation, cables, capacitors and liquid dielectric. They are:

A) High Voltage & Ultra High Voltage Test Facilities:

1. Impulse Voltage Generator of 3million volts, 150kJ and Power frequency cascade Transformers of 1200kV (2 nos of 600kV) at Bangalore to carry out Dielectric, RIV, Corona and allied tests on electrical power equipment & accessories up to and including 400kV, Pollution tests on insulators by salt fog/solid layer method upto 400kV AC & 150kV DC, Comprehensive test facility for testing of ZnO blocks up to 11kV

Figure 1: Impulse Voltage Generator, Bangalore

2. UHV Test facility at Hyderabad equipped with cascade Transformer comprising two units rated 800kV each (total rating 1600kV, 9600kVA) and Impulse Generator of 5MV and 500kJ to carry out High voltage testing of electrical equipment rated up to 1200kV and Pollution test on equipment rated up to 800 kV. The pollution test chamber is one of the largest in the world with a diameter of 24m and a height of 27m.

3. Cables & Capacitors Test facilities at Bangalore:
   - ❖ Facilities for Testing of Power Cables & Accessories up to and including 220 kV, Testing of Power Capacitors upto 3500kVAR, 16kV AC @ 50hz for routine and type tests and up to 1000kVAR, 9kV for Endurance test

Figure 2: Testing of 220kV Cable

   - ❖ Temperature rise test facility upto 10000/ 25000 amps, Flame Retardant Low Smoke Test facility and testing of insulating materials.
   - ❖ Facility for conducting diagnostic field testing and condition assessment of in service HV Power Equipment like Turbo Generators & associated electrical system, Hydro generators & associated electrical system, HV motors, Power Transformers & HV Bushings, Switchyard equipments like CTs, CVTs, PTs, Las, Power Cables.

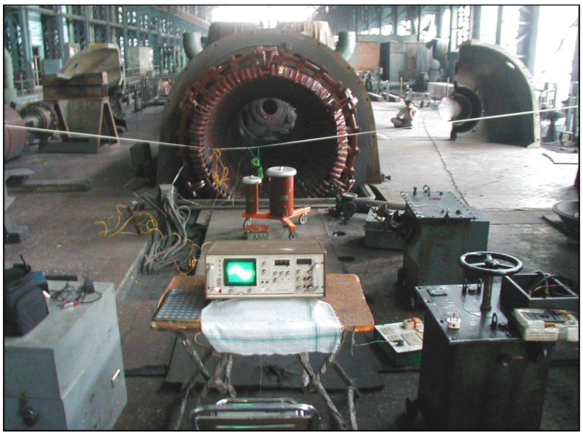

Figure 3: Diagnostic PD test on 110MW Turbo generator

4. Dielectric Materials Testing**:** Testing of new oils, service oils & furan as per IS 335, IS 1866 & IEC 61198 respectively. Testing of polymeric and lubricating samples.

RESEARCH ACTIVITIES AT CPRI

CPRI has been taking up R&D programs in various areas of electrical power generation, transmission and distribution in its endeavor to assist utilities to supply reliable and quality power to the consumers. The following are broad objectives with which the research projects are taken up in CPRI.

- o Offering technical advice and trouble shooting
- o Product development and improvement to meet global standards
- o Bridging the gap in testing and developing special testing technologies
- o Large collaborative research projects with utilities and industries
- o Electrical products and process improvement

Some of the projects have been undertaken in collaboration with industries & utilities, while others are taken up in-house to develop the expertise and infrastructure to serve the power sector. CPRI also coordinates the collaborative research funding of Ministry of Power, Government of India for projects with participation from the industry with quantifiable deliverables.

Over the years the Institute has successfully executed over 300 research projects. As fallout of the activity, over 450 Technical Reports have been brought out and in excess of 2200 Research Papers have been published in National and International fora. Over 50 Technologies have emerged out of which more than 30 have been commercialized on a non-exclusive basis. A few important and recently completed in house research projects deal with:

- ❖ Dynamic performance evaluation of Protective Relays using Real Time Power System Simulator
- ❖ Effect of corrosive sulphur on transformer components
- ❖ Dielectric Diagnosis of HV rotating machine insulation based on structural changes of the insulation due to ageing
- ❖ Electromagnetic method of stress assessment to benchmark structural soundness in turbine and other plant components
- ❖ Condition Assessment of Complex Geometry Power Plant Components by Ultrasonic Time of Flight Diffraction [TOFD] Technique
- ❖ Design and development of prototype unit for cleaning and working of vertically mounted disc insulator

A few of the ongoing projects which are funded under the collaborative research scheme are:

- o Development of Silt Erosion Resistant Material for Turbines of Hydro generators.

- National Effort to develop Technology for Custom Power Devices – Development of (a) 4 x 500 kVAr STATCOM for IT-Park, and 2.5 MVAr STATCOM for Steel Plant.
- Development of High Temperature Superconducting Transformers
- Development of a prototype of 132kV Optical Current Transformer for use in the 132kV system

RESEARCH ON COMPOSITE INSULATORS

CPRI has established expertise in the area of development and testing of composite insulators and have developed compound for silicone rubber insulator. Prototype of the first Indigenous composite insulator of 400 kV class has been developed under the ages of Department of scientific and industrial research for a manufacturer in Hyderabad, India. CPRI has recently carried out systematic long-term (1000 hour under salt fog) ageing studies on composite insulators with bio contamination deposit on its surface in the form of algae observed in cold countries especially on silicone rubber insulators. When fungi and other microorganisms colonize the surface of an insulator, they are suspected to impede the drying of the insulator surface and accelerate the insulator surface degradation by enzymes secreted by fungal contaminants. The study results are being analyzed to understand the process and to determine the effect on the insulator dielectric strength.

Figure 4: Virgin insulator (on the left) and two Insulators with bio contamination

DIELECTRIC TESTING OF UHV INSULATION

The Ultra high voltage laboratory at Hyderabad is an out door laboratory established more than 15 years ago with a vision that India shall have to adopt 1200 kV ac and ± 800 kV dc class transmission systems in future. This has materialized and Indian Utilities, in particular Power Grid Corporation of India, are in the process of establishing them. In this endeavor, CPRI is playing a key role by way of carrying out dielectric tests on insulator strings and substation equipment insulation.

The lab has so far tested a large number of 765 kV ac transmission system insulator strings of various configurations, circuit breaker, CVT, CT and bus post insulators for their required insulation levels.

800 kV dc transmission system class insulators have been tested for Lightning impulse withstand of 2250 kVp and switching impulse withstand of 1850 kVp.

The laboratory carried out an important study to optimize the conductor - tower air insulation clearance for adoption in Indian 1200 kV ac transmission line and corona studies to optimize the conductor configuration for 1200 kV transmission lines.

Figure 5: Testing under progress to optimize tower window clearance of 1200 kV ac line

Figure 6: Corona cage with bundle conductor strung inside.

ACKNOWLEDGEMENT

This article is prepared with inputs from Dr. R.S. Shivakumara Aradhya (aradya@cpri.in), Mr. B. Gunasekaran (guna@cprihyderabad.com) and Dr. N. Vasudev (vasu@cpri.in)

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TECHNOLOGIES FOR TOMORROW

Development of large-capacity, 3-phase, 500kV transformer that is disassembled for shipment and reassembled at the site

1. Introduction

In order to maintain the quality verified by testing at the factory, under ordinary circumstances, 500kV/1500MVA transformers utilized as substations are transported as a unit without dissembling the main tank. Taking into account restrictions on weight and size when transporting, the tank was separated into one section for each phase. A single phase, 2-leg parallel coil configuration was also employed. In recent years, however, bases for unloading railway freight cars have been reduced, and transportation of heavy freight has become difficult due to aging railway routes.

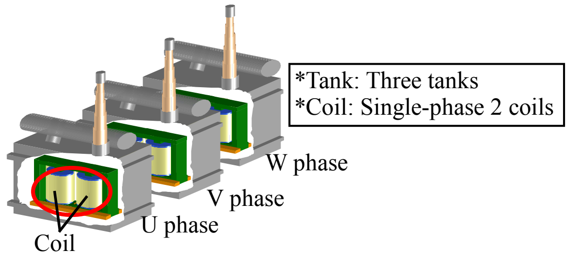
The method of dissembling transformers for shipment and reassembling them at the site (ASA: Advanced Site Assembly) was developed to reduce weight for transportation, and is already widely used. Tokyo Electric Power Company and Toshiba Corporation therefore jointly developed a 3-phase, all-in-one 500kV transformer employing this method by further enhancing their dust/humidity control technologies and technologies to disassemble and reassemble large coils/cores. The result will serve as the standard configuration of 500kV transformers of the future. Along with rationalizing temperature rise specifications and system back impedance specifications, new technologies were employed to enhance winding capacity and short circuit strength for the transformer. Measures were also devised to reduce weight of winding to reduce transportation weight for each transportation unit. Along with realizing 500MVA/leg for substation transformers -- the largest class leg capacity the world over -- the amount of materials used was dramatically reduced to realize a compact, environment-friendly transformer that offers lower loss.

2. Development concept

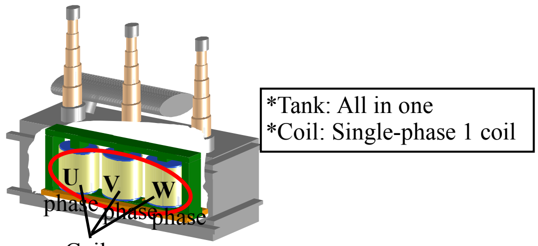
The following concepts were clearly promoted for development of the next-generation transformer for 500kV substations.

Development concept (1): Up to now, materials have accounted for approximately 50% of the initial cost of 500kV transformers. Taking into account the recent sharp rise in price of silicon sheet steel / copper wire and long term material procurement lead time, the target of development was 1 tank/3-phase, 1 coil/1-phase configuration designed to minimize the amount of materials used for the basic structure of transformers.

Development concept (2): Concerning transportation conditions, based on the fact that freight transportation has become more difficult, employing the method of dissembling transformers for shipment and reassembling them at the site has been a prerequisite for transportation by road. The target was also to reduce transportation weight to the 45-ton class so comparatively less expensive general purpose trailers for which road travel restrictions are relaxed could be used.



(a) Conventional transformer



(b) Newly developed transformer

Fig.1 500kV transformer configuration comparison

3. Applied technologies

Technologies applied to realize the previously mentioned development concepts are as follows:

(1) Enhanced winding capacity

The amount of heat generated within coils has increased approximately 1.7 times due the fact that capacity of coils has doubled in comparison with the existing type. Consequently, with the existing configuration, temperature tends to rise resulting in thermal degradation, and in turn, dramatically reducing life of the coil

Under ordinary circumstances, possible countermeasures against increase in current and calorific power are: (1) Increase thickness of the copper wire used in the coil proportionally to the increase in current to reduce current density, and (2) increase the amount of oil used to cool the coil. The former is not applicable because it increases the weight of the coil so a general purpose trailer cannot be used for transport. In the case of the latter, it is not preferable to increase the amount of oil in order to secure reliability in relation to the phenomenon of static electrification caused by friction produced by oil flowing between insulation (charge build-up due to static electrification increases proportional to 2 or 3 times the velocity of the oil flow).

The winding was therefore significantly improved by streamlining specifications and applying new technologies while holding down increase in oil flow and copper wire size as follows:

a) Development of coils that can be used at high temperatures

As the result of determining insulation and life characteristics of thermal upgraded paper, it was decided to use amine added insulation paper to wrap around the copper wire of coils because it resists thermal degradation and offers the required insulation performance while wrapping the copper wire. This raised the temperature rise limit of the coil 10K higher than the JEC standard value.

b) Suppression of heat generated from the coil

Continuous Transposed Cable (CTC) arranged from fine wire is used for the copper wire of the coil. Heat generation (eddy-current loss) caused by intersection of leakage flux is suppressed by minimizing the height and width of the wire (eddy-current loss ∝ the square of wire width).

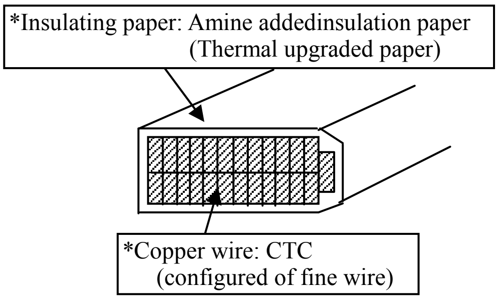


Fig. 2: Technologies applied to coils (copper wire / insulating paper)

c) Establishment of 3D magnetic field analysis technology

Because leakage flux produced from the coil increases as current per coil increases, heat generation and local overheating tend to occur when leakage flux intersects with the tank/core. Along with getting a detailed understanding of temperature of various parts utilizing 3D magnetic field analysis technology to effectively cope with increasing leakage flux, a new magnetic shield has been developed to effectively suppress local overheating.

(2) Improvement of mechanical strength

If leg capacity of the coil is doubled, magnetic mechanical force applied on the coil increases approximately 1.6 times that of a conventional coil, and coil deformation tends to occur. As was previously stated, in order to reduce weight, strength cannot be enhanced by using thicker copper wire. Mechanical strength has therefore been dramatically improved by utilizing the following technologies:

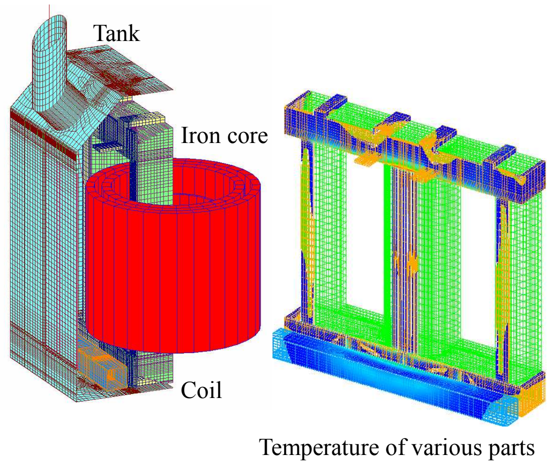


Fig. 3: Magnetic field analysis model and local overheating analysis examples

a) Formulation of dynamic analysis technologies for coil deformation

Mechanical strength of inside winding used to be evaluated by static evaluation of conductor buckling strength between two points of support (forced buckling), but analysis of dynamic free buckling thinking of the winding considering that a loop was conducted. Precision of winding strength evaluation was improved this time by conducting model tests and dynamic analysis of free buckling of winding to which the test results are applied. Based on this, system impedance that in the past could not be incorporated into evaluation of short circuit mechanical strength as the margin of analytical error was successfully added to the specifications.

b) Application of high strength wire

High strength wire with 20% improved strength processed by applying pressure to copper wire has been applied in some parts.

(3) Improvement/rationalization of ASA Transformers

A reliable method of dissembling transformers for shipment and reassembling them at the site (ASA) was established by designing jigs/tools to reduce weight for transport and developing dust/humidity control technologies for large transformers.

a) Development of jigs/tools to reduce transportation weight

It was also decided to switch from iron to aluminum tanks used for transporting coils in order to reduce weight. Combined with the previously mentioned coil weight reduction technologies, transportation weight was reduced to the 45-ton level.

Fig. 4: Coil transportation

b) Development of method of inserting coils that doesn't require opening the roof

Assembly at the site is conducted in a dust-proof house that offers the same humidity and dust control as the factory. The roof used to have to be opened to lower the coil into the core using a crane. Now the coil is inserted using a gantry crane and the roof no longer has to be opened. This avoids risk of quick changes in weather and time schedule delays due to bad weather.

Fig. 5: All-weather dust-proof house

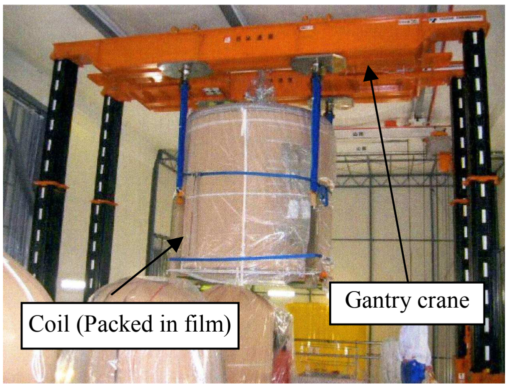


Fig. 6: Coil insertion by gantry crane

4. Results and future schedule

Along with enabling a dramatic reduction in cost compared with existing 500,000V transformers, the developments described herein have reduced the amount of copper wire used by approximately 50%, loss by approximately 20%, weight by approximately 35% and installation area by approximately 40%.

Since completion of construction in June 2008, operation has been going smoothly using the initial unit (1000MVA) at the Shintokorozawa Substation. Three 1500MVA transformers are scheduled to be employed at the Shinkoga Substation from 2010 to 2011. It is anticipated that in the future 500kV transformers will play a huge role as the standard for power system formation from the standpoints of cost and function.

Fig. 7: Shintokorozawa Substation No. 2 transformer

Table 1: Basic specifications of 500kV transformer

Item	Specs./structure
Overall structure	1 tank / 3-phase batch 1 coil / single-phase
Rated voltage	525kV/275kV/63kV
Rated capacity	1500MVA/1500MVA/450MVA
Short-circuit impedance	14% (primary/secondary)
Test voltage (primary)	LI: 1300kV, 1550kV AC: 475kV-635kV-475kV
Temperature rise limit	Max. oil temp: 60K Winding avg: 70K
Short-circuit current	63kA (Takes system impedance into account)
Transportation/ assembly method	Disassembled for transport, re-assembled at site Transport weight including trailer: About 45 tons or less

---

Takayuki Kobayashi, Ichiro Ohno (Tokyo Electric Power Company)
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The Largest Scale Dielectric Tests of 1100kV Gas Circuit Breaker

1. Introduction

UHV AC 1100kV transmission is an effective transmission technology for large-capacity, long-distance transmission. Development of 1100kV equipment began in the latter half of 1980's by Tokyo Electric Power Company (TEPCO) in Japan. TEPCO has been performing field verification tests of 1100kV equipment since 1996 at test substation [1-2]. In China, the AC 1100kV transmission tests were started from 2008. The dielectric type tests were carried out on 1100kV Gas Circuit Breaker (GCB) for China. The voltages of these tests were the world highest level. Moreover, there was a combined voltage test which applies the power-frequency voltage (AC voltage) to both terminals across the open switching device. This test item which was not in the test specification of 1100kV GCB for Japan was added. In this paper, the AC-AC combined voltage test method and result are reported.

2. Structure of 1100kV GCB

For the 1100kV GCB, the resistor insertion method was applied for both closing and opening operation to suppress the switching overvoltage level. Structure of 1100kV GCB is shown in Fig. 1-2. The 1100kV GCB consists of two main interrupters and two resistor interrupters with resistor units in parallel. Between switching device terminals of two main interrupters, grading capacitors are installed in parallel respectively in order to divide a voltage with two interrupters equally. As two interrupters are arranged symmetrically, there is no difference in structure found from the each connection terminal side of 1100kV GCB.

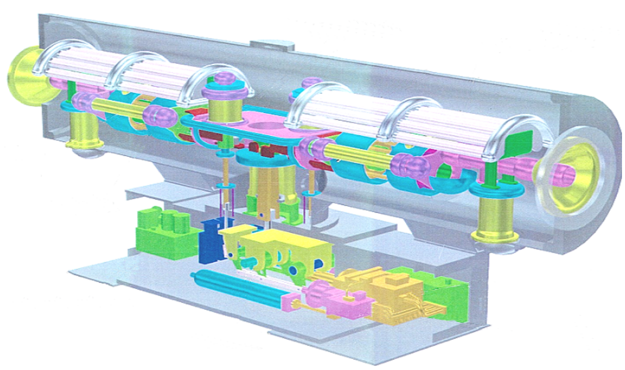

Fig. 1. Schematic diagram of 1100kV GCB

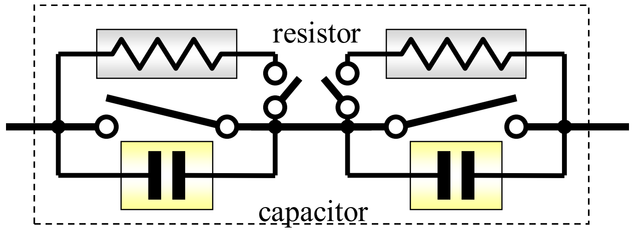

Fig. 2. Block diagram of 1100kV GCB

3 Test Method

In the dielectric type tests of 1100kV GCB for China, there was a combined voltage test which applies the power-frequency voltage (AC voltage) to both terminals across the open switching device for 1 minute. The AC-AC combined test voltages are 635kV$_{rms}$ for one terminal and 1100kV$_{rms}$ for the other terminal at reversed phase.

There are three difficult problems to perform the AC-AC combined voltage test at reversed phase.

1. Two AC voltage sources are needed for the AC-AC combined voltage test. But, generally a high-voltage testing laboratory has only one large scale of testing transformer in a testing room.
2. Since 1100kV GCB with two breaks has grading capacitors across terminals, a large current flows through the capacitors in the test circuit. One source voltage also influences on the other source voltage greatly due to the capacitors. For this reason, it is very difficult to control the applied voltages individually.
3. A large power supply is needed due to the current through the grading capacitors of 1100kV GCB.

These problems have been solved by the following methods.

1. A testing transformer of rated voltage 2300kV has already been installed in a testing room. Another testing transformer of rated voltage 900kV was transferred into the same testing room as the other AC voltage source. The AC-AC combined voltage test setup is shown in Fig. 3.
2. The AC-AC combined voltage test was able to be carried out with the following circuit composition. One AC voltage source circuit

was composed in which the current becomes the minimum as resonance circuit composition. The other AC voltage source circuit was composed in which the change of impedance becomes low. By optimizing the circuit composition, the mutual influences on each AC source voltage became very small, and each AC voltage control was made possible.

3. A generator in our high power laboratory was used for a power supply of both AC voltage sources to need large power.

Moreover, it was necessary to protect testing transformers from an overvoltage caused by flashover between terminals. In addition to the conventional protection device, the 1100kV disconnecting switches in which the resistors were installed were added as the newly protection devices. Before the dielectric test, the overvoltage generated when a flashover occurs between terminals was analyzed using Electro-Magnetic Transients Program (EMTP). By installing the protection devices, overvoltage at the flashover could be reduced to the voltage level below the dielectric withstand of the apparatus.

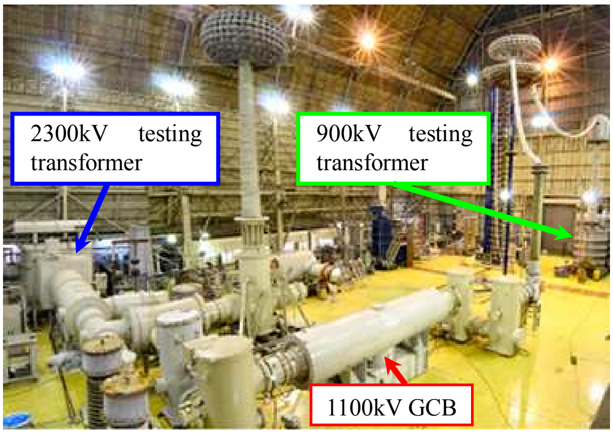

Fig. 3. AC-AC combined voltage test setup

4. Test Result

The dielectric tests were carried out by the method of applying the supply voltage of reverse phase to two sets of the testing transformers. The applied voltage ratio of two test circuits were fixed in the low voltage, and then power supply voltages were raised at the ratio. There was almost no influence on the phase shift by the resistor in protection devices.

The measured waveforms are shown in Fig. 4. An AC voltage of $1100kV_{rms}$ + $635kV_{rms}$ at reversed phase was applied across the terminals of 1100kV GCB for 1 minute. The phase difference between AC voltages applied across terminals was about 176 degrees.

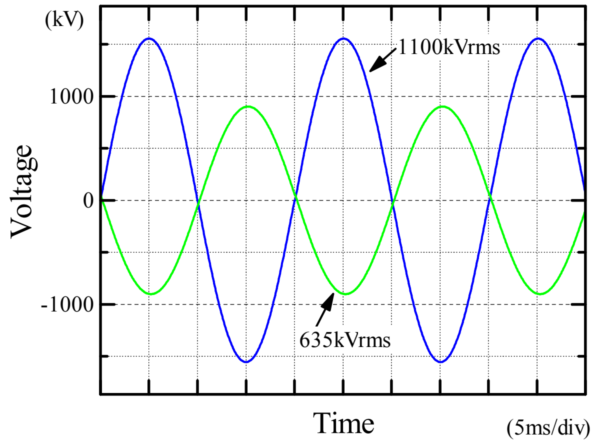

Fig. 4. Measured waveforms

5. Conclusion

The testing method of an AC-AC combined voltage test of 1100kV GCB has been developed and the dielectric performance of 1100kV GCB has been confirmed.

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[1] TOSHIBA Review, 1995 Vol.50 No.5

[2] Y. Yamagata, S. Okabe, "Utility's experience on design and testing for UHV equipment in Japan", Second International Symposium on Standards for Ultra High Voltage Transmission, January 2009, New Delhi

[3] IEC 62271: High-voltage switchgear and controlgear

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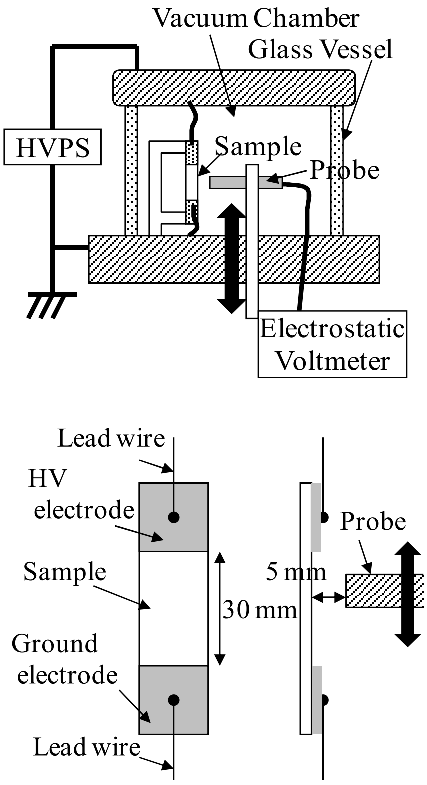
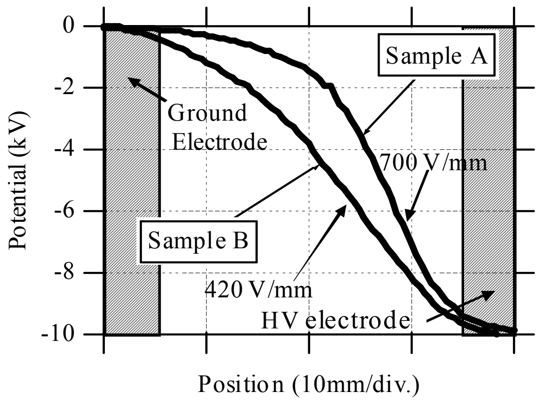
TECHNOLOGIES ALERT

Electrostatic Potential Distribution Measurement in Vacuum

Surface charging affects the surface breakdown on insulation materials in a vacuum. To investigate this effect, Hitachi, Ltd. developed an electrostatic potential distribution measurement system. The potential distribution is measured by an electrostatic voltmeter probe that is scanned along the sample surface in a vacuum without a contact between the sample and the probe. This system was used to measure the potential distributions of two test samples (Sample A and B) and to investigate the correlation between the roughness of the insulation material and the surface charge. Sample A was borosilicate glass with a flat surface, and Sample B was sandblasted borosilicate glass. The measured potential distribution profile of Sample A had an area with a high electric field near the HV electrode, and the maximum field was 700 V/mm. On the other hand, the profile of Sample B was close to linear, and the maximum electric field was 420 V/mm. The roughness of the surface can reduce the amount of surface charging. The effect of changing the roughness of the surface and the results of the discharge tests will be clarified.



Schematic diagram of electrostatic potential distribution measurement system and overview of samples



Electric potential distributions of Sample A and B

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MISCELLANEOUS

Photos on Front and Rear Covers

Front Cover

10MVA/20MJ SMES (Superconducting Magnetic Energy Storage)
– Field test of the SMES for load fluctuation compensation –

SMES of the10,000kW for the power control in power system has been manufactured, and connected to a real power grid. In addition, innovative basic researches, for example, low cost converter, maintenance-free cryo-coolers, inter-locks system and so on, have also been developed. The SMES was installed in the metal rolling factory with hydro power plant. Field test has been carried out for load fluctuation compensation. SMES was able to compensate for the active power according to the fluctuating load, and confirm the situation with a smooth load change of 11kV bus of hydro power stations.

Field test of 10MVA/20MJ SMES for load fluctuation compensation had been carried out successfully and following items were confirmed.

Figure 1 shows Superconducting Coil Cryostat of the SMES.

(1) Active Power Control
It was confirmed that the fluctuation load was reduced due to the input/output of SMES active power at the connection point with the 11kV medium voltage network.

(2) Reactive Power Control
It was confirmed that the reactive power control of the generators was reduced due to the input/output of SMES reactive power.
It was also confirmed that the field current and the field voltage of the generators were lowered.

(3) Number of Operations for Load Fluctuation Compensation
It was confirmed that over 50,000 operations were executed.

(4) The perfection level and reliability of the system were confirmed through protected operation, control, and normal operation.

(5) Verification of High-Speed Response
Confirmed high-speed following capability up to several Hz. Step responses for active power and reactive power was less than 20ms. Regarding the status of the amplitude ratio and phase differences of the frequency response, high-speed following capability up to several Hz was confirmed.

In the future, it will be necessary to develop improved technologies that can contribute to power system control by establishing the optimal integration of the SMES system with existing power sources, dispersed power sources, which are expected to become more common, and wind power plants. In addition, it will also be important to improve the related technologies in order to reduce SMES costs by developing coils using next-generation wires, and to promote the verification of high reliability necessary for power equipment.

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Rear Cover

SEM Photos and Space Charge Distributions before and after Electrochemical Migration Growth in a Printed Wiring Board

Electrochemical migration is a kind of electrochemical phenomenon, in which conductor materials are ionized and migrated to and through the insulation layer by electric field. Nowadays, insulating materials for printed wiring boards (PWBs) must have even higher resistance to electrochemical migration in order to maintain long-lasting high reliability. Therefore, to study characteristics of migration, a reliable nondestructive method to detect its growth in the thickness direction is required.

A paper/phenol-resin composite PWB was set between a copper anode and an aluminum earthed cathode at 85 °C and 85 %RH, and a dc electric field of 3 kV/mm was applied for 98 hours to induce electrochemical migration. Upper and middle four figures show surface and cross sectional microscopic images observed for a PWB before and after the migration experiment. Growth of electrochemical migration with a length more than 1 mm along the surface direction from an anode edge is clearly shown in the two left optical microscopy images. Furthermore, penetration of migration through the adhesive layer and its extension into the bulk is clearly seen in the right scanning electron microscopy (SEM) images, which are superposed by energy-dispersive spectroscopic images showing the presence of Cu atoms by red dots.

The lower figure shows space charge distributions obtained by the pulsed electroacoustic (PEA) method for the PWB before and after the aging. Note that repetitive oscillatory signals appearing in the paper/resin composite are caused by eight-layered lamination of prepreg. Before the aging, a large amount of negative charge is observed on the interface between the composite and adhesive layer. After the aging, the negative charge disappears and positive charge appears, indicating that migration penetrates the adhesive layer. To conclude, these figures clearly demonstrate that growth of electrochemical migration along the thickness direction in the paper/resin composite PWB can be detected by the PEA method.

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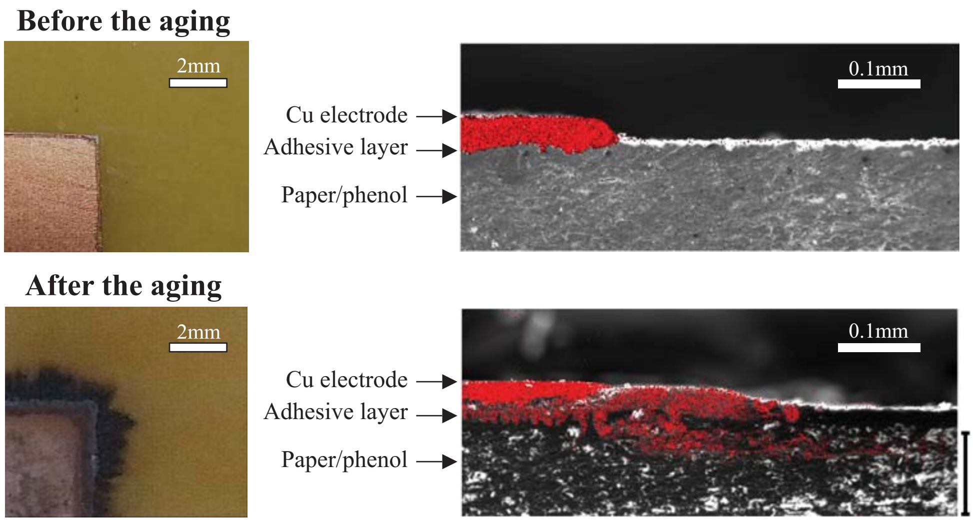

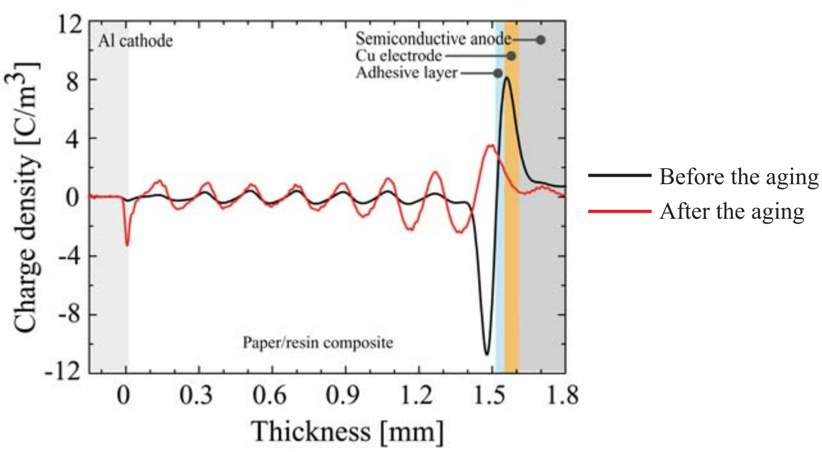

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