Electrical Insulation News in Asia

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IEEJ

CONTENTS

MISCELLANEOUS

PREFACE

Prof. Y. Suzuoki

A Message from Nagoya

I am with Nagoya University. As the name indicates, it is in the city of Nagoya. The area around Nagoya has been known as a center for manufacturing industry. Some of you may remember the 7th ICPADM banquet attraction in which they showed wooden mechanical marionettes created some 230 years ago. The traditions have been carried on and developed by many Nagoya based manufacturing companies as symbolized by Toyota, NGK and so on.

During the last decade, Japanese economy has suffered recession. The economical situation here, however, has been less bad. This is because the regional economy has been powered by the sound manufacturing companies. Furthermore, we had two big projects in this area, i.e. the construction of Central Japan International Airport (*Centrair*) and 2005 World Exposition, Aichi, Japan. *Centrair* was constructed on an artificial island and was opened in February, 2005. *Centrair* places emphasis on cargo flights for manufacturing companies in the area and has made a good start. 2005 World Exposition, Aichi, started on March 25, 2005 and ended on September 25. More than 120 countries including 28 from Asia participated in the exposition and it attracted more than 22,000,000 people, which is far beyond prior expectation.

The main theme of the exposition was "Nature's Wisdom". This, of course, is not directly related to electrical insulation but an important experiment on electric power supply was carried out by NEDO (New Energy and Industrial Technology Development Organization). In order to contribute to the wider implementation of new types of environmentally benign energy sources such as photovoltaic, wind and fuel cell and other distributed generators, it is important to compensate fluctuating outputs and minimize the impact on the external grid line by forming a local micro gird. At the expo site, three types of solar cells (total 330 kW), three types of fuel cells (PAFC, MCFC, SOFC, total 1,340 kW) and NaS battery (500 kW) were installed to form a micro grid. Fuel gases made from garbage, wood chips and plastic wastes collected in the expo site were supplied to the MCFC. On demand projection, temporal change in PV output and demand fluctuation, the outputs of the fuel cells and NaS battery were controlled to meet the electricity and cooling demands of Japan Pavilion and NEDO Pavilion without making detrimental impact on the external grid line. The new energy micro grid experiment at the expo site was successfully over as the exposition came to an end on September 25. The system will be moved to the *Centrair* area and the experiment will be continued by supplying energy to a neighboring city hall and so on. I believe the project is important and interesting from the viewpoints of future energy supply system as well as town planning. Furthermore, I hope this kind of experiment may in future bring up new aspects of electrical insulation, diagnosis, asset management and so on.

Now the two big projects are over and some people fear a decline of the activity in Nagoya area. Some economists foresee that this area will not remain only as a center of manufacturing but will become an international center of information exchange and dissemination in the field of economy and manufacturing. They say gradual change is going on and Nagoya is attracting some corporate headquarters, as sophisticated manufacturing requires close contact and cooperation between a corporate headquarter and a manufacturing site. As a member of Nagoya University, I hope the information exchange among Asian colleagues and partners become active also in the academic and engineering field. We believe EINA magazine plays an important role in establishing close communication in the field of electrical insulation technology. I feel great respect for those who have started and supported EINA magazines.

Lastly, I introduce our research field and activities on which we would like to exchange information. We have extended research field from the traditional electrical insulation field to environmentally benign energy systems. Our present research subjects are as follows.

(1) Assessment and development of efficient and environmentally benign energy systems
(i) New distribution system for large scale introduction of distributed generators
(ii) New urban energy system for sustainable society
(iii) effective use of distributed renewable energy (PV, biomass, etc.)
(iv) effective use of electricity and heat for home cogeneration system

(2) Improvement of performance and reliability of electric power apparatuses and systems
(i) mechanisms of electrical and water treeing degradation
(ii) space charge characteristics of insulating materials
(iii) degradation diagnosis and life cycle management of power apparatuses

Dr. Yasuo Suzuoki

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OUTLINE OF TECHNICAL COMMITTEES IN IEEJ

Dielectrics and Electrical Insulation (DEI)

Chairperson:	T. Okamoto (CRIEPI)
Secretaries:	K. Uchida (Chubu Electric Power Co. Ltd)
	Y.Tanaka (Musashi Institute of Technology)
Assistant Secretaries:	M. Okashita (Showa Electric Wire and Cable)
	H. Nishikawa (Shibaura Institute of Technology)

This Technical Committee (TC-DEI) was set up in 1979 succeeding the Permanent Committee on Electrical Insulating Materials upon the reorganization of IEEJ. The activities of the Committee have been covering mainly solid and composite dielectric materials and their technologies. The primary activity of TC-DEI is the annual Symposium of Electrical and Electronic Insulating Materials and Applications in Systems (SEEIMAS), formerly called Symposium on Electrical Insulating Materials (SEIM). The TC-DEI organized 36th Symposium (2004 SEEIMAS) at Shibaura Institute of Technology, Tokyo with General Chair of Dr. T.Okamoto. The participants were about 100 and 70 papers were submitted. TC-DEI held 2005 International Symposium on Electrical Insulating Materials (ISEIM) in Kitakyu-syu-shi, Japan with Honorary Chair of Prof. T.Tanaka and General Chair of Dr. T.Okamoto. The conference was successfully held with the participants about 140 from about 20 countries and with Prof. T. Mizutani and Prof. C. Laurent as special invited speakers as well as other in-session invited speakers. The new trend of the conference was to introduce sset Management Session especially for researchers of high voltage related issues, Space Charge Session including space craft issues, Nanotechnology for Dielectric Session, and Dielectrics for Telecommunication Session for frontier researchers. International Technical Exchange Session was chaired by Prof. T.Tanaka. The TC-DEI currently runs ten Investigation Committees (IC's) that organize several technical meetings a year. The IC's are categorized into four research areas as shown in Table 1 in order to meet the needs of DEI technology in Japan. Recently one of the secretaries of TC-DEI was changed from Dr. Y.Miyashita of Mitsubish Cable Company to Dr. Y.Tanaka of Musashi Insititute of_Technology.

Table 1 Recent Investigation Committees under TC-DEI

[Macro-positioning of DEI technology]

- ●Environment-friendly materials and systems for electric and electronics application (04/04-03/07, Chairman: Y.Suzuoki (Nagoya University))
- ●Economical evaluation of insulation diagnosis (04/04-03/07, Chairman: N.Hozumi (Toyohashi University of Technology))

[New materials including nano-materials]

- ●Application and improvement of organic molecular films and organic/inorganic composites with controlled nano-structures (04/04-03/07、Chairman: F.Kaneko (Niigata University))
- ●Dielectric and insulating materials for information communication (01/04-12/06, Chairman: K.Fukunaga (National Institute of Information and communication Technology))
- ●Development of organic electrical and electronic materials with flexible structure to nanotechnology (07/03-06/06, Chairman: M.Iwamaoto (Tokyo Institute of Technology))
- ● Interfacial phenomena and application of nano-composite dielectric materials (10/05-09/08, Chairman: T.Tanaka (Waseda University)):to be established

[Diagnosis of electric and electronic equipment]

- ●On-line insulation diagnostic methods of power cable and apparatus (01/03-12/05, Chairman: K. Uchida (Chubu Electric Power Company))
- ●Characterization and prevention of ion-migration in printed circuit boards (05/05-04/06, Chairman: Y.Yamano (Chiba University))

[Basic dielectric and breakdown phenomena]

- ●Charge behavior and interface of high electric field insulation (07/02-06/05, Chairman: M. Nagao (Toyohashi University of Technology))
- ● Surface functions and longterm performance evaluation of outdoor polymer insulators (01/06-12/08, Chairman: H. Homma (CRIEPI)):to be established

Electrical Discharges (ED)

Chairperson:	M.Yumoto (Musashi Institute of Technology)
Secretaries:	M.Hikita (Kyushu Institute of Technology)
	T.Nakano (National Defense Academy)
Assistant Secretaries:	F.Tochikubo (Tokyo Metropolitan University)
	H.Yasui (Toshiba Corporation)

The activities of the Technical Committee on Electrical Discharges (TC-ED) have been covering mainly physics of electrical discharges in various media including vacuum and their technologies.

Now, 4 investigation committees are organized in the TC-ED and are running actively for survey of the subjects listed in Table 1. Two committees will be organized in January, 2006. One is the committee on the field of plasma application for the environmental purification technology and the other is the committee on the data-base of the interactions between photon (especially VUV) or electron and atoms/molecules.

The report of the investigation committee is normally published as the technical report of IEEJ. 3 technical reports which are the field of long gap discharges including lightning, the field of plasma processing and the data-base will be published in 2006 from the TC-ED.

The TC-ED is supporting about ten domestic technical meetings on electrical discharges every year. Some of these meetings are cooperated with the TCs on Dielectrics and Electrical Insulation, on High Voltage Engineering, on Switching and Protecting Engineering and on Frontier Technology and Engineering. The poster session has been held to encourage the young researchers linked with the technical meetings once a year during the past 4 years. More than 20 papers are presented and some senior members also join the session, and many fruitful discussions are carried out every year.

The TC-ED also organizes the international conference. "Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering" will be held at Hanyang University in Korea on November 3 and 4, 2005.

ISDEIV (International Symposium on Discharges and Electrical Insulation in Vacuum) will be held at Matsue Terrsa, a conference hall on Matsue city, Shimane prefecture, from September 25 to 29, 2006. The details of the ISDEIV is reported elsewhere of this magazine.

ACED (Asian Conference on Electrical Discharges) will be held at Hokkaido University from October 16 to 19, 2006.

The TC-ED also promotes the young researchers 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. In usual, around 40 young researchers and engineers enroll in the seminar and have a time to discuss about topics related to electrical discharges. The seminar will be held at Takarazuka in Hyogo on November 4 and 5, 2005.

Table 1 Investigation Committees in TE-ED

Research Subject	Chairperson
Lightning strokes to structures (3years from January 2003)	T.Shindo (CRIEPI)
Fundamental Characteristics of Arc and Glow Discharges (3years from June 2003)	Y.Yokomizu (Nagoya University)
Measurement and Simulation Technologies used for Controlling and Understanding Discharges in Vacuum (3years from June 2004)	O.Yamamoto (Kyoto University)
The Ultimate Measuring Techniques for Discharge Phenomena in Dielectric Liquids (3years from June 2004)	N.Yamashita (Keio University)

Plasma Science and Technology (PST)

Chairperson: S. Ono (Musashi Institute of Technology)
Vice Chairperson: K. Yukimura (Doshisya University)
Scientific Secretary: Y. Ono (University of Tokyo)
T. Ikehata (Ibaraki University)

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. For example since April 2005, four technical meeting were held; in June at National Institute of Fusion Science in Toki City followed by a study tour to the Large Helical Device (LHD) for fusion research, in August at University of Tokyo, in September at Waseda University in Tokyo and also in October at Hyogo Prefecture University. At each symposium, about 20 to 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 symposium on plasma technology) had been held in Taiwan in collaboration with domestic societies related to plasma science and technology since 1999. Next APSPT is preparing now and will held December 2005 in Yunlin Taiwan. Aiming at more flexible management, APSPT-4 became sponsorship by the international organization committee from this time. While many members of TC-PST participate in the international organization committee, TC-PST is continuing playing a role important as a support organization.

TC-PST currently runs one investigation committee, and a few new will be set up in future. The investigating committees, Plasma ion intensive use process investigation committee and Microwave plasma investigation committee, which broke up within the past several years, had published their investigation as hard cover books.

Table1. Investigation Committee in TC-PST

Title	Chairperson	Term
Spherical tokamak	Y. Nagayama (National Institute of Fusion Science)	3 years from August 2004
The advancement of metal sputtering plasma	K. Nakamura (Chubu University)	to be established in October 2005

Pulsed Electromagnetic Energy (PEE)

Chair Person: Kazuhiko Horioka (Tokyo Institute of Technology)
Vice Chair Person: Weihua Jiang (Nagaoka University of Technology)
Secretary: Koichi Takagi (Iwate University)
Assistant Secretary: Hiroyuki Shinkai (Central Research Institute of Electric Power Industry)

The Technical Committee on Pulsed Electromagnetic Energy (TC-PEE) was set up in July 1999 by the exertion of Dr. Kiyoshi Yatsui (Nagaoka University) and efforts to enhance the activities in this field have been continued. During this intervening period, researches on pulsed electromagnetic energy have evolved into a well-developed subject in the field of electric

power engineering, plasma and discharge engineering, high energy density physics, accelerator engineering and others. By the modification of pulsed electromagnetic energy, we can make extremely high energy density (high temperature and/or high density) states that can be utilized for generations of high power lasers, intense radiation sources, high current particle beams and also for formation of new materials. As the field of high energy density plasma has a multi-disciplinary nature, extensive discussions of related subjects were difficult in conventional societies.

The purpose of this committee is to provide a forum to discuss important technical developments, their applications, increased understandings, new trends, and also future prospects in the field of pulse power technology and the high energy density states. In particular, keeping this field attractive for young scientists and motivating them have been of primary concern for all of committee members.

Regularly, Technical Committee Meetings are held four times a year. To provide international forum and promote international collaborations, the meeting is held once a year, as an international symposium with collaboration among the researchers in Japan, Korea, and China, which is named "International Symposium on Pulsed Power and Plasma Applications (ISPP)". The 5th ISPP-2004 was held in KERI (Korea Electromagnetic Research Institute) on Oct.18-19 (2004), and the next symposium (ISPP-2006) is expected to be in China. The objective of this symposium is to provide a forum for discussion of the subjects in the field of pulsed electromagnetic energy, mainly in the three countries. However, those research meetings including regular technical meetings, are open for persons whoever interested in the field of pulsed electromagnetic energy.

There is one investigation committee in the TC-PEE ; "Industrial Application of Pulse Power Technology", which is chaired by Weihua Jiang (Nagaoka University of Technology). In addition to the conventional pulsed power technology, highly repetitive devices are developing based on the recently advanced semiconductor switching devices and power modulators. Those devices should open wider application fields such as materials, environmental, biochemical and/or medical sciences and technologies.

Electromagnetic Compatibility (EMC)

Chairperson: Z-I. .Kawasaki (Osaka University)
Secretaries: Y. Mizuno (Nagoya Institute of Technology)
T. Funaki (Kyoto University)

The Technical Committee on Electromagnetic Compatibility (EMC) behaves to achive their own final goals. Those are

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 this purpose the committee pays their attention on 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 Lightning Risk and Management for Electrical Power System and Communication System
2. Investigation Committee on Electric Field and Current Induced in a Human Body Exposed to Electromagnetic Fields.
3. Investigation Committee on Earthquake Prediction by Electromagnetic Filed Measurement.
4. Investigation Committee on High Speed Power Line Communication and EMC

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 "White Paper" named the Report of Investigation Committee.

Electromagnetic environment is the atmosphere in which electromagnetic phenomena exist, and consists of 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. Electromagnetic compatibility (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 Prof. T. Takuma, Prof. O. Fujiwara chaired the committee from 2002, and Prof. Z-I. Kawasaki has succeeded Fujiwara since April, 2005.

The committee organizes technical conferences annually as the Memory of Kobe Earthquake, which occurred on January 17. 1995. The committee holds a few technical conferences, additionally, and those are in March, July, September and November for 2005.

1. Investigation Committee on Lightning Risk Management for Electrical Power System and Communication System

This committee has started its activity in July 2003. Prof. Zen Kawasaki of Osaka University is chairing this committee. The Objectives of the committee activity are followings

1. Risk management for the metal communication network against lightning hazards,
2. Risk management for the optical communication network against lightning hazards,
3. Risk management for the local area (LAN) network against lightning hazards,
4. Risk management for the radio LAN network against lighting hazards
5. Risk management for high power line network against lightning hazards,
6. Risk management for LSI circuit against lightning hazards,
7. Risk management for power electronics facilities against lightning hazards,
8. Risk management for future sensor network against lightning hazards

2. Investigation Committee on Electric Field and Current Induced in a Human Body Exposed to Electromagnetic Fields

This committee was established in April 2003. The mission of the Committee is to investigate various techniques for calculating induced electric field and current, and also survey the already reported calculation results. EMF issues are generally divided as to frequencies into the following categories; power frequency of 50 or 60 Hz for commercial power use, high frequencies near 1 GHz for cellular phones, and intermediate frequencies for various apparatus such as IH (induction heating) appliances. Although various numerical techniques such as FEM, FDTD, BEM, and so force, are available, it is still unclear what kinds of calculation techniques are most appropriate for a specified problem. The complicated human tissue properties also increase the difficulty in this issue. The following subjects are the items of investigation in this committee:

(1) Survey of techniques of calculating induced electric field and current in a part of a human body or a whole body;
(2) Comparison of the calculation techniques concerning calculation accuracy, time and so force;
(3) Evaluation of the calculated results;
(4) Survey of research subjects hereafter;
(5) Preparation of a committee report on the above items.

The committee has held 3 meetings and a research conference last year.

3. Investigation Committee on Earthquake Prediction by Electromagnetic Filed Measurement

This committee has just been established in Sep-

tember 2004. It is chaired by Emeritus Prof. K. Horii of Nagoya University. This committee was located as the succeeding committee for the former "Investigation Committee on Pre-occurrence Phenomena of Earthquakes by the Observation of Environmental Electric Field." According to the previous report, there is large variety of the electromagnetic phenomena related to earthquakes, and a long term universal measurement and research is inevitable to clarify the phenomena. This committee therefore enforced the research activity furthermore and especially focused on the following four subjects:

(1) Analyze various measurement techniques and measurement errors;
(2) Make an inter-comparison and evaluation for measurement results
(3) Analyze the relationship between measured data and earthquakes
(4) Discuss the possibility of establishing a earthquake prediction system

The committee focuses on establishing a highly reliable measurement technology with synthesizing many research results of antecedent electromagnetic phenomena of earthquakes. Periodically research conference is also planned.

4. Investigation Committee on High Speed Power Line Communication and EMC

This committee will be established in December 2004 and chaired by Prof. M. Tokuda of Musashi Institute of Technology. The purpose of the committee is to solve various EMC related problems towards the establishment of power line communication systems. The development of power line communication apparatus are going ahead, while there is a lack of study in depth from a theoretical viewpoint. This committee therefore will promote the researches from an academic viewpoint. It will focus on the following 6 subjects:

(1) The trend of power line communications in domestic and abroad;
(2) The trend of international standardization;
(3) System configuration method.
(4) Origination mechanism of electromagnetic field leakages;
(5) Suppression technology of electromagnetic field leakages;
(6) Current conditions of demonstrative experiments

Light Application and Visual Science (LAV)

Chairperson: Shinichi Takahashi (Keio University)
Secretaries: Yukitaka Shinoda (Nihon University)
Hisashi Honda (Toshiba Lighting & Technology Corporation)

Activities of The technical committee on light application and visual science (TC-LAV) have been covering fields of optical application for medical treatment, media devices for information processing of visual sense, light sources and their measurement, application of infrared light, and advanced lithography.

Miniaturization of semiconductor devices has been progressed very vigorously in these 30 years, and the trend will be continued further more, even though the minimum feature size has been reduced to less than 100 nm. Half pitches of 65 nm and 45 nm are expected in 2007 and 2010, respectively in International Technology Roadmap for Semiconductors (ITRS). In these trends, technology motive force for miniaturization is the improvements in lithography process.

Minimum pattern size obtained by lithography is mainly decided by the resolution of projection optics used for the exposure, and the resolution R depends on the wavelength λ and the numerical aperture NA of the optics. That is,

$$R=k_1\lambda/NA. \quad (1)$$

Here, k_1 is the constant showing the efforts to enhance the resolution by adopting super resolution technology such as phase shifting mask, modified illumination, novel resist process, etc. The value of k_1 is always 0.5-0.7. However, it becomes 0.25-0.4 if every possible resolution enhancement technology was applied.

Several years ago, it was strongly felt apprehensive for the end of the optical projection exposure, because all these parameters of λ, NA and k_1 were anticipated to arrive at each limit. For this reason, various next generation lithography (NGL) methods have been intensively researched. Representative methods are electron beam (EB) projection lithography, EB proximity lithography, F_2 projection lithography using F_2 laser, reflection

projection lithography using extreme ultra violet (EUV) light, second generation X-ray proximity lithography, etc. Although a lot of candidates were investigated, there were some problems in each method, and the favorite considered as the post-193 nm projection lithography using ArF excimer laser light was not fixed.

However, in 2001-2002, immersion optical lithography was suggested and advocated as a new NGL candidate. At first, there felt some problems concerning an immersion liquid, rising of bubbles, optics design, etc. However, the feasibility has been investigated in these 2 or 3 years, and it has been confirmed that there are no show stoppers. Thus, ArF immersion lithography in water is becoming to the certain favorite of NGL. It is expected that the resolution is improved in 1/1.44 depending on the refractive index of water.

Other NGL candidates were also considerably selected. EUV lithography was fixed to the most favorite method for the post-immersion lithography. It has become a general opinion that generations of half-pitch 65-45 nm will be realized by immersion lithography and generations of half-pitch 45-32 nm will be supported by EUV lithography.(Investigation Committee (TC): Advanced Technology for Lithography)

In the field of discharge light sources research on mercury-free fluorescent lamps has been one of the important and popular topics in these 10 years. For a long time Xenon and mixture of Xenon and other rare-gases had been thought the most expected discharge medium for a mercury-free fluorescent lamp. However none of the researchers achieved the enough luminance and efficacy with a discharge of xenon or xenon and rare-gases mixture.

Recently Jinno's group has reported by using an auxiliary external electrode for xenon pulsed discharge lamp, 90 lm/W of efficacy and 12,000 cd/m^2 of luminance simultaneously. This technology is leading the world and is attracting many light source researchers' interests. Other direction of development is flat-panel fluorescent lamps. Mikoshiba's group developed mercury-free xenon discharge flat-lamp.

Another trend of mercury-free light sources is Molecular Discharge (MOLED). Various efforts are now made and some new idea is reported. Devonshire's group reported near UV emission from OH and CN. Hatta's group reported CO emission in VUV region. Jinno's group reported N_2 emission in near UV region by using A-N_2 penning like energy transfer.

In the field of high-pressure discharge, EU countries are now promoting a project named COST21 and the lighting branch is focusing on development of new generation metal halide lamp.

In Japan, Kase and Sawa reported rupture mechanism of high-pressure mercury discharge lamp by using numerical simulation. The research on mechanical issues in high pressure discharge lamp was new frontier and they are the pioneer in this field.(TC: Diagnostics and Modeling of New Light Sources)

Next topics are Fukushi robot and Seal robot for disabled persons. The seal robot Paro was developed by T.Shibata's group at the National Institute of Advanced Science and Technology (AIST) to physically interact with human beings. Paro's appearance is that of a baby harp seal, which has white fur for three weeks after birth. As for perception, Paro has four primary sensors; sight (light sensor for vision), tactile, auditor (determination of sound source direction and speech recognition) , and posture sensors beneath its soft white artificial fur. In order that Paro should have a soft body, an air-bag-type tactile sensor was developed and implemented. To provide movement, the robot has eight actuators; two for upper and lower eyelids, one for rotation of eyes, two for the neck, one for each front fin, and one for two rear fins. Paro weighs about 2.8 Kg.

Paro operates by using the three elements of its internal states, sensory information from its sensors, and its own diurnal rhythm(morning., daytime and night) to carry out various activities during its interaction with people. Paro has a behavior-generation system consisting of two hierarchical layers of processes: proactive and reactive. These two layers generate three types of behavior: proactive, reactive, and physiological behaviors.

As a second topic, we introduce Fukushi robot to aid feeding is based on new concept such as Taoism, and the results of setting up a system for the remote control of the robot. The real time OS used is RT-Linux, which is still in the development stage, and, therefore this involves some problems even more difficult to overcome than algorithm design, including the necessary of carrying out trial and error to test version compatibility with other equipment etc., when the OS is used on the network, resulting in. This study addresses the safety of fukushi robots, the concept of Taoism of old China in relation to robotics, and the problems encountered in designing a remote controlled fukushi robot, and reports on the results of a design concept that confers a sense of reassurance to the user.

In near future, support technologies will be a very important theme to a field of new academia to support the elderly people for their comfortable and safe life, by researching, developing, designing and improving the tools and their living environment (housing and urban amenity), from a standpoint of the gerontology and ergonomics; it can be truly said that it is the field intimately related to the welfare industry to target the elder

persons.(TC: Media Devices and Visual Systems)

The plasmon polaritons, which are collective motion of electrons in metals, and electromagnetic waves couple and constitute the surface plasmon polaritons (SPP) on metal surfaces. A metal having fine structures with a period near the wavelength of electromagnetic waves is called a plasmonic crystal, where the SPP is localized or waveguided. The plasmonic crystals are expected as new optical devices. On the other hand, terahertz (THz) waves, which mean the electromagnetic waves in the frequency region 0.1 ~ 10 THz, have made great progress recently owing to the development of the method of generating THz waves by using lasers. Transmission properties of 2-dimensional plasmonic crystals in THz region are introduced.

Figure 1 shows the transmission spectra of a system made of two aluminum plates (2-dimensional plasmonic crystals) perforated with a circular hole array in a triangular lattice. The interval of the two plates and the relative lateral shift of the hole positions of them are denoted by h and d, respectively. The h dependences of the transmission spectrum for p=0 mm (the hole position is overlapped, (a)) and p=0.57 mm (opposite, (b)) are quite different. The transmission spectra for p=0 and 0.57 mm are similar when h is larger than the wavelength (see (d)). However, the transmittance is higher for p=0.57 mm than for p=0 mm when h is smaller than the wavelength (see (c)), which contradicts with the intuition. This anomalous transmission property is explained by the coupling of the SPPs on the two metal plates. In addition to such anomalous transmission, various new phenomena related to the SPP such as the enhanced transmission and polarization rotation have been found. These phenomena are interesting not only from the viewpoint of physics of plasmonic crystals but also from the development of new optical and sensing devices in the visible and infrared regions.(TC: Infrared Application for Safety and Peace)

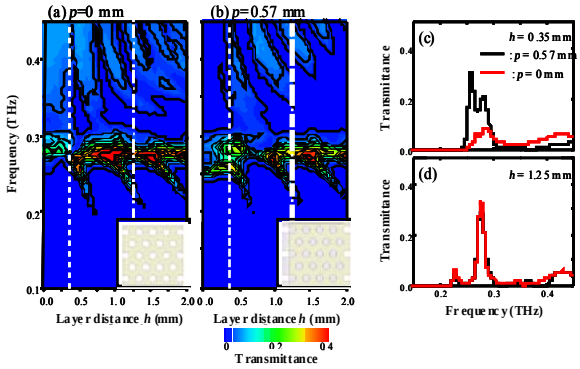

Fig.1 THz transmission spectra of the double layer 2-dimensional plasmonic crystal.

History of Electrical, Electronics, and Information-Related Engineering (HEE)

Chairperson: Yasuharu Suematsu (National Institute of Informatics)
Vice- Chairperson: Satoru Yanabu (Tokyo Denki University)
Secretaries: Masami Sukeda (Hitachi, Ltd)
Masao Takahashi (Toshiba Corporation)

【Purposes and Circumstances of the Committee】

In July 2002, a time-limited "Special Committee for the History of Electrical Engineering" was established at the recommendation of the Institute of Electrical Engineers of Japan (IEEJ) to conduct activities in conjunction with related scientific societies.

Moreover, since the five scientific societies related to electricity and information agreed to set up a "Liaison Council of Electrical and Information-related societies" starting in April 2003 to "strengthen their cooperation," the special committee was reorganized as the "committee for the history of electrical, electronics, and information-related engineering." With the active participation of each society in committee activities backed by full understanding and support, the committee began its work with the purposes of "formulating a basic plan for activities related to the history of electrical, electronics, and information technologies, planning investigative activities, and implementing promotional projects."

In line with this approach, the special committee for the history of electrical engineering has completed its two-year activities, having obtained favorable results from joint work conducted in investigative activities on how to preserve the records and the joint hosting of workshops. The five scientific societies that organized the newly cre-

ated committee are the Institute of Image Information and Television Engineers(ITE), the Information Processing Society of Japan(IPSJ), the Illuminating Engineering Institute of Japan(IEIJ), the Institute of Electrical Engineers of Japan(IEEJ), and the Institute of Electronics, Information and Communication Engineers(IEICE) that currently serves as the managing society.
On January 24, 2005, the committee held a meeting attended by the members concerned, appointed Yasuharu Suematsu as chairman, Shoji Shinoda and Yuji Ohkita as vice chairmen, and confirmed the structure of the committee with the representatives of each society and individually participating members. The first official meeting was subsequently held with the activities coordinated by the five societies getting off to a fast start.

【Domestic and Overseas Trends】

IEEE and IEE have already begun coordinated activities with the related scientific societies. These vigorous activities include realistic virtual museums, interview-based surveys involving noted individuals, the recognition of historical relics, recording of related technologies, activities to present awards, the introduction of other museums, and the commissioning of research to universities. Both institutes have cross-disciplinary organizations engaged in activities with adequate funding. Moreover, IEEE has established a large-scale, cross-disciplinary History Center that is playing an active role in disseminating "knowledge."

【Survey Items of the Committee】

While collecting knowledge from individuals with vast experience in wide-ranging fields that cross and concern the five scientific societies, the committee plans to investigate the following and conduct surveys as follows:
(1) Prospective activities regarding the history of electrical, electronics, and information-related technologies that cover all fields of the related scientific societies.
(2) Structuring of the foundation in order to strengthen its finances for youth education and supporting activities.
(3) Planning investigative actions, including digital archives, interview-based surveys, recognition of recorded materials, conservation of technical products, and the recording of technological history, along with advice and support for organizations that conduct planned investigations.
(4) Interchanges and information exchanges with overseas organizations (e.g., IEEE, IEE)
(5) Deepening and revitalizing activities by coordinating with universities.
Moreover, by using examples of large-scale activities conducted by IEEE, the committee plans to consider what specific promotional activities should be conducted regarding the history of electrical, electronics, and information-related technologies.

【Expected Effects】

Since the history of electrical, electronics, and information-related technologies in Japan will be adequately recorded and preserved, with accumulated data being publicized at home and abroad, this history will become widely available for education purposes in addition to helping clarify divergent viewpoints about the electrical, electronics, and information-related industries, and their technologies in the future.

Activities of the Investigating Research Committee on Factors of Innovation in the Postwar Development of Electrical Engineering

Chairperson: Takayuki Nagata
(The National Science Museum)

In December 2004, a new investigating research committee was formed under the Technical Committee for the History of Electrical Engineering. I would like to describe a general outline of this new committee below.

The mission of the committee is to find factors influencing innovation. In pursuing innovation, it is quite natural to place great emphasis on R&D, but it is also necessary to think about how to push forward with innovation in an effective manner. Studying the conditions under which to create innovation and the related mechanisms is essential. Nonetheless, there are wide-ranging factors that contribute to innovation. The new committee has only a limited number of members burdened by time constraints. They might well end up being buried in a flood of materials and data, if they challenge tackle it directly. The Technical Committee for the History of Electrical Engineering has decided to accept the challenge in view of its study of the history of technology, and thus formed a new investigative research committee. The purpose of this new committee is to determine the factors that contribute to innovation by analyzing the postwar development of electrical engineering.

Such an investigation like this must collect, among other things, an abundance of examples. Of course, this is not to say that any kind of case examples will do; the bottom line is gathering useful examples. The committee has decided that useful examples should be collected from oral history

records. We are already familiar with such records that include those collected by the "Investigating Research Committee on Interview-based Surveys Involving Senior Researchers of Electrical Engineering" that ended last year, and those collected by the interview-based surveys conducted in cooperation with the Japan Research Industries Association before the new investigating research committee was established.

The subjects of these oral history interviews are honorary members of IEEJ, who must be nominated from among those who have served as IEEJ chairmen or vice chairmen or among researchers responsible for exceptional research findings. All such persons have enjoyed great accomplishments as researchers or research administrators, and their vast experience offers an invaluable source of first-rate materials for the history of technology. All honorary members belong to the generation that supported Japan's postwar reconstruction from the standpoint of technological development, having served as front-line researchers and engineers. Among the technological developments that drove Japan's postwar reconstruction that was exceptional in world history, we may be able to find a certain model for innovation on which we must focus, and the oral records obtained from these honorary members, who are considered living witnesses to postwar technological development, should prove to be highly valuable information.

In fact, from past studies based on oral history we have obtained a number of interesting case examples that showed us how technological breakthroughs were made and learned that the maturity of peripheral technology is indispensable for technological development. These people also offered us important clues about how to conduct studies. Oral history gives us a living history of technology. Since there are still some honorary members yet to be interviewed, we fully expect to survey more members in the future. We are, therefore, determined to increase the number of case examples by conducting as many interview-based surveys as possible during our ongoing investigation.

At the same time, such esteemed individuals generally tend to feel so devoted about their work that it is highly likely that what they say is subtly influenced by what they wish to emphasize. Moreover, there may be some lapses of memory. It is, therefore, necessary to consider such weak points when regarding oral history. It is also true that we cannot collect an adequate number of examples based on a limited number of interviews. To compensate for this inadequacy, we will search related literature as much as possible.

High Voltage Engineering (HV)

Chairperson:	S. Yokoyama (Kyushu University / Central Research Institute of Electric Power Industry)
Secretaries:	I. Aono (Mitsubishi Electric Corp.),K.Hoshina(Toshiba Corp.)
Assistant Secretary:	Y.Mizutani (Central Research Institute of Electric Power Industry)

This technical committee (TC) belongs to power &Energy (P&E) Society of the IEE of Japan ,and supervises activity of investigation on technical subjects related to high voltage engineering. Five investigation committees listed in Table are active in September 2005.

The 4th International Workshop on High Voltage Engineering (IEHV 2004) was held in Sapporo city, following the 1st IWHV at Okinawa in 1999, and 2nd IWHV at Tottori in 2000 and 3rd IWHV at Fukuoka in2003.

The objective of this workshop is to provide a forum to discuss novel findings in the field of high voltage engineering, mainly in Asian countries. The workshop will be organized every alternate fiscal year. Selected papers of the IWHV with original and interesting findings will appear in a special issue of the Transactions of IEE of Japan.

There were 8 sessions, where 54 papers were presented orally for two days. All speakers presented their paper in English, following fruitful discussions. Also special lecture was given by Prof. Jinliang of Tingha University, China on the theme "Studies on Grounding Technologies for Power System in China"

The workshop banquet was held at Beer Restau-

rant "Supporo Beer garden", where 70 participants changed various information of the world wide technology of electric power industries, the research on electric discharge phenomena while enjoying the food (and history) of Supporo city.

We hope the next IWHV 2006 will also be valuable workshop for exchanging the information related to rapidly moving technology of high voltage engineering.

In November 2005 a joint technical meeting of IEEJ with TCs on Electrical Discharge and Switchgear and Protection will be held in Takamatsu of Shikoku District.

TC on High Voltage Engineering meeting meets four times a year. One of the meetings will be associated with a technical visit to Kyushu area.

The members of the committee other than the chairpersons of the investigation committees are from universities (4), a research institute (2), electric power utilities (4), and manufacturers (9) .

Table . Investigation Committees in TC-HV

Research Subject	Chairperson
Manner of Lightning Damages to Wind Power Stations	S.Yokoyama (Kyushu University / CRIEPI)
Insulator Contamination (performance measurement technology)	K. Takasu (CRIEPI)
Mechanism of Lightning Outages on Distribution Lines.	Y.Moro-oka (Kyushu Electric Power company)
Surge Phenomena on Low-voltage and Control Circuits	T.Funabashi (Meidensha Corp.)
Numerical Electromagnetic Analysis Methods for Surge Problems	A.Ametani (Doushisha University)

Instrumentation and Measurement (IM)

Chairperson: Katsunori Shida (Saga University)
Vice- Chairperson: Yoshitaka Sakumoto (Japan Electric Meters Inspection Corporation)
Secretaries: Terumitsu Shirai (Japan Electric Meters Inspection Corporation)

The field of instrumentation and measurement technology is very wide and has a long history.

Our committee has always followed up 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 division 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. 16 members including a chairperson, a secretary and an assistant-secretary constitute the committee.

ii) The meeting by the chairperson, the secretary and the assistant-secretary is held four times every year for tentatively planning the activities of the committee.

iii) The workshops for the presentation and discussion of studies and researches are taken place almost every month in principle as a main activity.

iv) The investigating committee for special subject is established.

v) The visit of professional facility is planning to carry out twice per year.

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

ultra-high speed electronic instrumentation

electro-magnetic measurement related with electrical environment
optical measurement applied to electronic instrumentation
high precision electronic instrumentation applied to frequencies and time domain
bio-electronic measurement applicable to the welfare field in society shifted to the aged
magnetic measurement related to magnetic sensors.

The workshops mainly take place at Tokyo area, and sometimes in Saga (Kyushu Island), in Osaka and in others. The theme of presentation in the workshop is 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 80 titles. The workshop is supported by IEEE IM and sometimes by other organization.

A investigating committee for special subject by the name of the application technology of precise measurement for frequency and time is now organized and is in full activity. (the chairperson: Prof. Sakuta (Nihon University))

Our committee website(http://www.im-ieej.com/) also helps to understand our activity.

One scene of some workshop

Written by Prof. Katsunori Shida, Chairperson of the Committee
(Saga University)
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Metal and Ceramics (MC)

Chairperson: Yasuzo Tanaka (International Superconductivity Technology Center)
Secretary: Masanao Mimura (The Furukawa Electric Co., Ltd.).

Thank you for your interest in 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, radioactivity, composites etc.

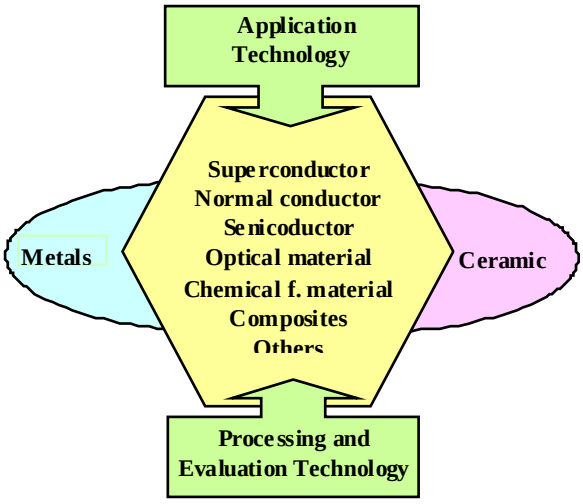

Figure 1 Activity scope of the TC-MC

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

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 and the Investigation Committee under the TC-MC. The following introduces the resent Symposiums in the National Convention of the IEEJ as shown in Table 1, and the second 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. Last three years, we provided new three technologies and related materials such the current nanotechnology, the attractive carbon nanotube and the functional diamond.

Recently, much attention has been paid on an investigation on advanced materials for future batteries and fuel sells to be compatible with clean, green and renewable society.

Table 1 Symposiums in the National Convention of the IEEJ

Theme	Date	Site
Observation on nanotechnologies and super- conductors	2003.03.17	Tohoku-Gakuin University
Attractive carbon nanotube as a new electric and electronic material	2004.03.17	Aoyama-Gakuin University
Remarkably advanced diamond for electric and electronic materials	2005.03.17	Tokushima University

Activities of Investigation Committee in TC-MC

As of 2005, there is one investigation committee under TC-MC as shown in Table 2, the name of which is "Fabrication technologies and characterizations of advanced superconducting materials". The chairperson and secretary are Hiroaki Kumakura (National Institute for Materials Science, NIMS) and Takao Takeuchi (NIMS), respectively. Regularly, there are four meetings a year.

The meetings discuss fabrication technologies and evaluations on electromagnetic, thermal and mechani-

cal properties mainly for Nb3Al conductors, bismuth-based oxide superconductors, MgB2 conductors and yttrium-based oxide superconductors. Especially, most interesting investigation results will be fabrication technologies to produce a long-length wire for MgB2 and yttrium-based oxide superconductors, and their cost performance as the practical materials.

Table 2 Investigation Committees under the TC-MC

Research Subject	Chairperson (Affiliation)	Period	Remarks
Superconducting materials and electronic devices	Nobuyuki Yoshikawa (Yokohama National University)	1999.10-2002.09	Close
Wire and conductor forming of super- conducting materials	Shirabe Akita (CRIEPI)	2001.10-2004.09	Close
Fabrication technologies and characteriza- tion of advanced superconducting materials	Hiroaki Kumakura (NIMS)	2004.10-2007.09	Active

IEC Japanese National Committees Related to Electrical Insulating Materials

IEC TC10 Japanese National Committee

Chairperson: M.Tsuchie (Mitsubishi Electric Corporation)
Secretary: T.Takahashi (VISCAS Corporation)

TC10 takes charge of fluids (insulating oil and SF6) which is applied to electrical equipments such as transformer, cable, condenser and switchgear. Recent main items under active discussion are IEC60422 (Supervision and maintenance guide for mineral insulating oil), IEC60599 (Guide to the interpretation of dissolved and free gases analysis), IEC62021 (Determination of acidity-Test method) and IEC60836(Specification of silicone oil) etc.

TC 10 Japanese national committee has an activity in connection with relevant persons in the field of insulating oil in JPI (Japanese Petroleum Institute).

IEC TC15 and SC15C Japanese National Committees

TC15:

Chairperson: Yoshiaki Yamano (Chiba University)
Secretary: Toshio Shimizu (Toshiba Co.Ltd.)

SC15C:

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

Japanese national committees of TC15 and SC15C have been held the meeting 3times and 4 times in a year, respectively. The national committee of TC15 had two subcommittees, SC15E and SC15C. SC15C was very busy committee; During the last year, 23 documents for standardization for SC15C have been sent from Central Office, including CD, CDV and FDIS, all of which were deliberated and discussed in the meetings of the national committee. Furthermore, 15 voting results or compiled comments, and 10 maintenance cycle reports were circulated in the member of the national committee.

For the activities on the working groups in the SC15C, the experts from Japan participate in WG5 (flexible insulating sleeving) and WG7 ((reactive resinous compound and varnish). SC15C meeting has been annually held. This year, the meeting was held during a week in May in Tokyo Japan. More than 40 persons were attended in the meeting.

In July this year, IEC SC15C was transformed into IEC TC15 by a decision of IEC SMB, because a new TC112 was constructed merging TC98 into SC15E in April this year. The corresponding Japanese National committees will be reconstructed within this year. The works of the new TC15 are almost unchanged from that of SC15C, which are focused on, but not limited to, the development and maintenance of existing international standards on specifications for solid electrical insulating materials alone or in simple combinations. This includes coatings which are applied in the liquid state but cure to solids, such as varnishes and coatings.

IEC TC98 Japanese National Committee

Chairperson: T.Okamoto (Central Research institute of Electric Power Industry)
Secretary: K.Kimura (Kyusyu Institute of Technology)
K.Haga (Fuji Electric System Co.,Ltd.)

TC98 (Electrical insulation systems) has been dealing with thermal endurance test methods for electrical insulation systems that compose of electrical conducting part and electrical insulating part for these ten years. The very basic document is IEC 60505 (Evaluation and qualification of electrical insulation systems). This document provides the basic idea of degradation mechanism of electrical insulation systems and its evaluation methods. There are several important document series such as IEC 61857 (Electrical insulation systems -- Procedures for thermal evaluation --). Recently it was determined that TC98 would be merged with SC15E (Insulating materials -- methods of test--) and renewed as TC112 (Evaluation and qualification of electrical insulating materials and systems). The new TC started from this summer.

CIGRE SC D1 Japanese National Committee

(Materials and Emerging Technologies)

Chairperson: M. Nagao (Toyohashi University of Technology)

Secretary: M. Tsuchie (TM T&D Co.Ltd.)

Assistant Secretary: T. Takahashi (Central Research Institute of Electric Power Industries)

CIGRE (International Council on Large Electric Systems) is a permanent non-governmental and non profit-making International Association founded in 1921. In 2002 Study Committees (SC) were reconstructed to 16 committees belonging to 4 categories: A (Equipment), B (Subsystems), C (Systems) and D (Horizontal). Among them, SC D1 was characterized as a horizontal one which contributes to other SC's in categories A, B and C. The title of SC D1 is "Materials and Emerging Technologies" and the mission is to facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of materials and emerging technologies for power systems.

SC D1 has now 12 Working Groups (WG); WG D1.01 (Fluid-Impregnated Insulating Systems), WG D1.03 (Insulating Gases), WG D1.05 (Capacitors), WG D1.07 (Solid Insulating Materials for Rotating Machines), WG D1.11 (Service Aged Materials), WG D1.12 (Materials for DC Applications), WG D1.14 (Material properties for nonceramic outdoor insulation), WG D1.15 (HTSC-material applications & cooling), WG D1.16 (High Field Phenomena in Solid Insulation and Interface). WG D1.17 (HV Asset condition assessment tools, data quality and expert systems), WG D1.18 (Impact of emerging generation technology) and WG D1.33 (HV test and measuring techniques). In 2004 Paris and 2005 Crete meeting, we decided to establish 2 new WG's on the titles of "Solid insulation endurance under transient voltages" and "Non-destructive water treeing detection in MV XLPE cables".

The preferential subject of 2006 SC D1 Paris Group meeting reflects recent topics of SC D1 as follows, PS1: Partial Discharge measurement with non-conventional systems (sensors, sensitivity, calibration; related knowledge rules; comparison with conventional systems), PS2: Materials issues in emerging technologies (reusing of materials, refurbishment, life extension), PS3: High performance materials and new materials for severe operating conditions (nano materials, superconducting materials, space charge-less materials, bio dielectric materials, eco-friendly materials, etc.). From Japan, following 3 papers were applied and all papers were approved to submission; "New development for detecting partial discharge using an UHF method and its application to power apparatus in Japan" by F.Endo, N.Okabe, M.Hanai, H.Hama, M.Nagao, "Superiority in Partial Discharge Resistance of Several Polymer Nanocomposites" by T.Tanaka, Y.Ohki, T.Shimizu, N.Okabe and "Horizontal Evaluation and Systematization of Common Technology in Electrical Insulating Materials for High-voltage Power Equipment" by H.Ohkubo, N.Okabe, H.Murase, H.Hama, M.Hikita, Y.Shirasaka.

The next International SC D1 meeting is scheduled in Paris from August 27 to September 1st, 2006, in conjunction with 2006 CIGRE Paris Group meeting. The meeting place of 2007 meeting is not decided, but maybe in Korea or Belgium. The Japanese National SC D1 has usually 3 or 4 meetings a year.

INTERNATIONAL TECHNICAL EXCHANGE SESSION IN ISEIM 2005

2005 International Symposium on Electrical Insulating Materials

2005 International Symposium on Electrical Insulating Materials (ISEIM 2005) was held at the Kitakyushu International Conference Center in Kitakyushu City, Japan, from June 5 to 9, 2005. **The International Technical Exchange Session** was held for information exchange and human contact among researchers of Pan-pacific regions in the field of electrical insulation.

Short Report on ISEIM 2005

Tatsuki Okamoto
General Chair
Organizing committee of ISEIM 2005
(CRIEPI)

Due to the power business liberalization, investment into research on high voltage machine development has been decreased dramatically and the mission of researchers of insulating materials and their application should be changed according to the circumstance change. Under those background, the objectives for insulating materials researchers become more difficult to determine than before and therefore the missions of ISEIM 2005 become more important. As for helping to find new research hints, we set special mission to the conference. We planned to have new and important sessions like Asset Management Session especially for researchers of high voltage related issues, Space Charge Session including space craft issues, Nanotechnology for Dielectric Session, and Dielectrics for Telecommunication Session for frontier researchers with inviting many authorities in each research field.

Besides those special sessions this conference had three basic important missions. One was to obtain deep research information on insulating material related issues. Each researcher with different background meets others and may deepen their knowledge and may find new possible research objectives. Along with this direction, we invited two excellent lectures, Prof. T. Mizutani and Prof. C. Laurent who will give us deep and advanced research meanings. Second important mission was to send information widely. Along with this direction we planned to have International Technical Exchange Session with being chaired by Prof. T.Tanaka, the Honorary Chair of ISEIM 2005 under his excellent leadership. Within the session there were more than twelve contribution papers from Aisian countries and pan-pacific countries. The third one was to get acquainted each other and then may expand participants life-range. Along this direction we planned several social events within the conference program. As General Chair of ISEIM 2005, I hope those missions of this conference will satisfy all of the participants.

As a result, the conference was successfully held with more than 80 contribution papers and 140 participants from about 20 countries. I would like to thank deeply all of the participants from all over the world and I hope all of the participants and their accompanying families will have present time during the stay in Japan. I also would like to thank all of the organizing committee members and sub-committee members for their immense effort to realize this conference. I also thank sincerely all the supporting members of this conference for their tremendous contributions.

Short Explanation of Activity of Dielectric and Electrical Insulation Committee of IEEJ

(1) Investigation Committees (Sub-committees of DEI Committee)

[Macro-view of DEI technology related]

*Environment-friendly materials and systems for electric and electronics application (04/04-03/07, Chair: Y.Suzuoki (Nagoya University)

*Economical evaluation of insulation diagnosis (04/04-03/07, Chair: N.Hozumi (Toyohashi University of Technology))

[New materials including nano-materials related]

*Application and improvement of organic molecular films and organic/inorganic composites with controlled nano-structures (04/04-03/07、Chair: F.Kaneko (Niigata University))

*Dielectric and insulating materials for information communication (01/04-12/06, Chair: K.Fukunaga (National Institute of Information and communication Technology))

*Development of organic electrical and electronic materials with flexible structure to nanotechnology (07/03-06/06, Chair: M.Iwamaoto (Tokyo Institute of Technology))

*Application of nano-composite materials to DEI systems (10/02-09/05, Chair: T.Tanaka (Waseda University))

[Diagnosis of electric and electronic equipment related]

*On-line insulation diagnostic methods of power cable and apparatus (01/03-12/05, Chair: K. Uchida (Chubu Electric Power Company))

*Insulation ageing and surge endurance of printed circuit boards (04/02-03/05, Chair: Y.Yamano (Chiba University))

[Basic dielectric and breakdown phenomena related]

*Charge behavior and interface of high electric field insulation(07/02-06/05, Chair: M. Nagao (Toyohashi University of Technology))

*Discharge evaluation and ageing phenomena on the surface of polymer insulators (04/02-03/05, Chair: K. Gotoh (Consultant))

(2) Academic Conferences (Sponsored and Co-sponsored during 04/04-03/05)

* The 35th Symposium on Electrical and Electronic Insulating Materials and Applications in Systems (Tokyo, 11/05)
* Conference on Insulation for Inverter Surge Voltage (Kokura, 6/04)
* Conference Session on Printed Circuit Technology (Sendai, 8/04)
* Conference Session on Organic Ultra-thin films (Tokyo, 11/04)
* Conference Session on Polymer Insulators (Tokyo, 12/04)
* Conference Session on Functional Thin Films (Tokyo, 01/05)
* Conference on Environmental Insulation issues, Asset Management and Insulation Diagnostics (Nagoya, 01/05)
* Conference on Nano-composites, Space Charge and Interface issues and International Conference Reports (Tokyo, 01/05)
* Conference Session on Polymer Insulators (Tokushima, 03/05)
* Conference Session on Ultra-thin films and Nano-structure Session (Tokushima, 03/05)

(3)Technical Tours

*CRIEPI（Field Test Facility of 500m Superconducting Cable）(09/04)
*Center for Next Generation Engineering and Technology, Nihon University (12/04)

(4) IEEJ DEIS Committee Webpage (Japanese only)

*http://www.waseda.jp/assoc-DEI/index.html

Digest Report on International Technical Exchange Session

Date and Time: June 6th, Monday, 2005, 18:30-21:00

Venue: International Conference Room at Kitakyushu International Conference Center, Kitakyushu, JAPAN

Chair: Dr. Yong-Joo Kim (Korea Electrotechnology Research Institute, Korea)
Chair: Prof. Toshikatsu Tanaka (Waseda University, Japan)

Photo: Char Prof. T. Tanaka (left) and Dr. Y. Kim (right)

Participants: About 50 participants attended the meeting.

Photo: The International Technical Exchange Session

During this session "Questionnaire for EINA Magazine", Application Form for EINA magazine and EINA Magazine No.11 were served to all participants. At the end of this session, 7 pieces of questionnaire and 10 pieces of application form were collected.

During ISEIM 2005, 144 copies of EINA Magazine No.11 were served to the participants of this conference.

Photo: Chair and All presenters in International Technical Exchange Session in 2005 ISEIM

Abstracts of International Technical Exchange Session

ES-1

Problems during the development of Insulation Technology

Z. Yan, G. J. Zhang

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Due to the big demand of power supply in China, the annual increasing rate of power industry is about 10-15%, but the major parts still lack of electricity. On the basis of building 750kV AC and ±500kV DC power equipments and transmission lines, that of 1000kV AC, ±800kV DC will be built in the near future. In order to build and control more and more advanced plants and utilities, not only the research and application of advanced technology but also a lot of engineers and researchers are more important than before.

ES-2

International Co-operation on Condition Monitoring and Diagnosis Technologies under Ubiquitous Environment

Yong-Joo Kim

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Nowadays, emerging technologies such as IT (Information Technologies) under ubiquitous environment has become an important issue in condition assessment of power apparatus. The paper encourages Pan Asian Countries to organize an international consortium for development of condition monitoring and diagnosis technologies under ubiquitous environment.

ES-3

Research on the Characteristics of Outdoor Insulation in Complex Atmospheric Environment in China

W. Sima, Caixin Sun, Xingliang Jiang, Lichun Shu

Key laboratory of high voltage and electrical new technology of the Ministry of Education,
Chongqing University, China,400044

-Introduction-

In view of the technical difficulties of outdoor insulation in complex climate environment, which arise from the West-to-East Power Transmission project in China, the key laboratory of high voltage and electrical new technology of the Ministry of Education in Chongqing university has carried out long-term research work.

ES-4

Researches on High Voltage Engineering and Their Future Trend in Indonesia

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This paper reports the research activities in the field of high voltage engineering and its application in electric power industries in Indonesia. In general, the activities were driven by the application of high voltage (HV) and extra high voltage (EHV) transmission systems in the country. The operation and maintenance of HV and EHV equipments are greatly affected by the tropical climate of the country. This attracts researchers to investigate the effects of tropical climate on HV and EHV equipments. In this paper, the tropical climate of Indonesia and research activities in universities as well as in research institutes and utilities are briefly introduced.

ES-5

Biodegradable dielectric Liquids for transformer applications

P. Thomas

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Mineral oil which is a derivative of petroleum crude is used in transformers, capacitors, switchgears and in circuit breaker from the beginning. There are nearly 1500 different types of crudes are produced around the world which differ from one another in chemical composition. These mineral oils are less fire resistant, non- biodegradable, poor oxidation stability and toxic in nature. At present, these types of liquids are being imported for special applications. CPRI has been working on the area of development fire resistance and biodegradable fluids for such applications. Considering the environmental issues, fire resistant and biodegradable fluids needs to be developed in India.

ES-6

Environmental Aging of Polymeric Insulators in Pakistan

Mohammad Amin

Univ. of Engg. And Tech. Taxila, Pakistan

-Introduction-

Polymeric materials in electric power applications has increased rapidly. Special interest has been paid on the use of polymeric materials for high voltage outdoor insulators. Some of the major advantages of the polymeric insulators over the traditional ceramic ones are their light weight and lower cost. They are easier and cheaper to store, transport and install. However, the polymeric materials are more prone to deterioration and chemical alterations which can seriously reduce the reliability and life-time of the insulator in service.

ES-7

High Voltage Engineering Applications in Sri Lanka

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This paper introduces the energy and electric power systems in Sri Lanka. It shows the data, for example, generation statistics, fuel used for thermal generation, number of consumer accounts by tariff, length of transmission and distribution lines, number and capacity of substations and number of consumer accounts by province.

ES-8

Investigations for Solving Problems of Insulator Applications in High Voltage Lines in Thailand

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This paper presents investigated studies for solving problems of insulator applications in electrical power systems. The background of problems including pollution effects and insulators punctured are pointed out. The measures for solving the mentioned problems were developed and presented. The investigated results are illustrated and discussed.

ES-9

Numerical Field Analysis and Other HV-Related Research at Chulalongkorn University

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-Introduction-

This paper gives an overview of the research at the High Voltage Laboratory, Department of Electrical Engineering, Chulalongkorn University. The HV laboratory has been established since 1955. At present, it has four teaching staffs. The laboratory carries out basic and applied research on various topics, which are to be briefly described in the following sections.

ES-10

A Review of Australian Research Activity in HV Insulation and Insulation Diagnostics

T R Blackburn

School of Electrical Engineering, The University of New South Wales
Sydney NSW 2052, Australia
Email: t.blackburn@unsw.edu.au

Insulation research in Australia is performed primarily in the University sector, although there is specific activity occurring in applied areas of condition monitoring and testing in some electrical supply utilities and at the National Measurement Institute in Sydney. The main thrust of all research activity is in areas directly associated with the condition monitoring and assessment of high voltage equipment and with those dielectric material properties directly applicable to high voltage equipment operation. The major areas of research and development are in partial discharge monitoring and dielectric response in transformers and high voltage cables, assessment of composite insulator condition and in optimizing monitoring techniques for ageing infrastructure, including medium voltage circuit breakers. The main trend in monitoring is towards on-line methods, particularly partial discharges at very high frequencies. In the materials area, there is activity in high temperature effects on oil, cryogenic insulation, bio-degradeable oils, XLPE ageing and practical ageing assessment of oil-paper systems. While direct pure research grant funding from the government to universities is diminishing, there is some growth in funding for collaborative research between universities and the electrical supply utilities.

ES-11

Dielectrics and Insulating Materials Research Activities in Japan

Tatsuki Okamoto

Electric Power Engineering Laboratory. CRIEPI,
2-6-1, Nagasaka, Yokosuka, Japan 240-0196

This article reports the state-of-art of TC-DEI (Technical Committee of Dielectrics and Electrical Insulation of IEEJ) activities. The activities are basically based on the activities of 8-10 investigation committees under TC-DEI. Recent activities were categorized into three functions in this article. Those are activities on asset management (AI application and insulation diagnosis), activities on new insulating and functional materials (Nano composite) and activities on new insulation technology for power transmission (high Tc superconducting cable insulation).

Summary of "Questionnaire for EINA Magazine"

At the end of this session, several pieces of questionnaire were collected.

1. Do you know EINA magazine?

Yes (6) No (1)

2. What would you like to see in EINA magazine?

- Yes
- Researchers conducted in Asian Countries and Company with other party of the world.
- News in Asia and Research Activities.
- Electrical Insulation Development in Asia
- General Development in Electrical Insulation in Asia, New Technology in Asia.
- The activities and research, the technical development.
- General review articles on progress in EI.

3. EINA magazine introduces activities of various committees associated with the IEE of Japan committee, research activities in Asia, and new technologies in Japan and so on. What kind of news would you like to see in EINA magazine?

- OK
- News regarding the last Technologies.
- New Technologies in Japan and Asia Countries.
- Research activities in Asia, new technologies in Japan and so on.
- Research activities in Asia, and New technologies in Japan.
- As mentioned above.

4. Do you find the magazine and Website to be informative and helpful?

- Yes (5)
- It is my first time to see this magazine.
- Yes, very informative and helpful.
- Marginal

5. Do you have any ideas on how to better distribute EINA magazine to other Asian countries?

- Via Contact person in the country.
- Sending some copies to Electrical Schools.
- Submission of more information from Asian countries and other countries.
- Use PDF, sent by E-mail.
- Might be sent in E-mail.

6. EINA tries to include news and articles from Asian and Pan-Pacific countries and regions, although EINA magazine has until now focused more on Japanese news than foreign news. How do you think more Asian countries can participate in EINA?

- By asking more researchers in the region to contribute to EINA.
- Making more affiliates can be of help.
- That is good, Yes.
- Invite some researcher introduce what their development and technique experience.
- Might invite more research out side Japan to write something on new development in Asia.
- Maybe, Indonesia
- Yes, that would be better.

7. Have you ever submitted any news about engineering or related activities in your country to publications in other countries such as EINA magazine?

- Yes (2)
- Yes, but not for EINA magazine.
- No (5)

8. Do you have any current news on research activity in your country?

- Yes (1)
- No (5)
- No. But I will let you know if we have one in the future.

9. Please tell us your news source and more details about the activities in your country to EINA magazine.

- Institution of Engineer, Iran
- Institution of Engineer, Australia
- I will do so.
- Conduction Mechanism in Polymers and nano-particle/polymer composite
- Power cable on-line monitoring.
- Electrical Aging Evaluation and Monitoring on-line of High Voltage Power Apparatus.

RESEARCH ACTIVITIES AND TECHNICAL EXCHANGES IN ASIAN COUNTRIES

Conference Records

International Conference on Electrical Engineering 2005 (ICEE 2005)

The International Conference on Electrical Engineering (ICEE) 2005 was held in Kunming, the "Spring City" of China from July 10 to 14, 2005.

ICEE aims to provide a forum for sharing knowledge, experience and creative ideas among electrical engineers worldwide. Since ICEE the First, the conference has been held every year. ICEE 2005 was sponsored by the Chinese Society for Electrical Engineering (CSEE), co-sponsored by the Institute of Electrical Engineers of Japan (IEEJ), the Korean Institute of Electrical Engineers (KIEE) and the Hong Kong Institute of Engineers (HKIE). It was mainly organized by China Electric Power Research Institute (CEPRI), in co-operation with Thermal Power Research Institute (TPRI). The theme of the ICEE 2005 is "Step Towards the Future Electrical Engineering". The ICEE papers cover the following wide topics.

- Fundamentals, Materials & Education
- Power Systems & Energy
- Electronics, Information & Control Systems
- Electrical Machines, Power Electronics & Industry Applications
- Sensors & Micro-machines
- Other Related Areas

Fig.1 Conference venue

After the opening address, Dr. Hasegawa, president of IEEJ, gave a keynote speech entitled "Perspective of near future society and roles of the IEEJ" and the other three speakers from Hong Kong, Korea and China delivered interesting speeches of their countries' (regions') aspects about energy development and electricity market and their latest technologies. Many questions, answers and opinions were exchanged during the speeches.

ICEE 2005 received 427 full papers from 19 countries and regions. In addition to 23 technical sessions, 1 special session, 2 panel sessions and 3 poster sessions were held in the conference and active presentations and discussions were made throughout the sessions. Personally, it was impressive that Korea Electric Power Corporation made several presentations about its transmission business, especially for the 765 kV transmission systems.

The technical tour was held on July 14. The participants visited Puji substation where the China's first high temperature superconducting power cable system was installed. The 33.5m long, 35 kV/2 kA (77 K) cable system has been put into industrial operation for about one year. After that, one group went to the Stone Forest national park and the other group went to a large cave. They enjoyed the great scene generated by the natural force.

Fig.2 Technical visit (Puji Substation)

ICEE 2006 will be held by KIEE at YongPyong Resort, Korea, from July 9 to 13, 2006.

Eiichi Nagao (Mitsubishi Electric Corporation)

Announcement of International Conference to be held in Asia

Introduction to CMD2006

International Conference on Condition Monitoring and Diagnosis

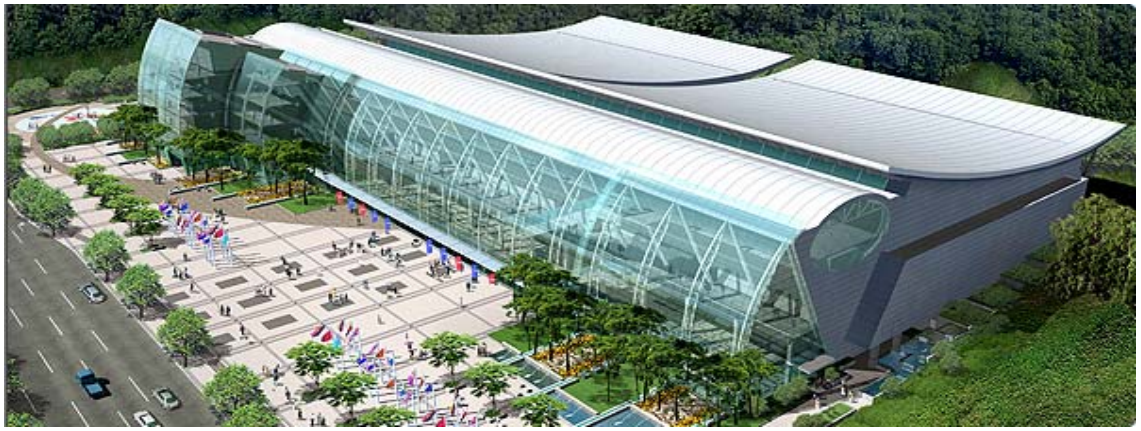
www.cmd2006.com

General Chairman of CMD 2006

Prof. Kyu-Bock Cho, Ph.D
Department of Electrical Engineering,
Hanseo University, Chungnam, Korea

The International Conference on Condition Monitoring and Diagnosis (CMD) had been launched and decided to be held every other years in Korea, Japan and China in turns, at the last jointed conference of ICMEP-ACEID2003 in Chongqing China as a unification conference of ICMEP and ACEID.

And now, on behalf of The Korean Institute of Electrical and Electronic Engineers (KIEEME – Dae Hwa Soh, President) and Korean Electrotechnology Research Institute (KERI – Dong-Wook Park, President), I am pleased to announce that "the very first International Conference on Condition Monitoring and Diagnosis (CMD2006)" will be held during April 2~5, 2006 in Changwon, Korea. KIEEME will put every effort to make the meeting to be the most fruitful and memorable one to all the participants and their partners.



To provide participants with great opportunities to learn up-to-date knowledge to exchange ideas and share different views on the all aspects of Condition Monitoring and Diagnosis, the scientific program will cover various fields such as

SPECIAL TOPICS

A. Condition Monitoring and Diagnosis Technologies under Ubiquitous Environment
B. Monitoring and Diagnosis System for Nuclear Power Plant
C. Condition Monitoring and Diagnosis for System Environmental Performance

Main Topics

1. Condition Monitoring for Power-and Gas / Oil Plants & Power Systems
2. Diagnosis and Condition Monitoring for HV Electric Power Apparatus & Power Systems
3. Investigation into the Mechanism of Electrical, Mechanical, Thermal, Chemical, Phenomena and Electronic Failure
4. Applications of Information Technology in Asset Management
5. Strategic Planning and Management for Condition Monitoring
6. Monitoring in the Electricity Markets and Regulation under Various Economic Aspects

The KIEEME and KERI encourage all of you to join the conference to be a frontline expert, and also to relish the cultural attractions, the pleasant climate, traditional hospitality and cuisine of the harmony of the Orient and the West in Cahangwon.

As a part of the conference, CMD 2006 Pre-Workshop was held on August 23, 2005, Seoul, Korea with 15 prominence and well-known invited speakers from China, Japan and Korea. It was really good chance for all of us to get to know each other and to exchange valuable information in advance. And it played its important role in strengthening mutual relationship and cooperation for further development of Condition Monitoring and Diagnosis as we expected. We all came to believe through CMD 2006 Pre-Workshop that CMD 2006 would be the critical conference for a continued prosperity in this field.

The scientific program including the distinguished presentations is following as below:

Session I

- Partial Discharge Monitoring and Diagnosis of Power Generator
  Dr. Gao Wen-Sheng (Tsinghua Univ., China)
- The Modern Technology and Development Trend for CMD of Electrical Equipments
  Dr. Hongzhong Ma (Hohai Univ., China)
- Maintenance and Asset management of Electric Equipment of Manufacturing Industry in Japan
  Dr. Masaaki Ikeda (Nippon Petrochemicals, Co., Ltd., Japan)
- Prospects of Business Models for Utilities Based on Broadband PLC
  Dr. Soo Bin Yim (Xeline, Korea)
- Wireless Sensor Network for On-line Diagnosis and Monitoring of Electric Facilities
  Dr. Young Jin Park (KERI, Korea)

Session II

- Monitoring and Diagnostic Strategy for Insulation Condition of Oil-immersed Power Transformer
  Prof. Guan-Jun Zhang (Xi'an Jiaotong Univ., China)
- An Experimental Investigation on TSC of the Composite Insulators
  Dr. Lijian Ding (North China Power Univ., China)
- On-going Research Projects related CMD framework
  Dr. Tatsuki Okamoto (Electric Power Engineering Research, Laboratory CRIEPI, Japan)
  • Substation Monitoring and Diagnosis System
  Mr. Yang-Sop Shin (LS Industrial System Co., Ltd., Korea)
- Development of Monitoring and Diagnostic System for SF6 Gas Insulated Switchgear
  Mr. Min Soo Kim (Hyosung Co., Korea)

Session III
• Heat Circuit Model for Monitoring Hot-spot of Coil in Traction Transformer *Prof. Guangning Wu (Southwest Jiaotong Univ., China)*
• Optimal Condition for Term of Guarantee and Tolerance Risk Ratio in Insulation Diagnosis *Prof. Naohiro Hozumi (Toyohashi University of Technology, Japan)*
• Strategic Planning and Management for Condition Monitoring *Dr. Satoshi Matsumoto (Kyushu Institute of Technology, Japan)*
• Generator Online Diagnosis System (2) *Dr. Young Jin Lee (Autopower, Korea)*

For further information on CMD 2006, please visit the official web site at www.cmd2006.com or contact the Conference Secretariat;

Co & Ex Korea Co., Ltd. Tel: 82-2-3444-4942 / Fax: 82-2-3444-4943
/ E-mail: secretariat@cmd2006.com

8th International Conference on Properties and Applications of Dielectric Materials (ICPADM2006)

June 26 – 30, 2006, Grand Bali Beach Hotel, Denpasar, Bali, Indonesia

Sponsored by:
IEEE Dielectrics and Electrical Insulation Society

Co-Organized by:
Department of Electrical Engineering, Bandung Institute of Technology
Department of Electrical Engineering, Udayana University

Invitation

The 8th International Conference on Properties and Applications of Dielectric Materials (ICPADM2006) will be held in Bali, Indonesia on June 26 – 30, 2006. The previous three conferences were held in Seoul, Korea (1997), Xi'an, China (2000) and Nagoya, Japan (2003) and were successful with more than 250 participants and 250 papers. The purpose of this conference is to provide a forum for researchers, scientists and engineers from all over the world to exchange ideas and discuss recent progress in electrical insulation, dielectric materials, test and measurement techniques, and related problems from basic properties to practical applications. The organizing committee cordially invites you to participate in the conference.

Venue

ICPADM2006 will be held at the Grand Bali Beach Hotel, Sanur, Denpasar, Bali. Bali is the most attractive region in Indonesia with respect to tourism activity. Bali has been in a leading position in the economic growth of Indonesia from tourism. Sanur, Bali's original seaside resort, has been known for its world class facilities and an atmosphere of comfort and privacy. The Grand Bali Beach Hotel is set on a wide stretch of white sand right at the heart of Sanur. Extensive gardens landscaped around mature trees stretch down to one of Bali's favorite beaches - perfect for swimmers, surfers, sun-worshippers, and other outdoor enthusiasts.

Main Topics

1. Electrical Insulation in Power Apparatus (GIS, Transformers, Rotating Machines, Cables, Capacitors, Insulators, Arresters, etc.)
2. Monitoring and Diagnosis of Insulation, Risk Management, Condition-Based Preventive Maintenance, etc.
3. Ageing and Lifetime Estimation
4. Partial Discharge, Treeing and Tracking
5. Dielectric Phenomena and Their Applications
6. Electrical Conduction and Breakdown in Dielectrics (Solid, Liquid and Gas)
7. Surface and Interfacial Phenomena
8. Space Charge, DC Insulation

9. HV Power Electronics Device (Power Module) and Printed Circuit Board (PCB)
10. Eco-friendly Power Apparatus and Cables (Design, Materials, Recycling, etc.)
11. Dielectric Materials for Electronics and Photonics (Organic EL, Electronic Devices, Optical Devices, etc.)
12. New and Functional Dielectric Materials (Ceramics, Biomedical Materials, Soft-Materials, Nano-Materials, etc.)
13. Testing and Measurement Techniques
14. Globalization of Insulation Technology (International Standards, etc.)

Language

The working language of the conference will be in English. All printed matter will appear in English.

Abstract Submission

You are invited to submit an abstract of not morethan 200 words to the Conference Secretariat by November 1, 2005. The abstract must include title, author's name(s), affiliation(s), mailing address, telephone and fax numbers. Acceptance or rejection notices will be mailed by late November 2005 to the corresponding author of submitted abstracts. The authors of accepted papers will be requested to submit camera-ready manuscripts by February 1, 2006. All accepted papers will be published in the Conference Proceedings.

Invited Lectures and Special Sessions

Invited lectures by distinguished researchers including Liu Ziyu/Ieda Memorial Lecture are planned. Special sessions on topics such as Insulation Diagnosis (GIS, XLPE Cables, Transformers, Rotating Machines), DC Insulation, Space Charge, Cryogenic Insulation, Organic Electronics, etc. are planned.

Sightseeing Tours

Sightseeing tours to several famous places in Bali will be arranged for all participants.

Registration Fees (In USD)

	By April 1, 2006	After April 1, 2006
Member	475	525
Non-Member	525	575
Student	250	300
Accompanying person	150	150

ORGANIZING COMMITTEE

General Chair : Suwarno

EXECUTIVE COMMITTEE

Chair : R. Zoro

Program Committee	Chair: S. Hidayat Chair: B. Anggoro Chair: S. Sudirham
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Local Arrangement Committee	
	Chair: D. Antari

SECRETARIAT

Chair : R. Mardiana

ICPADM 2006 Website

More detailed information about ICPADM 2006 is available at the following web site:
http://www.icpadm2006.com/

Important Dates

Abstract Due Date:	November 1, 2005
Manuscript Due Date:	February 1, 2006
Deadline Preregistration:	April 1, 2006
Conference:	June 26-30, 2006

SECRETARIAT

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http://www.icpadm2006.com/

International Conference on Electrical Engineering 2006 (ICEE2006)

The conference will be held in Yongpyong, Korea on July 9—13, 2006.
Organized by The Korean Institute of Electrical Engineers (KIEE)
co-organized by The Chinese Society for Electrical Engineering (CSEE)
The Institute of Electrical Engineers of Japan (IEEJ)
The Hong Kong Institution of Engineers (HKIE)

The International Conference on Electrical Engineering (ICEE) aims to provide a forum for sharing knowledge, experience and creative ideas among electrical engineers worldwide. The theme of the ICEE 2006 is "Step Towards the Future Electrical Engineering".

The XXIInd International Symposium on Discharges and Electrical Insulation in Vacuum (ISDEIV2006)

International Symposium on Discharges and Electrical Insulation in Vacuum will be held at Matsue Terrsa, a conference hall of Matsue City, Shimane Prefecture, Japan, from ***September 25 to 29, 2006***. This symposium is a non-profit, international organization whose purpose is to encourage the advancement of the science and application of electrical insulation and discharges in vacuum, primarily by conducting symposium for the exchange of scientific and practical information.

Author should submit a 250 words abstract by ***November 30, 2005***. The acceptance will be notified by ***January 15, 2006***. The deadline for submission of camera ready manuscripts is ***April 30, 2006***.

Secretary: Dr. O. Yamamoto of Kyoto University
Address: Dept. of Electrical Eng., Kyotodaigaku-katsura, Kyoto, 615-8510 JAPAN
TEL: +81-(0)75-383-2229 FAX: +81-(0)75-383-2229
E-mail: isdeiv2006office@eee.u-ryukyu.ac.jp Web site: http://isdeiv.eee.u-ryukyu.ac.jp/

NICT EMC Center

Kaori Fukunaga

EMC Project Office, Koganei, Tokyo 184-8795, Japan

The National Institute of Information and Communications Technology (NICT) was established in April 2004 by integrating the Communications Research Laboratory (CRL) and the Telecommunications Advancement Organisation (TAO). CRL was first established as the Radio Research Laboratory in 1952 under the Ministry of Posts and Telecommunications, and has been the only national research institute for information and communications. TAO was established in 1979 to support communications and broadcasting industries. The headquarter is located in Koganei, Tokyo, and has four major research centers, three observatories, two standard wave transmission centers that provide the Japan Standard Time, and many other research centers (Fig. 1). Outside of Japan, NICT has a computational linguistics laboratory in Thailand, a wireless communications laboratory in Singapore, remote sensing experimental facilities at University of Alaska, and international offices in Paris and in Washington DC. The annual budget of NICT in 2005 is approximately 60 billion yen (600 million USD), and the number of full-time NICT employees is 480 including 305 researchers. The aim of NICT is to contribute to sophisticated information and communications technologies through research and development from the fundamental physics to industrial applications.

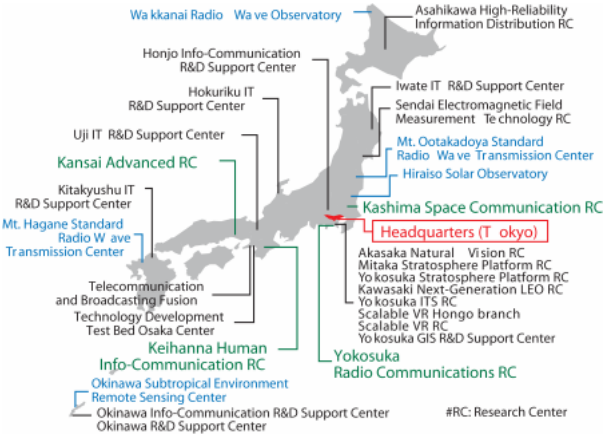

Fig.1 NICT major facilities.

In the ubiquitous society that allows people to access networks by any types of wireless terminal, electromagnetic compatibility (EMC) is one of the most important research subjects that ensure safe and secure information and communications technology (Fig. 2). The EMC center has three research groups and one project office.

Fig.2 Electromagnetic compatibility (EMC).

The EMC measurement group maintains excellent measurement facilities and offers calibration services of radio instruments for measuring and inspecting antennas and other equipment. Recently, the electromagnetic security issue has become important. The group works to establish a guideline against information leakage by electromagnetic waves and electromagnetic interference (Fig. 3), as well as to carry out basic research on the protection of information in electromagnetic waves. A radio clock adjusts the time automatically in synchronisation with the Japan Standard Time provided by NICT. The group analyses the

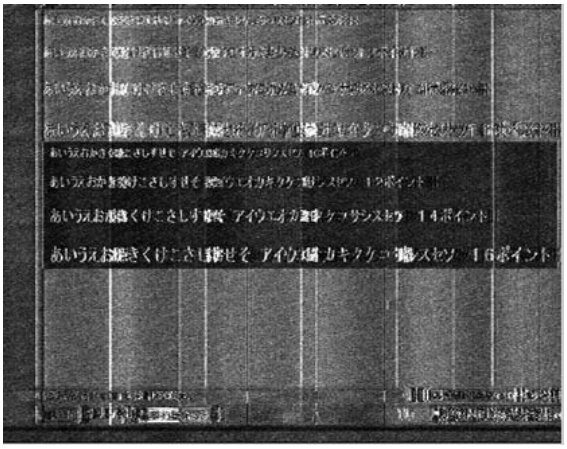

Fig.3 Information leakage from PC. The PC was set 3 m away from the antenna.

electromagnetic environment around the frequency range of the standard signal (Fig. 4). Through the development of innovative measurement methods, the EMC measurement group contributes to international standards, such as International Electrotechnical Commission (IEC), International Telecommunication Union (ITU) and Comité International Spécial des Perturbations Radioélectriques(CISPR).

The Communications System EMC Group investigates the influence of a newly developed communication systems, such as ultra wide band (UWB) system, on existing communication systems and evaluates measurement methods for electromagnetic disturbance in digital wireless systems. The amplitude probability distribution (APD) measurement method has been standardised by CISPR as the evaluation method for radiated disturbance. Figure 5 shows an example of the measurement of the influence of noise from a microwave oven on digital communications. The group has developed an electromagnetic environment monitoring car that can measure three electric field components from 30 MHz to 3.5 GHz, independently and precisely while running (Fig. 6).

The Biomedical EMC Group is involved in international safety guidelines and methodologies for compliance of mobile phones and other various wireless communication terminals with the safety guidelines. (Fig. 7)The group and three universities developed whole-body voxel models of Japanese adult males and females of average height and weight. These models consist of 8 million 2-mm cubics and are segmented into 51 tissues and organs (Fig. 8). These models are offered internationally for nonprofit academic research purpose.

The EMC research field is one of the most important subjects that support telecommunication industries. It is not very profitable; it hardly attracts considerable attention unless there is a problem. This is very similar to the position of electrical insulation research in which readers of this journal engage. We believe both research fields are essential to establishing fundamentals of our high-tech social life.

For further information, visit our website at "http://emc.nict.go.jp"

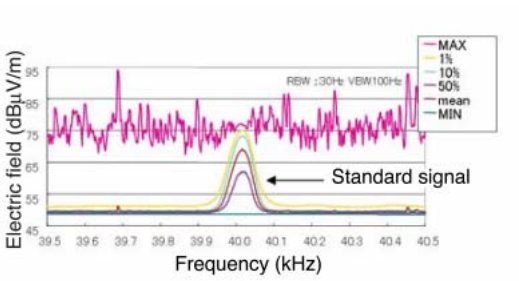

Fig.4 Electromagnetic environment measurement.

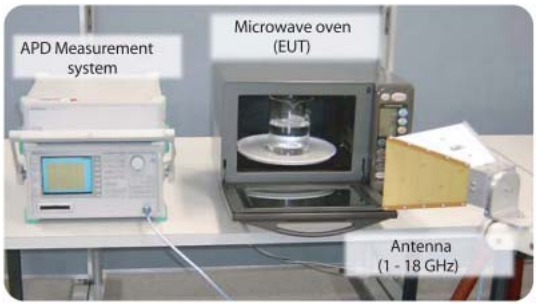

Fig.5 APD measurement system.

Fig.6 Electromagnetic environment monitoring car.

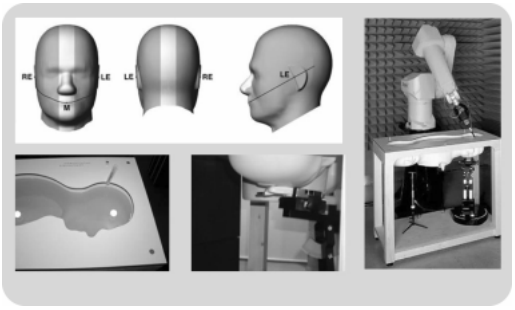

Fig.7 Spesific absorption rate measurement system for mobile phone safety test.

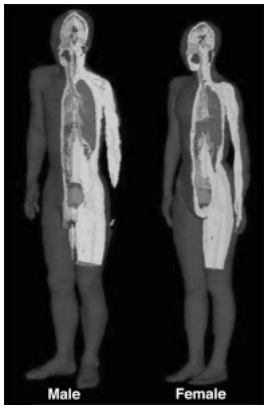

Fig.8 Numerical human models of Japanese adults.

Development of MgO/LDPE Nanocomposite Material for DC Insulation

Outline

Polymer nanocomposite materials have been given much attention as a new insulation material because the properties of the original material can be drastically improved by adding a few percent of nano-sized filler [1]. We have developed a nanocomposite material with nano-sized magnesium oxide (MgO) added to a low-density polyethylene (LDPE) [2]. The addition of only a few percent of nano-sized MgO in LDPE demonstrates following excellent effects for DC insulation [2, 3];

- The volume resistivity of LDPE increases by the power of 10.
- The amount of space charge in LDPE under high electric field is reduced.
- The DC breakdown strength of LDPE is increased.

Materials [2]

MgO nano-filler, which has an average diameter of 50 nm was mixed with LDPE. Before kneading, MgO was subjected to surface treatment with a silane coupling agent and to jet grinding treatment. The dispersion state of MgO in the MgO/LDPE composite material was evaluated by using a transmission electron microscope (TEM) as shown in Figure 1. Figure 1 shows TEM photograph of 5 phr sample. (phr: per hundred parts of resin, for example 1 phr means 1 g of MgO was mixed to 100 g of LDPE.) In this photograph, the lamella structure can be seen as a white stripes pattern. Other points, much darker in color than the surrounding area, can be seen. It was confirmed that these darker points were MgO by using energy dispersive X-ray fluorescence analysis (EDX) [2]. From the results of TEM investigation and EDX analysis, MgO of diameter 200 nm or less is dispersed in LDPE.

Volume resistivity [2, 3]

The volume resistivity of MgO/LDPE nanocomposite materials, which are about 200 μm thickness in the sheet specimen, were investigated. A three-terminal electrode system was employed and the diameter of the main electrode was 65 mm. Measurements were made at up to an electrical field of 80 kV/mm, and at temperatures of 90 ℃.

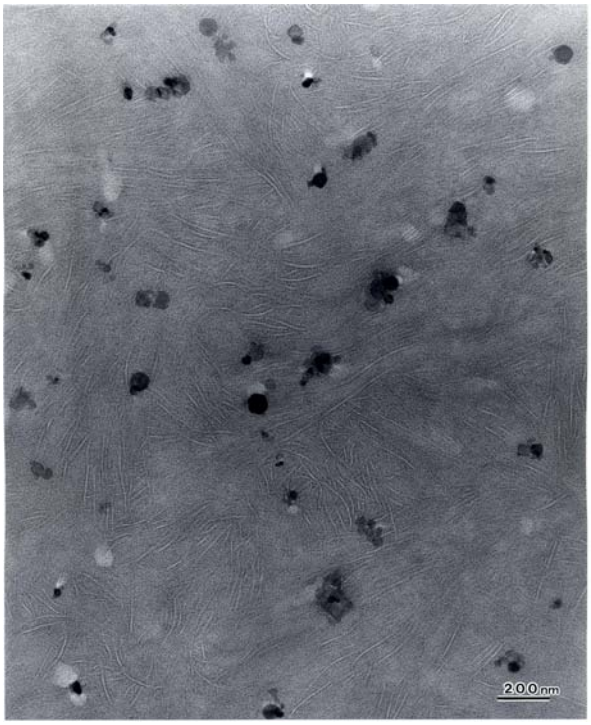

Figure 1: TEM photograph of MgO/LDPE nanocomposite material. MgO content is 5 phr.

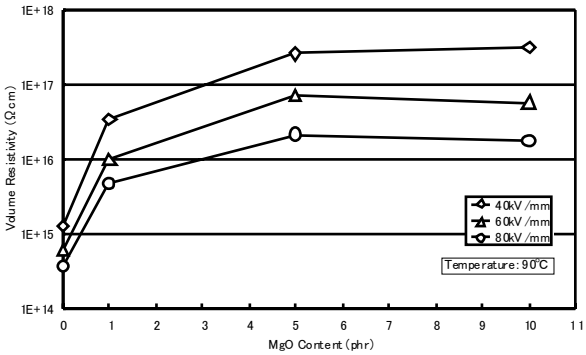

Figure 2: The dependence of MgO content on volume resistivity

The volume resistivity was evaluated from the leakage current value ten minutes after the measurement was began. Figure 2 shows the dependence of the MgO content on the volume resistivity under an electric field of 80 kV/mm. The volume resistivity of LDPE is increased more than 10 times by adding only 1 phr of nano-sized MgO. Up to the MgO content of 5 phr, the volume resistivity is increased as the MgO content is increased.

However, at an MgO content of more than 5 phr, the volume resistivity is not increased by increasing the MgO content.

Space Charge [3]

The space charge behavior in MgO/LDPE nanocomposite materials was measured with the PEA method (the pulsed electro-acoustic method). A sheet specimen of about 100 μm thickness was used. Both high voltage and ground electrode are formed by gold evaporation with a diameter of 10 mm. The space charge measurement was carried out at a temperature of 30 ℃. Figure 3 shows the space charge and electric field distributions in LDPE without MgO under a DC field of 124 kV/mm application. There was a positive charge accumulated 600 seconds after the voltage was applied. The electric field in the specimen is enhanced due to the accumulated space charge. This positive charge was injected from the anode and then moved in the direction of the cathode. Figure 4 shows space charge and electric field distributions in MgO/LDPE nanocomposite material with an MgO content of 1 phr. The positive space charge is accumulated near the anode 600 seconds after the voltage was applied. But the amount of accumulated charge is small and stress enhancement is much less in MgO/LDPE nanocomposite materials rather than in LDPE, though the electric field of 120 kV/mm or more is applied.

DC Breakdown Strength [3]

The DC breakdown strength of MgO/LDPE nanocomposite materials was measured applying a DC ramp voltage with a rising rate of 500 V/s. A McKeown type electrode system (sphere-sphere electrode system embedded in epoxy resin) was employed for the breakdown measurement. The test was carried out at a temperature of 30 ℃.Figure 5 shows the dependence of MgO content on the DC breakdown strength. The breakdown strength of LDPE increases by adding only 1phr of nano-sized MgO. However, the DC breakdown strength does not continue increasing when more MgO is added.

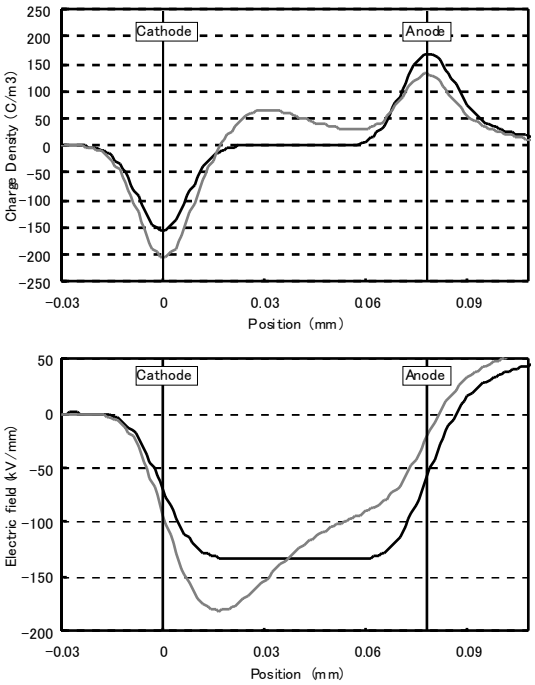

Figure 3: The charge density and the electric field distribution in LDPE (MgO content is 0 phr). The applied electric field is 128kV/mm. The thin line represents the date at 10sec and the heavy line at 600sec.

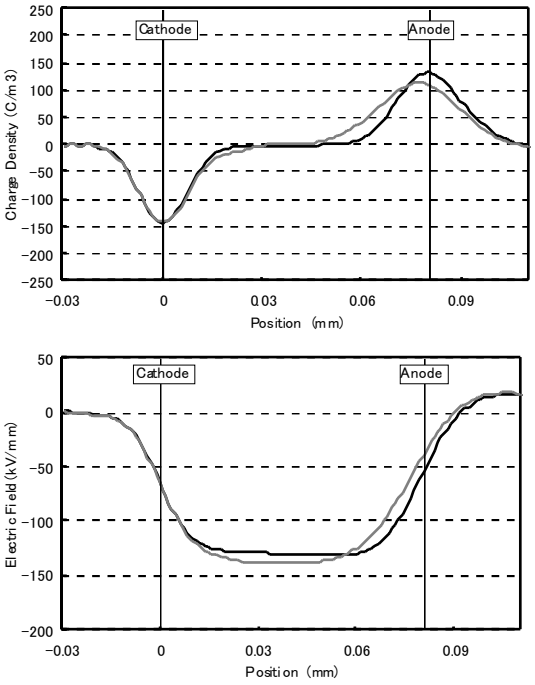

Figure 4: The charge density and the electric field distribution in MgO/LDPE nanocomposite material (MgO content is 1 phr). The applied electric field is 124kV/mm. The thin line represents the data at 10sec and the heavy line at 600sec.

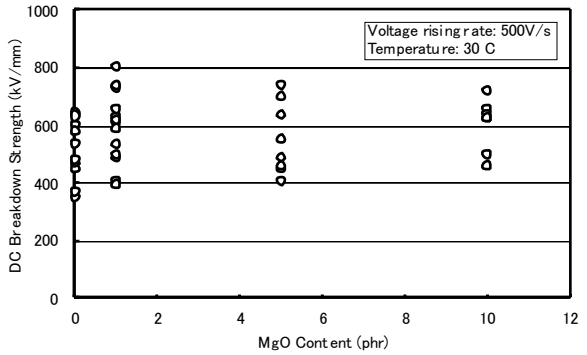

Figure 5: The dependence of MgO content on the DC breakdown strength.

Conclusions

A nanocomposite material, composed of nano-sized MgO-filler added to LDPE, was developed. The addition of nano-sized MgO in LDPE demonstrates following excellent effects;

1) The volume resistivity of LDPE, under 40-80kV/mm electric field application at a temperature of 90 ℃, increases by the power of 10 due to the addition of only a few percent of nano-filler.
2) The amount of space charge in LDPE under high electric field is reduced and the ratio of stress enhancement becomes less due to the addition of nano-sized MgO-filler.
3) The DC breakdown strength of LDPE is increased by adding nano-sized MgO-filler.

These results are good indication that the developed MgO/LDPE nanocomposite can be a candidate for DC cable or joint insulation.

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Development of Y-branch Type Joint for 275kV XLPE and Fluid-filled Cable

Introduction

In case new substations are planned to be introduced in the urban area, π branched lines are generally employed to connect to the nearest existing transmission lines. In order to minimize the cost of the switching equipment and cables, 275 kV Y-branch joint (hereafter called "YJ") was developed, which was so designed as to connect to not only the existing 275 kV XLPE cable but also the existing 275 kV fluid-filled cable. This newly developed YJ has been used in two actual commercial lines since 2002 and other three lines are under construction in Japan.

275kV YJ Construction

The construction of YJ is as shown in Fig.1. It consists of an epoxy unit, a pre-molded rubber-cone with a spring unit for the XLPE cable and oil-impregnated papers with an epoxy bell-mouth for the fluid filled cable. The cable conductors can be connected through multi-contacts, which are attached on each of conductor ferrules, to the electrode embedded in the epoxy unit.

The YJ has the following special features:

1) Large and Y-shaped cast epoxy,
2) With an embedded shielding electrode made of aluminum to minimize the weight.
3) Epoxy unit that can be used for not only fluid-filled cables but also XLPE cables.
4) Multi-contact conductor connection.

When only two cables are connected by YJ for temporary operation of the line, YJ can be put into service with the remaining mouth closed by an insulating plug.

Verification (Qualification & Type) Tests

Verification tests were carried out to confirm the performance of the YJ. The YJ's initial and long- term electrical test results confirmed the long-life of over 30 years operation.

1) Epoxy Unit Specimen Test

The heat-shock withstand test and the partial discharge test were carried out. All the test results were satisfactory and the large Y-shaped epoxy unit was proved to be manufactured without any defects.

2) Initial Performance Test

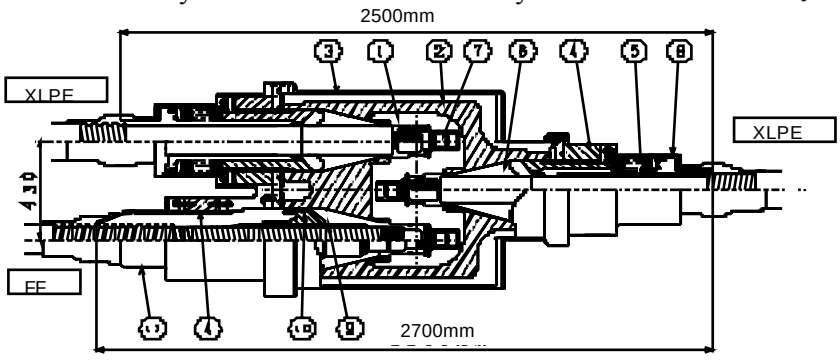
To verify the initial performance of the assembled YJ, partial discharge test, AC and Impulse withstand voltage tests, and AC and Impulse voltage breakdown tests, etc. were successfully carried out.

3) Long-term Loading Cycle Tests

A long-term loading cycle test for 6 months was successfully carried out with two circuits to verify the long-term performance of the YJ.

Conclusion

Through the initial electrical performance tests and a long-term loading cycle test, the developed YJ was verified to have sufficient electrical and mechanical characteristics for the 275kV transmission system.



1) Aluminum shielding electrode 2) Epoxy unit 3) Protective casing 4) Insulating tube 5) Spring unit
6) Pre-molded rubber-cone 7) Conductor ferrule 8) Protection casing for XLPE cable
9) Oil-impregnated paper 10) Epoxy bell-mouth 11) Protection casing for fluid filled cable

Fig. 1. Construction of 275kV YJ (XLPE-XLPE/Fluid-filled)

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Novel High Thermal Conductive Epoxy Resins

Introduction

The improvement of heat dissipation in electric and electronic devices has become a very important issue recently, because operating currents and circuit densities in devices show a consistent tendency to go up in various systems. Although the thermoset resins are mainly used for insulating materials, they have quite low thermal conductivities, usually a 1 - 3 order lower than those of ceramics and metals. So the technical key point should be to use insulating materials having higher thermal conductivities.

One approach is generally known and is used to apply composites of thermosets with inorganic ceramic powders having high thermal conductivities. This is effective for heat diffusion to some degree, but usually affects working, molding and processing and have high elastic moduli and low flexibilities. Intrinsic solutions for this problem should be to improve thermal conductivities of the insulating resins 'themselves'. These afford the higher thermal conductive composites with the same amounts of ceramic powder and the same thermal conductive composites with smaller amounts of ceramic powder.

We have developed the novel material design to improve the thermal conductivity of isotropic resins 'themselves' by controlling the higher order structure.

Novel Epoxy Resins Controlled Higher Order Structure

Fig. 1 shows the schematic representation of the higher order structure of the resin to afford macroscopic isotropy and high thermal conductivity. The proposed resin has three features;
(1) in the resin, there are microscopic anisotropic crystal-like structures by oriented mesogens in diepoxy monomers,
(2) the resin is macroscopic isotropy by disordering the domains of the crystal-like structure, and
(3) the crystal-like structure is connected with the amorphous structure inside by covalent bonds that let the boundary between them be indistinct.

This higher order structure would suppress the phonon scattering, affording high thermal conductivity of the resin. The resin has an amorphous region that is disadvantageous for improving thermal conductivity. But the amorphous region is also advantageous for maintaining good working, molding and processing and high flexibilities that are the general and important properties of the resins for manufacturing use.

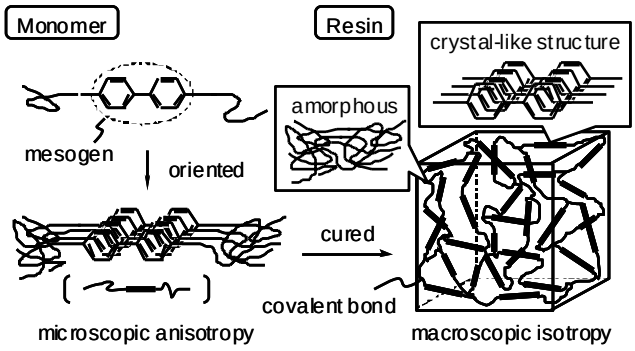

Fig. 1. Schematic representation of our approach to afford macroscopic isotropic resin having high thermal conductivity.

For this purpose, we have synthesized the novel liquid crystalline epoxy resin systems. These epoxy monomers were solid crystal at room temperature and have high melting points. The cured epoxy resins showed interference fringe by polarizing optical microscope observations under a crossed nicol situation as shown in Fig. 2, in comparison with observing no texture for the conventional bisphenol-A type epoxy resins. This result meant that the epoxy resins contained a crystal-like structure of highly oriented molecular groups.

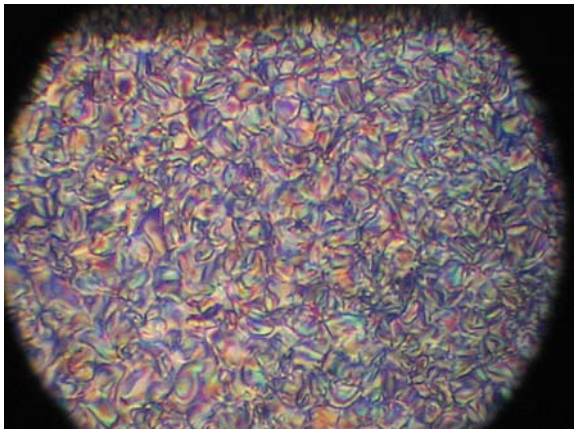

Fig. 2. Observed interference fringe by polarizing optical microscope under a crossed nicol situation.

The thermal conductivities of the developed epoxy resins were 0.25 – 0.96 W/m·K that were approximately 1.5 – 5.0 times higher than those of conventional epoxy resins of 0.17 - 0.21 W/m·K.

Furthermore, it was noticeable that these

values were higher than those of conventional high-density polyethylenes of 0.46 - 0.51 W/m·K (Fig. 3) known as having the highest thermal conductivities of all the insulating, organic, and macroscopic isotropic compounds. From these experimental results, our approach for improving thermal conductivity of insulating resin was proved, giving to epoxy resins with quite a high thermal conductivity.

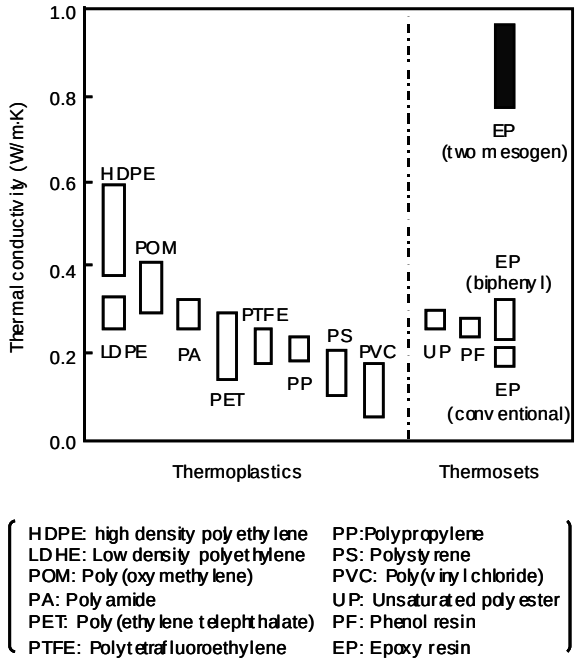

Fig. 3. Thermal conductivity of commercial resins and developed epoxy resins.

To obtain the evidence for the domain size of molecular ordering, we carried out direct observations at both mesoscopic (atomic force microscope; AFM) and microscopic (transmission electron microscope; TEM) scales. AFM and TEM images of the developed resins are shown in Fig. 4. The developed resin system shows an obvious lattice structure in the TEM image and large domains with sizes of about several micrometers in the AFM image. Furthermore, the domains form 'honeycomb' structures in the amorphous matrix, suggesting that most of the regions of the developed resin have higher order structures. On the other hand, no domains of order-structures can be recognized in the TEM and AFM image of conventional resin. Therefore, the existence of higher order structures in the resins definitely improves their thermal conductivities of resins 'themselves'.

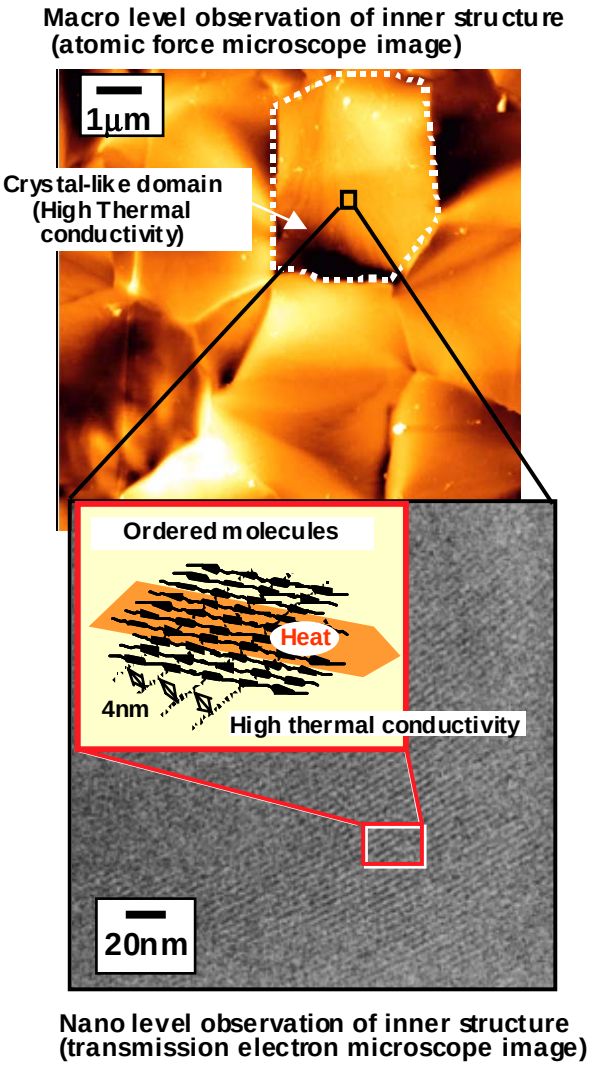

Fig. 4. Observation of inner structures of the developed epoxy resins by AFM and TEM.

Conclusion

We proposed a novel material design to improve the thermal conductivity of isotropic resins 'themselves' by controlling high order structures. By mixing this resin with certain kinds of ceramic powder (filler), it is enabled to obtain the higher thermal conductive composites, which has not reached by the conventional resin. The composites would be widely applied to the portable, multi-layered printed circuit boards for automobiles, the insulating sheets for power devices, casting and molding compounds, the insulated system for rotating machines, etc.

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Successful Field Tests of the World's Longest 500-m HTS Power Cable

1. INTRODUCTION

A high-Tc superconducting power cable (HTS cable), which enables high-capacity power transmission with its compact size, is expected to bring about significant advantageous effects as environmentally friendly and cost effective. A 500-m long HTS cable project has been carried out as a part of the Super ACE project of METI, being commissioned by NEDO to Super-GM, in order that we have studied the details of basic operation characteristics and the issue of long distance cooling with liquid nitrogen toward practical use. A 500-m HTS cable manufactured by Furukawa Electric has been laid in the Yokosuka laboratory of CRIEPI. Furukawa and CRIEPI have been conducting since April 2004 various tests including those for installation, basic characteristics, rated loading characteristics, load fluctuation characteristics, and limiting and overloading performance.

2. STRUCTURE OF HTS CABLE

Figure 1 shows the structure of the HTS cable. The HTS cable was designed with nominal voltage of 77 kV and current capacity of 1 kA. The HTS cable had a single core structure with an HTS shielding layer and a cold dielectric type electrical insulation, outer diameter of 133-mm, which enabled to install it into an underground duct with an inner diameter of 150-mm. The copper stranded wire was adopted as a former to sustain the tensile stress up to 17-kN during installation and to keep the short circuit current capacity of 31.5-kA for 0.5-s. A conductor layer and a shield layer were comprised of Bi2223 tapes. Around the core former, intervened by an electric insulation of 8-mm in thickness. The cryostat pipe had a structure of vacuum thermal insulation whereby super-insulations were multi-layered between double corrugated pipes of SUS.

3. TEST LINE AND COOLING SYSTEM

Figure 2 schematically shows the layout of 500-m HTS power cable test system. The three-dimensional layout had several distinguishing points to simulate the actual laying configuration, such as an underground section, a 10-m-high rising and falling section and an offset section for absorbing the thermal contraction and expansion simulating the conventional underground cable laying.

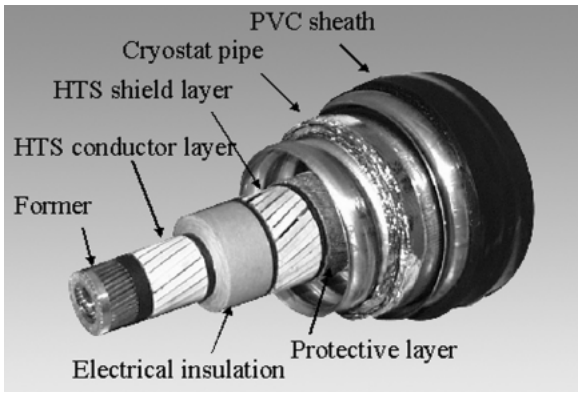

Fig.1 Structure of 500 m Cable

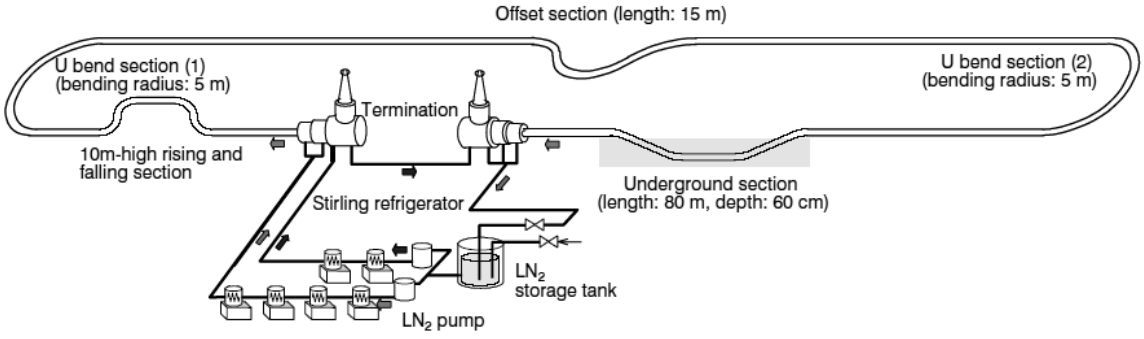

Fig.2. Schematic view of the layout of 500-m HTS power cable test system.

Fig.3. Terminals for 500-m cable tests

4. TEST RESULT

(1) Cable installation test

The cable installation was successfully executed for about 200-m duration including the 5-m-radius bending section and the underground section. A test piece that clipped from the head of the installed cable was no degradation in the critical currents before and after the transportation and the installation.

(2) Basic property test

The electrical basic properties, such as an initial withstand voltage and Ic, are shown in table 1. The HTS cable satisfied the designed specifications and was almost not damaged by the transportation, the laying and the heat cycle period.

(3) Rated loading test

A conduction current of 1000-A was continuously imposed for one month at a voltage to ground of 70-kV. These conditions were determined assuming insulation degradation in 30-years. After the one-month voltage and current loading, a 95-kV withstand voltage test was passed without occurrence of partial discharge. Thus, it was confirmed that electric insulation had good performance.

(4) Load fluctuation test

The current was made to fluctuate simulating daily load fluctuations in an actual system, and the behavior of the cooling system was investigated. Although certain amount of overshoot was observed, the system stabilized in about 3 hr.

(5) Limiting test & Overloading test

Refrigerators were stopped while continuing the rated loading test (70-kV, 1000-A), and temperature, pressure and partial discharge of the cable have been monitoring. The pressure reached its limitation first in 3 hr 30 min. In addition, all cooling function including refrigerators and pumps was halted for one-hour, keeping rated-power loading. No P.D. was detected and no problem occurred in both conditions.

Table 1. Results of basic property tests

Item	Value
Ic of the conductor	1570 A
Ic of the shield	1350 A
Withstand voltage	95 kV for 10 min
P.D. test	No P.D. at 95 kV Noise level of 100 pC.
Heat invasion	1.2 W/m
AC losses	1.3 W/m at 1 kA

5. CONCLUSION

The HTS cable withstood all the items of this field test without being damaged. It has been confirmed that the cable had high reliability because the cable has withstood various tests. The important achievements have been accomplished through this series of tests, and obviously contribute to practical applications of the HTS cable in terms of design, testing, installation and operation.

Reference

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An Electromagnetically Actuated Vacuum Circuit Breaker for 24kV Rated Switchgear "HS-X"

An electromagnetically actuated vacuum circuit breaker (VCB) for 24kV rated Switchgear "HS-X" has been designed and developed on the basis of the transient electromagnetic analysis coupled with motion[1]. The VCB has three advanced bi-stable electromagnetic actuators, which control each phase independently in Fig.1. The VCB serves as a synchronous circuit breaker as well as a standard circuit breaker. In this work, the flux delay due to the eddy current is analytically formulated using the delay time constant of the actuator coil current, thereby leading to accurate driving behavior. With this analytical method, the electromagnetic mechanism for a 24kV rated VCB has been optimized; and as a result, the driving energy is reduced to one fifth of that of a conventional VCB employing spring mechanism, and the number of parts is significantly decreased. Therefore, the developed VCB becomes compact, highly reliable and highly durable.

Fig.1. Photograph of the advanced electromagnetically VCB rating 24kV.

Description of mechanism

The developed VCB rating of 24kV is shown in Fig. 2 and specifications of this VCB are listed in Table 1. This VCB has three sets of vacuum interrupter, insulating rod, contact pressure spring and electromagnetic actuator. All parts are assembled on a straight line and the interrupter is driven directly by the actuator, thereby minimizing mechanical loss. Moreover, the VCB allows emergency manual trip operation similar to the conventional VCB employing spring mechanism. This breaker has an advanced bi-stable electromagnetic actuators, which control each phase independently. Fig.3 illustrates its closing principle using calculation results by 3-D FEM electromagnetic analysis. The operating system is composed of three electromagnetic actuators and an electronic control system. Actuators assembled on a straight line for each phase can be operated independently, thereby minimizing mechanical loss.

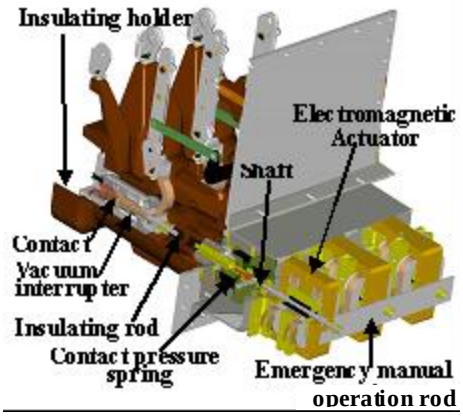

Fig.2. Inside structure of 24kV rated VCB.

Table 1. Specifications of 24kV rated VCB

Rated voltage (kV)	12	24
Rated normal current (A)	630/1250	
Rated short-circuit breaking current (kA)	25	
Rated making current (kA)	63	
Break time (cycles)	3	
Rated operating sequence : O-0.3s-CO-15s-CO		

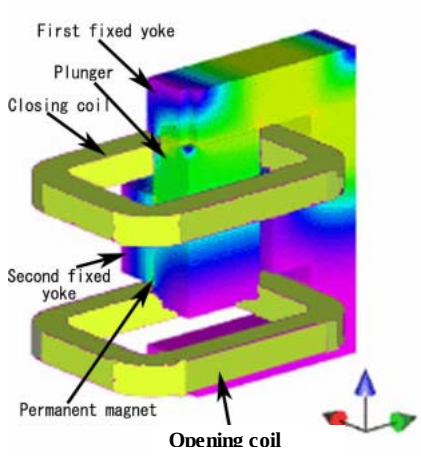

Fig.3. Operating principle of the actuator. (Coils are full models and materials are 1/4 models.)

Coupled analysis method and results

In this work, the flux delay due to the eddy current is analytically formulated using the delay time constant of the actuator coil current and the law of conservation of momentum at the non-continuous position of the moving mass and the contact pressure force as shown in Fig.4, thereby leading to accurate driving behavior as shown in fig.5. The performance of the 24kV rated VCB is summarized in Table 2. The electromagnetically operating mechanism has been optimized with this analytical method. Especially, CO operating energies has been reduced by optimizing the number of turns and the wire diameters of the coils. As a result, the number of individual parts has been reduced to 65% and CO operating energies have also been reduced to only 20% of the conventional spring mechanism. These results clearly indicate high durability and high reliability. Now, 80000 CO operations have been confirmed in the prototype electromagnetically mechanism. The VCB serves as a synchronous circuit breaker as well as a standard circuit breaker.

Table 2. Comparison with the electromagnetic and the spring mechanism

	Advanced electromagnetically Mechanism	Conventional spring Mechanism
Number of parts	65%	100%
Operating energies	20%	
Break time	3cycles	
Power supply	80V DC	

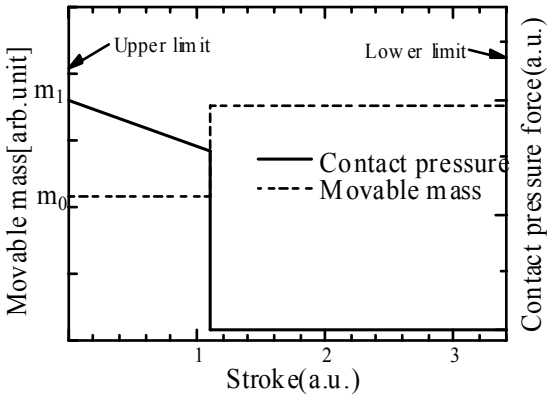

Fig.4. Stroke dependence of the mass and the contact pressure force.

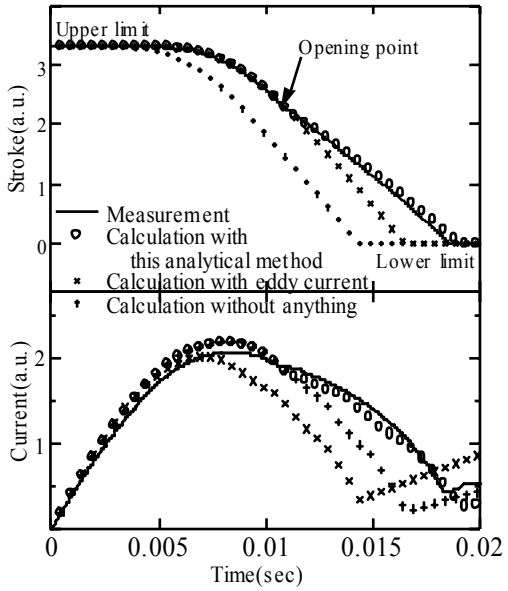

Fig.5. Calculated and measured strokes and currents on the opening operation

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[1] T. Takeuchi et al, "An Electromagnetically Actuated Vacuum Circuit Breaker Developed by Electromagnetic Analysis Coupled with Motion", IEEJ Trans. PE, Vol.124, No.2, 2004

MISCELLANEOUS

Photos on Front and Rear Covers

Front Cover: Korea Electrotechnology Research Institute (Changwon, Korea)

This figure shows the testing facilities installed for testing of ultra high-voltage apparatus and view of power arc test for medium voltage class insulator at the high-power testing facility in Korea Electrotechnology Research Institute (KERI).
KERI has been established in Changwon, Korea in 1976, as the non-profit and independent national organization for the purpose of developing and disseminating new knowledge and technologies in the fields of the electrical industry and electrical power business.

KERI has 4 Research Laboratory (Electric Power Research Laboratory, Industry Applications Research Laboratory, Advanced Materials & Application Research Laboratory, Fusion Technology Research Laboratory) and one Testing & Evaluation Division. Research about electrical insulation is carrying out actively in six research groups including Power Facility Diagnosis Research Group. Testing and evaluation service for heavy electrical apparatus of power system, such as power circuit breaker, load break switch, switchgear, power transformer and insulator etc., is one of major activities.

Now, Testing & Evaluation Division in KERI is providing the effective and utmost testing services for manufacturers and end users all around the world.

One facility has been installed at Changwon close to Busan, in 1982 for specially ultra high-voltage class apparatus and consisted of two major parts of :

The high-power testing facility made up of short-circuit generator with its short-circuit capacity of 4000MVA at 3 cycles and additional synthetic testing facilities with capability of 1600kVdc charging voltage, 8MJ.

The high-voltage testing facilities with 1600kV AC power frequency withstand voltage test transformer and 4MV impulse withstand voltage generator.

In the year of 2000, one more testing facility with its short-circuit capacity of 500MVA has been constructed particularly for the medium voltage apparatus at Euiwang close to Seoul, in order to provide testing services for the medium voltage apparatus.

With above facilities, KERI has been providing the top-class testing services and can fulfill the performance evaluation capability up to 550kV, 63kA power circuit breaker, as full-pole testing method.

(by Dr. Kang, Dong Sik, KERI,
Changwon, Korea)

Rear Cover: AFM images of Nanocomposites materials (Waseda University, Kagoshima National College of Technology, Japan)

Polymer nanocomposites are defined as polymers in which small amount of nanometer size fillers are homogeneously dispersed by only several weight percentages. These nanocomposites materials are considered to be suitable for electrical insulation. Partial discharge (PD) degradation was investigated to compare a polyamide (PA) nanocomposite with a PA microcomposite and a PA without fillers, or a base polymer. The nanocomposite was a reinforced PA with 4 weight (wt) % additions of nm-size layered silicates. The microcomposite was a reinforced PA with 30 wt % additions of μm-scale glass fibers. Such materials were exposed to PDs under the IEC(b) electrode configuration for evaluation of PD resistance. Comparison was made as to the surface roughness using atomic force microscopy (AFM).

The left, middle, and right figures show AFM images of the degraded areas in the base polymer, the microcomposite, and the nanocomposite, respectively, after PD degradation. Here, the division scales of the two axes representing two planar directions are 10 μm/div, while that of the height axis is 6 μm/div except for the right figure where it is 2 μm/div. From these figures, it is shown that the degraded area of the nanocomposite is as smooth as the non-degraded area. It is also clearly shown that the degraded area of the base polymer and the microcomposite is far rougher than that of the nanocomposite. Especially, on the degraded surface of the microcomposite, a glass fiber about 13 μm in diameter is clearly seen, although the non-degraded surface was as smooth as the non-degraded base polymer. It is concluded that the PA nanocomposite is more resistant to PDs than the PA microcomposite and the PA without fillers.

(by Masahiro Kozako,
Kagoshima National College of Technology,
Japan)

IEEJ Technical Reports Edited by TC-DEI and Related TCs

Technical reports listed here are made by investigation committees in the technical committee on DEI and related investigation committees since the publication of EINA No.11 (2004). They are described in Japanese.

No. 976 : "Evaluation Methods and Countermeasures of Audible Noise and Aeolian Noise from Overhead Transmission Lines"
(B), p.84, Aug., 2004, ¥2,625

No. 982 : "Partial Discharge Detection Technologies in Gas Insulated Apparatuses"
(A), p.70, Aug., 2004, ¥2,520

No. 985 : "Material technology for GIS"
(B), p.80, Sep., 2004, ¥2,520

No. 986 : "Status report on the installation and the operation of power capacitors in Japan"
(B), p.40, Sep., 2004, ¥2,310

No. 992 : "Research on the phenomena preceding earthquake by the observation of electro-magnetic field in environment"
(A), p.72, Dec., 2004, ¥2,520

No. 993 : "Current State and Trends of Technology for Gas Circuit Breakers"
(B), p.72, Jan., 2005, ¥2,520

No. 1001 : "Control Technology of Electrical Discharge in Vacuum Relevant to Generation of High Energy Density"
(A), p.86, Jan., 2005, ¥2,730

No. 1013 : "New light sources and Measurement"
(A), p.88, May, 2005, ¥2,835

No. 1016 : "Wire and Conductor Technology of Superconducting Materials"
(A), p.64, May, 2005, ¥2,520

No. 1018 : "Recent Developments on Pulsed Power Generation and Application"
(A), p.64, May, 2005, ¥2,520

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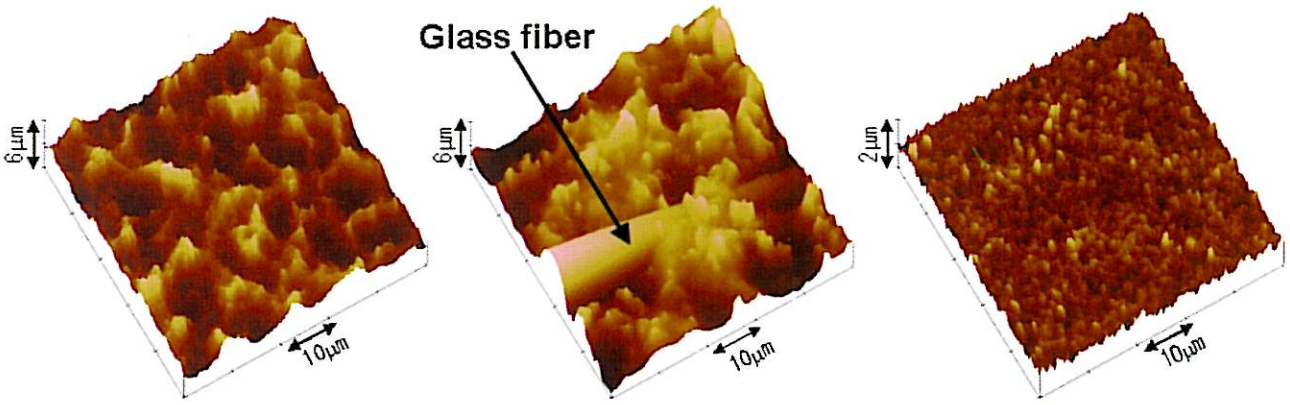

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