Electrical Insulation News in Asia

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IEEJ

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MISCELLANEOUS

PREFACE

Prof. T. Tanaka

World is changing: Please participate.

You are major players. Why don't you join us positively in our EINA activities? Two toys are available for you to play with. You are approaching EINA Magazine No.11 (2004) and ever changing EINA Website for you to enjoy and feed your opinion back. You may participate, communicate and urge a future change.

Somebody said, "Change has become a constant. In order to manage it, we need an expanding discipline. The way we embrace it defines our future". It is also true of our field: dielectrics and electrical insulation from gases and liquids to solids as well as high voltage engineering. World is shrinking as you recognize in daily life. We are getting closer and closer. International conferences or symposia we have to attend are often held, and tend to become more and more specialized year by year. We feel inconvenience in communication.

What should we do for the future? We await a change and even are forced to face it. We imagine a changing engineering society. Science and technology changes our society of course, and now people with different culture meet often, resulting in changing the world in return. Rapidly developing countries and rather stabilized developed countries must go together. It is traditionally stated that technologies flow downstream from developed countries to developing countries. It is partly true but not always. No wire telegraphy is necessarily welcomed by the developing countries. Wireless digital phones diffuse all over the world. There is no difference between the two. High-tech goods are often exported from the developing countries to the developed countries. Technologies and cultures flow downstream or upstream, depending on their kind. It is very much complicated.

Even in the field of electrical insulation, advanced materials such as nanodielectrics emerge and advanced asset management with data base and knowledge engineering should be tackled. Electrical insulation and high voltage engineering are diverse, dynamic and interdisciplinary in the engineering world. Such advanced technologies are needed equally in the developing countries as well as the developed countries.

We have to cooperate in any way. So we need another different communication tool, either. We recognize that our EINA activity is playing an important role for mutual communication and understanding. EINA magazine has helped in filling a communication gap for ten years. And then our Website came in three years ago, and has grown up gradually.

Here you are at No.11 issue. We try to include news and articles from Asian and Pan Pacific countries and regions. At the front cover you may see pictures from Tsinghua University (Graduate School at Shenzhen) and Wuhan University with their respective message. You may enjoy another article from Beijing Key Laboratory, China on High Voltage and Electromagnetic Compatibility. We have an article from Korea, too. It explains active investigation at Electrical and Optical Materials Laboratory of Wonkwang University. There are lots of records and announcements on international conferences and symposia in Asia.

The Magazine starts with activity reports from several IEEJ technical committees. The committees have their own sub-committees (named as investigation committees) on their respective specific themes such as

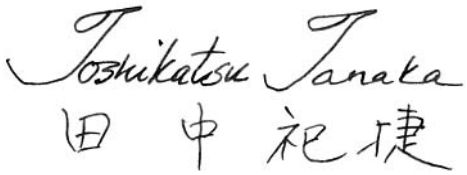
nanocomposites. So you may find several contributions from some of the investigation committees. And then you come over to “Jam Sessions” on symposia and laboratory tours that some of you participated in.

Where are you heading for? You can catch a glimpse of future technologies. There are four articles on HV cable terminations, switchgears, distribution equipments, and testing equipments for wires and cables. Then a new section comes out on “BOOK REVIEW”. On the rear cover, you meet with a new scientific new world “Charge Chromatography”: a beautiful representation of the space charge profile in a polymer.

And then, publications from investigation committees are listed for your convenience. Unfortunately they are all written in Japanese. Finally you may find a list of members of EINA Magazine Committee who have been engaged in cooperative work on IENA Magazine and Website. I personally acknowledge all of them for their dedication to these activities. Without their positive engagement, we have not made our publication available for you.

Please enjoy the articles and feed your opinion and articles back for next publication. We hope you will click http://eina.ws and correspond to eina@eina.ws without hesitation.

Professor Toshikatsu Tanaka, Waseda University
Chairperson of EINA Committee



OUTLINE OF TECHNICAL COMMITTEES IN IEEJ

Dielectrics and Electrical Insulation (DEI)

Chairperson:	T. Okamoto (Central Research Institute of Electric Power Industry)
Secretaries:	K. Uchida (Chubu Electric Power Co. Ltd)
	Y. Miyashita (Mitsubishi Cable)
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 35th Symposium was held at Nagoya University on June 1-5, 2003 as part of the 7th International Conference on Properties and Applications of Dielectric Materials (ICPADM) with more than 307 papers and 260 participants in spite of SARS problems. ICPADM was sponsored by IEEE DEIS and co-sponsored by IEE Japan. At the 7th ICPADM, Ieda Memorial Lecture was established to praise Prof. M.Ieda's great contribution to DEI technology development. The TC-DEI is planning to organize 36th Symposium (2004 SEEIMAS) to be held at Shibaura Institute of Technology, Tokyo with General Chair of Dr. T.Okamoto. TC-DEI also plans 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 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.

Table 1 Investigation Committees under TC-DEI

[Macro-positioning of DEI technology]

- Applications of Environmentally friendly materials to Electrical Apparatuses
  (04/04-03/07, Chairman: Y.Suzuoki (Nagoya University))
- Economical Assessment of Diagnosis for Power Apparatus
  (04/04-03/07, Chairman: N.Hozumi (Toyohashi University of Technology))

[New materials including nano-materials]

- Properties and Novel Functions of Nano-structured Organic and Composite Thin Films and Device Applications
  (04/04-03/07、Chairman: F.Kaneko (Niigata University))
- Dielectric and Electrical Insulating Materials for Communications Technology
  (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))
- Polymer Nanocomposites and their Applications as Dielectrics and Electrical Insulation
  (10/02-09/05, Chairman: T.Tanaka (Waseda University))

[Diagnosis of electric and electronic equipment]

- On-line Diagnosis for Electrical Equipments
  (01/03-12/05, Chairman: K. Uchida (Chubu Electric Power Company))
- Degradation of Insulating Properties and Endurance of Impulse Surge for Printed Wiring Board
  (04/02-03/05, Chairman: Y.Yamano (Chiba University))

[Basic dielectric and breakdown phenomena]

- Charge Behavior Associated with Interfaces under High Electric Field
  (07/02-06/05, Chairman: M. Nagao (Toyohashi University of Technology))
- Evaluation of Discharge Property and Degradation Phenomenon on the Surface of Polymer Insulating Materials
  (04/02-03/05, Chairman: K. Gotoh (Consultant))

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)
	T.Murata (Toshiba Corporation)

The Technical Committee on Electrical Discharges (TC-ED) belongs to the Fundamentals and Materials Society (A-Society) of the IEE of Japan. The activities of the Committee have been covering mainly physics of electrical discharges in various media and their technologies.

Now, 4 investigation committees are organized in the TC-ED and are running for survey of the subjects listed in Table 1. A new committee on the field of plasma application for the environmental purification technology will be organized in the beginning of 2005.

The report of the investigation committee is normally published as the technical report of IEEJ. 3 reports will be published in 2005 from the TC-ED and the web site of data-base on the basic processes of interaction between charged/excited particles and atoms/molecules will be prepared.

The TC-ED is supporting more than 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 for the last three years. More than 20 papers are presented at the session and many fruitful discussions are carried out every year.

The international conference is also promoted by the TC-ED. “Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering” will be held on 2005 in Korea. “International Symposium on Discharges and Electrical Insulation in Vacuum (ISDEIV)” are now planning to be held at Matsue city, Shimane prefecture, in 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 for two days. The seminar will be held at Gamagori in Aichi on November 4 and 5.

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)

Pulsed Electromagnetic Energy (PEE)

Chairperson: Kiyoshi Yatsui (Nagaoka University of Technology)
Vice Chairperson: Kazuhiko Horioka (Tokyo Institute of Technology)
Secretary: Weihua Jiang (Nagaoka University of Technology)
Assistant Secretary: Hidekazu Tsuchida (Central Research Institute of Electric Power Industry)

The Technical Committee on Pulsed Electromagnetic Energy (TC-PEE) was set up in July 1999, to offer the opportunities for the members of IEE of Japan in the R & D on pulsed power technology and associated applications.

It has been successfully available to achieve extremely high energy-density state by the pulsed power technology, even for very short time duration. To study from various points of views is very important not only from a physical aspect, but also from a lot of applications. In fact, the extreme state achieved is closely correlated with many applications because it involves extremely high temperature, high pressure, high electric filed, high density, high magnetic field strength, etc.

Regularly, Technical Committee Meetings are held four times a year. Furthermore, once a year, the Meeting has been held as the international symposium in the name of “International Symposium on Pulsed Power and Plasma Applications (ISPP)”. The first ISPP-2000, supported by the Korean Institute of Electrical Engineers, was held in Korean Electrophysics Research Institute (KERI), where 44 papers were presented from 7 countries. The 2nd ISPP-2001 was also held in KERI, where 69 papers were presented from 9 countries. Representatives from China also participated. The 3rd ISPP-2002 was held in Mianyang, China, where 107 papers were presented from 10 countries. The 4th ISPP-2003 was held in Nagaoka on Oct. 20 and 21, 2003, with 84 papers and 98 participants. The 5th ISPP-2004 will be held in KERI on Oct. 18 & 19, 2004. Basically, the ISPP meetings will be held every year in the good collaboration among Japan, Korea and China. In addition, first Joint Technical Meeting between Japan and USA started in 2002, the first one of which was held on Aug. 5-7, 2002 in Kona, Hawai, co hosted with the Technical Committee on Plasma Science and Technology. The 2nd one was also held in Maui, Hawai on Aug. 5 & 6, 2004.

As of 2004, there is one investigation committee in TC-PEE, the name of which is "Production and Applications of Pulsed Electromagnetic Energy". The chairperson, secretary and assistant secretary are Weihua Jiang (Nagaoka University of Technology), Sunao Katsuki (Kumamoto University), and Hiroyuki Shinkai (Central Research Institute of Electric Power Industry), respectively. Regularly, there are four meetings a year.

The main topics to be discussed in the regular research meetings (Pulsed Power Technology: PPT) involve development of pulsed power technology (e.g., power supply, switches, insulation technology), energy transfer technology of pulsed power (e.g., electron beam, ion beam, laser beam, pinch discharge, plasma focus), production, control, diagnostics, theoretical and computer simulation of extremely high energy-density state, applications of extremely high energy density state (e.g., microwave, materials, environment, radiation source, particle acceleration, flier acceleration, strong electromagnetic wave, inertial confinement fusion, free electron laser, X-ray laser, excimer laser, ultrahigh pressure / density / temperature / magnetic field strength, diagnostics, luminescence / display), and so on.

Recently, much attention has been paid on the development of highly repetitive pulsed power supply using semiconductor switches such as MOSFET, IGBT and SI thyristor. Wide applications have been available by pulsed power technology such as in materials, environment, biochemical or medical sciences.

The regular research meetings (PPT) are open for everybody who is interested in the pulsed power technology and associated applications.

Electromagnetic Theory (EMT)

Chairperson: M. Hayakawa (The University of Electro-Communications)
Secretaries: M. Matsumoto (Osaka University), K. Hattori (Chiba University)
Assistant Secretary: Y. Ando (The University of Electro-Communications)

Objectives

Electromagnetic theory (EMT) is the most fundamental subject which provides us with an important basis to the electrical engineering, electronic engineering, information communication engineering and related engineering. Nearly all kinds of equipments and systems just around us are associated with any techniques based on the electromagnetic phenomena, and so the electromagnetic theory is used in developing and designing those systems. Also, the electromagnetic theory is of essential importance in analyzing the interaction of electromagnetic fields with different kinds of media and also in the interaction of electromagnetic fields with the environment and biological systems. Thus the electromagnetic theory is contributing a lot to many other science and engineering fields.

The electromagnetic theory seems to be an old subject, but is still developing because numerous works are being carried out. A lot of research is under way on the fundamental theory of electromagnetic fields and also on its application to different fields. A new direction in recent years is the enormous development of different kinds of computational electromagnetics owing to the development of computers. These computational electromagnetics has been found to be of potential use in different fields.

We believe that the Japanese workers have been making outstanding contributions in the field of electromagnetic theory and related fields. We would like to maintain this qualified position of Japan in this field, by promoting the collaboration with foreigners and by bringing up the young Japanese colleagues who would contribute to the global activation of this electromagnetic society.

Purposes

The purposes of our technical committee are summarized as follows:

- Systematization of the study of electromagnetic theory
- Promotion of collaboration in each field of electrical engineering using the electromagnetic theory
- Providing the members of IEE with the information and knowledge of our committee and enlightening activity of our technical committee.
- Level up of our society by interaction with the domestic and foreign workers through the collaboration, and in the international conferences, etc.
- Education of electromagnetics to the students and growing up the young engineers in the next generation

Scientific scope of our technical committee

The scope of our technical committee includes;

- Fundamental theory of electromagnetics (including relativistic theory, quantum electrodynamics, etc.)
- Analysis theory of electromagnetic fields
- Numerical solutions and modeling of electromagnetic fields
- Simulation techniques of electromagnetic fields
- Scattering and diffraction of electromagnetic waves
- Interaction of electromagnetic fields with media (including laser, plasma, random media, etc.)
- Nonlinear problems
- Inverse problem, inverse scattering
- Electromagnetic environment
- Electromagnetic effect on biological systems
- Other related fields.

Activity

1. Investigating committees
   In our technical committee the following three investigating committees are now running, and we describe these separately later on.
   I. Computational Electromagnetics
   II. Natural Electromagnetic Phenomena and Electromagnetic Theory
   III. Nanometer-electromagnetic Waves and X-ray Fields Technology
2. Publication of a special issue on "Electromagnetic Theory and Its Application."
   This special issue (in English) was the collection of papers presented in the last regular EMT symposium held in Yamashiro spa last autumn. This special issue will include more than 30 papers and is scheduled to appear in December, 2004.

EMT symposium in Awaji

The EMT symposium has a long history of more than 30 years, and it is a regular meeting in which nearly all active workers in this field will join to-

gether to have extensive discussion on different subjects. This year this will be held at Awaji on September 27-29, 2004. More than 70 papers will be presented there.

Electromagnetic Compatibility (EMC)

Chairperson: O. Fujiwara (Nagoya Institute of Technology)
Secretaries: Y. Mizuno (Nagoya Institute of Technology)
T. Funaki (Kyoto University)
Assistant Secretary: K. Miyajima (Central Research Institute of Electric Power Industry)

Electromagnetic environment is the space 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. The committee has organized several dedicated research committees and has been working on research and survey in these fields. This report describes the committees' recent activities.

1. Investigation Committee on EMC problems in electric power system

This committee was established in July 2000 and closed in December 2002. Prof. Zen Kawasaki of Osaka University, chaired it. The purpose of this committee was to survey the EMC problems occurring in power apparatuses and power electronics instruments. In that field, EMC analyses have been conventionally limited to an individual system without considering the mutual interaction with other systems, and therefore this committee especially focused on the mutual EMC interactions among systems. The final report was published in December 2003.

The committee organizes technical conferences annually. This year the conference was held on 17 January. The committee also held a well coordinated seminar on 17 July 2004.

2. Investigation Committee on Pre-occurrence Phenomena of Earthquakes by the Observation of Ambient Electric Field.

This committee was established on December 2001 as a succeeding committee of Electromagnetic Phenomena Relating to the Occurrence of Earthquake, which belonged to the Technical Committee of High Voltage Engineering. The committee was chaired by Emeritus Prof. K. Horii of Nagoya University. It aimed at surveying the current technologies on earthquake prediction from the electromagnetic phenomena accompanied by earthquakes and discussing about their limitations. The committee was closed on September 2004 and now is devoting to the preparation of its final report. The report will give an overview on the measurement method of electromagnetic fields, antecedent electromagnetic phenomena of earthquakes, and the relationship between the observed electromagnetic phenomena and the earthquakes.

The committee was active not only in surveys but also in researches. It has held 13 meetings, 4 research conferences, and one symposium at the

annual conference of IEEJ. A memorial lecture is also planned on 17 January 2005 as the 10th anniversary of Great Hanshin earthquake.

3. Investigation Committee on Home Networks and EMC

This committee was established in October 2002 for surveying EMC problems and countermeasures in home network systems. The home networks include the wireless LAN, power line and ultra wide band communications, and the communication media are related to the xDSL (asymmetric digital subscribe line), CATV and radio waves. The committee was chaired by Prof. M. Tokuda, Musashi Institute of Technology. It has held 8 meetings and received 35 reports. The researches reveal the EMC problems such as radio wave interference in wireless LANs, radio-frequency leakage from power line communication systems and the interference between ultra wideband systems and other systems. The problems also relate to the spectrum administration in xDSL, mixture noises in CATV and radio-frequency interference in wireless access. The committee was closed in September 2004 and now is devoting to its final report. The committee will also hold a seminar relating on the report in December 2005.

4. 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.

5. Investigation Committee on Earthquake Prediction by Electromagnetic Filed Measurement

This committee has just been established in September 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.

6. 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: Seishi Sekine (Niigata University)
Secretaries: Yukitaka Shinoda (Nihon University)
Hisashi Honda (Toshiba Lighting & Technology Corporation)

The technical committee on light application and visual Science (TC-LAV) belongs to the Fundamentals and Materials Society (A-Society) of the IEE of Japan. Activities of the 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 ray, and fine lithography. Now, four investigation committees (IC) are running for survey of the subjects listed in table 1.

Role of the IC of ultra fine lithography is to investigate subjects of present lithography and the related matters and forecasting future progress and the possibility. This TC has already held 12 normal meetings and 2 special meetings, and themes are discussed very eagerly every time. Special meeting related to emersion lithography will be held on Nov. 12 this autumn, and the technology will be discussed deeply by opening the meeting to general researchers. As next generation lithographic technologies, projection lithography using extreme ultra violet light, electron-beam projection lithography, direct writing, proximity printing, and other some methods are also researched eagerly. This TC will continue the investigation till next March for introducing a report.

The IC of multiple infrared application is, at the present time, investigating (1) infrared sources using quantum well structure and photonic crystal, detectors using quantum dot, etc. in the 1st subject, (2) remote sensing technology, environmental analysis, THz laser sources, etc. in the 2nd subject, (3) IrDA(Infrared Data Association), wireless communications, human interface technology, etc. in the 3rd subject, and (4) radiation effect of a sub-millimeter wave to animal tissues, medical application of infrared spectroscopy, etc. in the 4th subject.

The IC of media devices and visual systems for older person has been concerning with media devices and electrical visual systems of 21st Century. Main investigation is new visual systems for elderly peoples based on gerontechnology. The gerontechnology is 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 older persons.

In this summer the 10th International Symposium on Science and Technologies of Light Sources (LS-10) was held at Toulouse in France. Through this conference the trend of research for light sources becomes clear. With considering recent research trend in the field of light sources, the IC of diagnostics and modeling of new light sources works for survey; (1) the trend of development and research for new light sources, (2) the modeling techniques for discharge light sources, and (3) the diagnostics techniques for discharge light sources. Through these surveys this committee reports and shows the new trend and direction of the research for light sources.

Table 1 Investigation Committee in TC-LAV

Research Subject	Chairperson
Ultra Fine Lithography (3 years from April 2002)	T. Horiuchi (Tokyo Denki University)
Multiple Infrared Application Technology (3 years from October 2002)	Y. Tsunawaki (Osaka Sangyo University)
Media Devices and Visual Systems for Older Person (3 years from July 2003)	K. Yamaba (Nihon Fukushi University)
Diagnostics and Modeling of New Light Sources (3 years from June 2004)	M. Jinno (Ehime University)

History of Electrical Engineering (HEE)

Chairperson:	Yasuharu Suematsu (National Institute of Informatics)
Vice-Chairperson:	Satoru Yanabu (Tokyo Denki University)
Secretaries:	Yukio Ishigaki (Hitachi, Ltd.)
	Masao Takahashi (Toshiba Corporation)
Assistant Secretaries:	Syuuichi Tai (Mitsubishi Electric Corporation)
	Toshiaki Maruoka (Toshiba Corporation)

The Technical Committee on History of Electrical Engineering (HEE) belongs to the Fundamentals and Materials Society (A-Society) of the IEE of Japan

In 1988, a workshop on electrical engineering history was formed by volunteers. Until then, researchers had studied engineering history individually, but this workshop provided a forum for them to learn about electrical engineering history as a common subject. In April 1990, the Institute of Electrical Engineers of Japan set up the Technical Committee for History of Electrical Engineering.

The main objective of HEE is to examine the direction in which electrical engineering should move in the years ahead by studying the past. Electrical engineering history constitutes the basis of technologies that we should develop. It is the starting point from which we should approach the future.

The international workshop that called The Maui meeting is promoted by HEE. The last Maui meeting was held at University College London on 30 June and 1 July 2004 and the next Maui meeting is planning to be held at Americas within three years. HEE have organized a panel discussion on research into electrical engineering history at the ICEE. Each conference holds a panel discussion emphasizing the importance of electrical engineering history.

Meetings for presenting research papers on electrical engineering history are held regularly under the auspices of the HEE. Starting in 1991, meetings have been held three times a year, so a total of 35 meetings have been held already and as many as 300 research papers have been presented.

Public information activities are running by HEE. One of these activities is the publication of a newsletter. Inaugurated in 1994, the newsletter reached its 34th issue this year. The four-page publication features technological history-related articles, records of visits to museums and book reviews. Another important public information activity is the web site. This web site was opened in 2001 and it announces workshops, publishes the summaries of research papers presented at the meetings, and publicize the committee's activities as I have mentioned in connection with the activities. The newsletters and the web site are in Japanese only but the web site in English will be soon. Please visit
http://www.iee.or.jp/fms/tech_a/ahee/index_e.html.

Table 1 Investigation Committees and Working Group in HEE

Research Subject	Chair Person
Systematization of Database on the History of Electrical Engineering (June 2001 -)	Yuji Okita (Toshiba Corporation)
Interviews with Leading Figures in Electrical Engineering (2001-)	Takayuki Nagata (National Science Museum)
Investigation of International Technology Exchange (in preparing)	Fumio Arakawa (Global Engineering Institutes)
Working Group for Studies into Award-presenting Activities in the History of Electrical Engineering (April 2001 -)	Hiroshi Suzuki (GE Power Systems)

High Voltage Engineering(HV)

Chairperson: S. Yokoyama (Kyushu University / Central Research Institute of Electric Power Industry)
Secretaries: T. Inoue (TM T&D), L. Aono (TM T&D)
Assistant Secretary: H. Goshima (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 April 2004.

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 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 Restaurant "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 2003 a joint technical meeting of IEEJ with TCs on Electrical Discharge and Switchgear and Protection was held in Okinawa.

TC on High Voltage Engineering meeting meets four times a year. One of the meetings is associated with a technical visit to Kantou 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 1 Investigation Committees in TC-HV

Researdh Subject	Chairperson
Selection of Lightning Parameters for protection of Power System Apparatuses.	S.Yokoyama (Kyushu University / CRIEPI)
Insularor 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 Investigation Committee	A.Ametani (Doushisha University)

Electrical Wire and Cables (EWC)

Chairperson: Takahisa Imajo (Central Research Institute of Electric Power Industry)
Secretaries: Testuo Ito (Central Research Institute of Electric Power Industry)
Fuminori Tateno (Viscas Corporation)
Assistant Secretary: Naohiro Hozumi (Toyohashi University of Technology)
Shoshi Katakai (J-Power Systems Corporation)

Technical Committee on Electrical Wire and Cables (TC-EWC) is a committee organized to support the IEEJ Power and Energy Society, and includes members from universities, power and communication utilities, the JR railway company, Japan Electric Cable Technology Center, JECTEC and cable manufacturers. The technical committee holds technical meetings to promote R&D activities in this field and provides an opportunity to present the results of technical achievements. Tree technical meetings was held as the joint meeting with TC-DEI, on January 27, 2004, in Tokyo, and focused on the subject of “Deterioration Diagnosis and Online Monitoring System”. In addition to organizing such technical meetings, the technical committee supervises investigation committee dealing with subjects, which are related to electrical wire and cables.

During the several years of activity, Investigation Committee for DC Cable Systems, the Investigation Committee for Technology of Wires and Associated Accessories for Overhead Transmission Lines, and the Investigation Committee for Computer Software and Its Application for Power Cable Line were organized. These investigation committees have published technical reports such as the report entitled “Recent Technical Trends in Overhead Power Transmission Lines”. This year, the TC-EWC is planning to organize new investigation committee for prefabricated accessories for XLPE power cable. The name and chairpersons of the committees are listed in Table 1.

Occasionally a technical visit by the committee members is made to encourage study on the advanced science and technology. This year, the committee members visited the wind power facilities operated by J-Wind in the coast area of Tokyo.

Table 1 Investigation Committee in TC-EWC

Research Subject	Chairperson
Investigation Committee for Accessories for 66kV and Higher Voltage XLPE Power Cable	A. Toya

IEC Japanese National Committees Related to Electrical Insulating Materials

IEC TC10 Japanese National Committee

Chairperson: M.Tsuchie (TMT&D Corporation)
Secretary: T.Takahashi (Fujikura Ltd)

TC 10 deals with fluids (insulating oil and SF6 for electrical equipments such as transformer, cable, condenser and switchgear. The activity of TC 10 Japanese national committee is in corporation with persons concerned in JPI (Japanese Petroleum Institute). Recent items under consideration are IEC60422(maintenance guide for mineral insulating oil), IEC62021(measurement method for acidity), IEC60567(guide for dissolved gas analysis), IEC60599(guide for the interpretation of dissolved gas) and IEC60836(specification of silicone oil) etc. This year the above items were mainly discussed at TC10 Funchal meeting in Portugal.

IEC SC15C Japanese National Committee

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

The task for SC15C is to prepare international standards on the specifications for solid electrical insulating materials alone and in simple combinations. This includes coatings which are applied in the liquid state but cured to solids, such as varnishes and coatings. SC15C is responsible for the fundamental task of electrical insulating material classification and specification. The current activities are performed in 5 working groups and 4 maintenance teams.

Japanese national committee of SC15C has been held the meeting 4 times in a year. During a last year, over 30 documents for standardization 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, 44 voting results or compiled comments, and 45 maintenance cycle reports were circulated in the member of the national committee.

For the activities on the working groups in SC15C, the experts from Japan participate in WG5 (flexible insulating sleeving) and WG7 ((reactive resinous compound and varnish). SC15C meeting has been annually held. Next year, the meeting will be held in Tokyo Japan.

IEC SC15E Japanese National Committee

Chairperson: N. Shimizu (Meijo University)

The scope of SC15E is to develop widely applicable methods for the determination of properties and endurance capabilities of solid electrical and electronic insulating materials alone and in simple combinations.

Japanese national committee of SC15E consists of 25 experts from universities, research institutes and industries. The national committee usually holds 5 or 6 meetings a year. In last year, about 50 documents were dealt with; the issues including revision of the test methods for thermal classification, thermal endurance, glass transition temperature, tracking resistance and ionizing radiation were discussed. For these issues, the national committee sends comments and/or proposals to the central office of IEC if necessary and votes at the each stage toward the final
form of IEC standard.

IEC SC15E now has 2 Working Groups and 6 Maintenance Teams. Japanese national committee

sends members to 2 Working Groups(WG 1: Thermal endurance, WG 2: Radiation) and 1 Maintenance Team(MT 8: Maintenance and revision of standards relating to tracking).

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 Industry)

CIGRE (International Council on Large Electric Systems) is a permanent non-governmental and non profit-making International Association founded in 1921. It has following 16 Study Committees belonging to 4 Categories. Category A (Equipment): A1 (Rotating Machines), A2 (Transformers), A3 (High Voltage Equipment). Category B (Subsystems): B1 (Insulated Cables), B2 (Overhead Lines), B3 (Substations), B4 (HVDC and Power Electronics), B5 (Protection, Automation and Metering). Category C (Systems): C1 (System Economics and Development), C2 (System Operation and Control), C3 (System Environmental Performance), C4 (System Technical Performance), C5 (Power Supply Regulation and Trading), C6 (Distribution Systems and Dispersed Generation). Category D (Horizontal): D1 (Materials and Emerging Technologies), D2 (Information System and Telecommunication for Power Systems).

The title of the Study Committee 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 we had a regular international meeting in Paris, France from August 30 to September 3rd and 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 next meeting is scheduled in Crete, Greece from June 15th to 22nd. The Japanese National SC D1 has usually 4 meetings a year.

ACTIVITIES OF INVESTIGATION COMMITTEES IN IEEJ

Applications of Environmentally Friendly Materials to Electrical Apparatuses

Chairperson:	Yasuo Suzuoki (Nagoya University)
Secretary:	Ryozo Takeuchi (Hitachi, Ltd.)
Secretary:	Masayoshi Ishida (University of Tsukuba)
Assistant Secretary:	Takeyoshi Kato (Nagoya University)

To cope with the increasing environmental problems, environmentally friendly technologies for materials, devices, apparatuses and systems have become increasingly important. Various measures against environmental problems have been developed but many of them remain within the framework of the existing present technologies. In 2002, Investigation Committee on Environmentally Friendly Materials and Systems for Electrical and Electronic Engineering was established to make systematic investigation on the state of the art and the trend of the measures against environmental problems and to clarify the guiding principles for the research and development of the future environmentally friendly technologies in the field of materials for electrical engineering and electronics and systems. During the course of the activity, investigation was focused on electrical properties of environmentally friendly materials, problems with life cycle assessment of apparatuses and systems and alternatives to conventional thermosetting insulating resins. The committee ended in 2004 and the results were presented at the symposium during the 2004 Annual Convention of IEE of Japan.

A new committee, Investigation Committee on Applications of Environmentally Friendly Materials to Electrical Apparatuses started in April, 2004, succeeding to the activity of the preceding one. The main fields of activity are (1) Assessment of properties and applications of environmentally friendly materials such as biodegradable polymers and recycled polymers, (2) Environmentally friendly design of apparatuses and components, and (3) Life-cycle assessment of apparatuses and systems. The committee also pursues the possibility of establishing new cooperative research projects on the basis of its activity. The committee also takes an interest in international activities in setting up standards for environmentally friendly technologies, materials and so on. The Final Technical Report will be issued from IEE Japan in 2006.

Economical Assessment of Diagnosis for Power Apparatus

Chairperson:	Naohiro Hozumi (Toyohashi University of Technology)
Secretary:	Masaaki Ikeda (Nippon Petrochemicals Co., Ltd.)
Secretary:	Katsumi Uchida (Chubu Electric Power Co., Inc.)
Assistant Secretary:	Masaki Kanegami (Central Research Institute of Electric Power Industry)

Objective

The purpose of insulation diagnosis for power apparatus is to avoid failures that may lead to a significant economical loss. Typical inspection is performed with a certain interval, normally several years. An apparatus may be replaced if a failure before the next inspection is expected with a certain probability or higher. On the other hand, the apparatus may be continuously used if the probability for failure before the inspection is significantly low. The diagnosis may reduce economic losses due to accidental failure; however, we should consider the losses caused by performing diagnosis.

Firstly, diagnosis needs some cost. Secondary, wrong diagnosis would lead to an inappropriate deal with the apparatus and bring an economic loss. For instance, a failure loss is expected when a proper alert has not been made because of "too loose diagnosis". On the other hand, prematurely loss is expected when the apparatus has been replaced because of too early alert made by "too severe diagnosis". The expected total loss is estimated as a function of risk ratio of the diagnosis. The optimal condition depends on the age and precision of the diagnoses as well. If all other factors are fixed, the minimum cost condition is realized by selecting a proper risk ratio.

The research in asset management is being acti-

vated by the requirement of cost reduction these days; however, most of the reports deal with the optimization for interval of replacement or maintenance. Cost assessment considering the reliability of diagnosis itself has not been reported, although some fundamental studies have just started.

Based on the above background, the committee deals with the assessment of the lifecycle cost when insulation diagnosis for power apparatus is performed.

Activities

The committee is composed of 14 members and investigating the following.

(1) Conception and methodology of asset management.

(2) Study on asset management with the existence of diagnosis.

(3) Way of thinking for economic loss accompanied by diagnosis.

(4) Synthetic view and countermeasure for life cycle management of power apparatus.

Term of investigation

August 2004 to March 2007 (three years)

Properties and Novel Functions of Nano-structured Organic and Composite Thin Films and Device Applications

Chairperson:	Futao Kaneko (Niigata University)
Secretary:	Tetsushi Okamoto (Toshiba Corporation)
Secretary:	Keizo Kato (Niigata University)
Assistant Secretary:	Kazunari Shinbo (Niigata University)

The committee was established in April 2004, with the term of three years. The investigation has focused attention on the functions of nano-structured organic and composite thin films and device applications related to:

1. fabrication techniques and novel functions of nano-structured organic thin films,
2. composite techniques and novel functions of nano-structured organic/inorganic materials,
3. optical and electrical properties of nano-structured organic and organic/inorganic composite thin films and the nano-interfaces, and
4. device and sensor applications of nano-structured organic and organic/inorganic composite thin films.

Up to September 2004, two committee meetings were held and detailed discussions among the members of the committee were carried out. Further lectures by the committee member and non-member researchers will be given about the above subjects. The committee members will also introduce the recent topical papers related with their researches and the above subjects, and earnest discussions will be done. Visiting the distinguished laboratories in Japan and the various investigations will be also carried out.

The results of the investigation will be summarized at the end of the term in 2007 as a technical report. Investigations on the properties and novel functions of nano-structured organic thin films and organic/inorganic composite thin films are very useful for new functional devices in the future.

Members:

Prof. M. Aozasa (Osaka City Univ.), Prof. S. Furukawa (Kyushu Institute of Tech.), Dr. A. Iwamori (Kanazawa Univ.), Dr. A. Kawamoto（Fukui National College of Tech.）, Dr. M. Kushida (Chiba Univ.), Dr. Y. Muramoto (Meijo Univ. of Tech.), Prof. S. Nakamura (Mie Univ.), Dr. H. Ohnuki (Tokyo Univ. of Marine Sci. & Tech.), Dr. K. Orihara (Yamagata Univ.), Prof. S. Sato (Akita Univ.), Prof. H. Yamamoto (Nihon Univ.)

Dielectric and Electrical Insulating Materials for Communications Technology

Chairperson: Kaori Fukunaga (National Institute of Information and Communications Technology)
Secretary: Tsuguhiro Takahashi (Central Research Institute of Electric Power Industry)

The progress of information and communications technology encourages all kinds of fundamental research, and the world economy depends on that progress. In the development of hardware for information and communications technology, in general, the function of devices is the main topic, and so that the insulating materials had not been the focus of research. However, operating frequency, electric field, temperature have all become higher, and at the same time, the size of any device has become smaller. Therefore the required electrical, mechanical, thermal properties have become extremely high.

The Investigation Committee on Dielectrics and Electrical Insulating Materials for Communications Technology has been established in January, 2004 to discuss dielectric and electrical insulating materials used for communications industry; from satellites to mobile handsets, especially following four topics.

*Dielectric materials in a space environment
*Insulating materials for high frequency cables
*Absorbers and materials for high security
*Insulating materials for printed circuit boards

The materials used in a space environment are exposed to the aggressive environment, including high energy electrons, protons, atomic oxygen etc. The committee can give opportunity of fundamental research on ageing phenomena. As the millimetre wave is going to be used widely, so that the inevitable loss in the cables before antenna is a serious problem. The noise from cables and connectors might be used to extract information from computers, so that high security cables should be developed. In the printed circuit board industry, passive components are going to be embedded in the insulation, and the operating electric field of power electronics devices has been continuously increasing. Moreover, power line cables for domestic appliances are expected to be used for transmitting high frequency signal, in the near future.

Since the communication network is as important as the high voltage power cable network in the information society, it is our duty to ensure the reliability of the communication network. The topics covered in this committee have been investigated in their own research groups and the 'communication' between the groups has not been very active, although the same materials are often used in all the groups. Polyimide films, for example, are used in satellites and in mobile handsets. So far, the committee gives opportunities to exchange knowledge and information between different research groups through the meetings.

Development of Organic Electrical and Electronic Materials with Flexible Structure to Nanotechnology

Chairperson: Mitsumasa Iwamoto (Tokyo Institute of Technology)
Secretary: Mitsuyoshi Onoda (University of Hyogo)

Purpose of Establishment

The committee started in October 2003 by 14 members to investigate and discuss the nano-technology for organic electrical materials with flexible structure and basics and applications in terms of organic electronic devices and will continued until 2006.

The operation of most optoelectronic devices is fundamentally ruled by the interfaces of semiconductor and metal contacts. The device performances are strongly depends on the interfacial properties. Then it is of great importance to pursue ability for the fruition of highly functional devices, where intentionally introduced tricky-but-intelligent nano-interfacial phenomena play a dominant role beyond the specific function of molecules themselves.

Electronic and optically functional devices using organic nano-materials with flexible structure have been developing to the stage of practical use. To improve the performance and the function of such devices, the profound understanding of electronic phenomena at the interface is critically important. Accordingly, it is necessary to understand what the ability of interface systems is and use intentionally the ability for the better performance. Our goal is to

realize not only thin film electronic devices, but also mono-molecular film electronic devices in its turn molecular electronic devices, namely establishing **"organic molecular device engineering"** for the future electronic technology.

Recently, research into the practical use of organic materials in electronic devices has produced excellent results. Organic nano-materials with flexible structure, techniques for the evaluation of ability, tricky but intelligent ideas for the organic devices, *etc*. will be discussed.

[1] Electrical and electronic function of organic thin films.
[2] Trends and topics on the nanometric interfacial controlled electronic devices with flexible structure (molecular actuator, optical devices, *etc*.).
[3] Molecular dynamics with flexible structure.
[4] Trends and topics on the molecular nanotechnology with flexible structure.
[6] Recent progress organic electronic devices with flexible structure and their application to information systems
[5] Other trends and topics concerning the nanotechnology for organic electrical and electronic materials with flexible structure.

Activilty

Since the establishment of this committee, the study meeting was held 4 times up to June 2004. In May 14, 2004, this committee gave a course in trends and topics on the organic molecular device engineering sponsored by Tokyo chapter, IEEJ. Further more, The 3 rd International Discussion & Conference on Nano-Interface Controlled Electronic Devices (IDC-NICE 2003) had been held at Tokyo, Japan on December 17-20, 2003, and also The 4 th IDC-NICE Devices will be held at Busan, Korea on October 6-9, 2004. The three years activity of the committee will be published in Technical Report of IEEJ.

(Responsibility for the wording: M.Onoda)

Polymer Nanocomposites and their Applications as Dielectrics and Electrical Insulation

Chairperson: Toshikatsu Tanaka (Waseda University)
Secretary: Mikimasa Iwata (CRIEPI)
Secretary: Masahiro Kozako (Waseda University)

Scope

Polymer nanocomposites are defined as polymers in which small amounts of nanometer size fillers are homogeneously dispersed by only several weight percentages. Addition of just a few weight percent of the nano-fillers has profound impact on the physical, chemical, mechanical and electrical properties of polymers. Such change is often favorable for engineering purpose. This nanocomposite technology has emerged from the field of engineering plastics, and potentially expanded its application to structural materials, coatings, and packaging to medical/biomedical products, and electronic and photonic devises. Recently these 'hi-tech' materials with excellent properties have begun to attract research people in the field of dielectrics and electrical insulation. Since new properties are brought about from the interactions of nanofillers with polymer matrices, mesoscopic properties are expected to come out, which would be interesting to both scientists and engineers. Improved characteristics are expected as dielectrics and electrical insulation. Several interesting results to indicate foreseeable future have been revealed, some of which have ever been discussed on materials and processing in the paper together with basic concepts and future direction.

The investigation committee was organized in October 2002. It consists of 27 members from universities (8), laboratories (3), power apparatus makers (5), cable makers (6), material makers (3), insulator maker (1), consultant (1). We have four or five regular meetings annually.

Symposium Papers

Symposium was held last March in conjunction with IEEJ National Convention. Following papers were presented and discussed:

(1) Status Quo of Development of Polymer Nano Dielectrics by T. Tanaka (Waseda University)
(2) Polymerization of Nanocomposites Polyamide Resin and Physical Properties by S. Murase (Tokyo University of Agriculturte and Technology).
(3) Characteristics of Nano Powder Synthesized by Discharges by M. Iwata (CRIEPI).
(4) Thermal and Mechanical Behavior of Thermoplastic Composites Containing Nano Clay by T. Kanno and H. Yanase (Fuji Electric Advanced Technology Co.).
(5) Synthesis of A New Nanocomposite Polyamide and its Thermal and Electrical Resistance by K.

Asano, K. Suzuki, K. Soma (Hitachi Cable, Ltd.), and K. Murouchi (Hitachi Magnet Wire Corp.).

(6) Preparation of Nanocomposites and their Application to Insulation Materials for Power Apparatus by T. Shimizu, T. Ozaki, T. Imai and T. Yoshimitsu (Toshiba Corp.).

(7) Partial Discharge Degradation Properties of Polyamide Nanocomposites by M. Kozako, Y. Ohki and T. Tanaka (Waseda University).

(8) Development of Novel Epoxy resins Containing Controlled High Order Structures by Y. Takezawa (Hitachi Ltd.)

ISEIM2004 Session

We plan to organize a session on Nanocomposites at ISEIM2005 to be held in Kitakyushu in June 2005. You are all welcome to submit papers and participate.

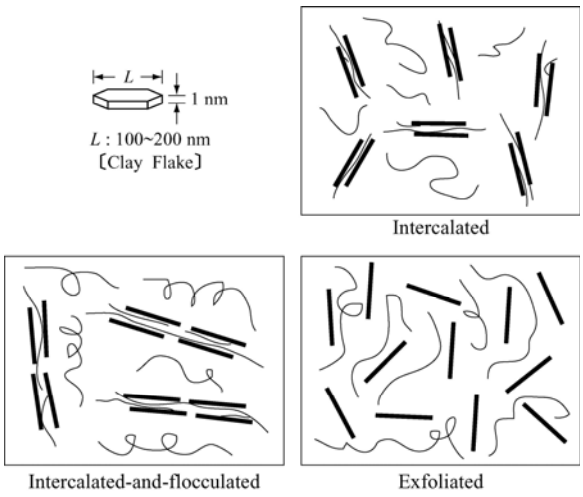


Fig. Schematic Illustration of Three Different Types of Polymer/ Layered Silicate Nanocomposites

Present Achievement

Polymer nanocomposites could be advantageous over traditional filled polymers in electrical and thermal properties as well as mechanical properties from the standpoint of dielectrics and electrical insulation. This feature will technologically result in compact design of electrical equipments with high reliability and thereby in significant cost reduction for system integration and maintenance. Since this feature is originated from mesoscopic characteristics of interaction zones between polymer matrices and nanofillers, it will open a new academic arena for dielectric and electrical insulation that will need quantum mechanics as well. Such interaction zones might be related to free volume and charge carrier trap distribution (shallow and deep traps), which should be further explored. In order to obtain excellent but low-cost polymer nanocomposites, existing material processing technologies should be more advanced so as to match dielectrics and electrical insulation.

Results are summarized as follows:

Effects of nanomization

(1) DC conductivity increases and decreases depending on measurement conditions. Introduction of deep traps are suggested.

(2) Interfacial polarization can be reduced compared to microcomposites.

(3) There seems to be a certain reduction of permittivity due to nanomization. But change of permittivity as well as tanδ is complicated, and not conclusive. Manufacturing processes should be more investigated for homogenous dispersion of nanofillers.

(4) Space charge, TSC and EL also give complex results in their threshold field and quantity. Introduction of additional levels of shallow and deep traps, as well as increase of trap density, might be involved. These might be deeply related to “interaction zones”. It is therefore necessary to characterize the interaction zones between nanofillers and polymer matrices chemically and physically.

(5) PD and tracking resistance improve. It is most probable. Role of nanofillers and interaction zones should be more clarified.

(6) Thermal conductivity and glass transition temperature could be increased by proper methods.

<u>Properties of polymer nanocomposites</u>

(1) Electrical and thermal properties as well as mechanical properties could be improved by nanomization of polymers. Polymer nanocomposites are advantageous over conventional filled polymers, because a small amount of nanofillers might not modify the characteristics of base polymers considerably.

(2) Intercalation methods, sol-gel method, molecular composite formation method and nanofiller direct dispersion method are the major processing technologies, and should be more developed for better and cheaper materials with excellent interaction zones.

(3) Polymer matrices, nanofillers, and interaction zones between them are three major parts of nanocomposites. Their respective roles should be investigated based on material characteristics of interest.

(4) Especially interaction zones should be characterized chemically and physically.

(5) Deep and shallow traps should be investigated and correlated with physical and chemical characteristics of interaction zones. Especially a theory for trap level and density modification should be established.

(6) Interaction zones are mesoscopic in nature.

This will open a completely new aspect of dielectrics and insulation studies, which need consideration based on quantum and statistical mechanics, too.

(7) Heat resistant thermoplastic nanocomposites are environmentally benign because of their recyclability. These could replace thermoset resins that cannot be recycled.

(8) Biodegradable polymers such as polylactic acid can be filled with nanofillers. PLA nanocomposites are expected to be used for eco-friendly electrical insulation.

Applications

(1) Polymer nanocomposites have been investigated for future use of electrical insulation for power apparatus, power cables, outdoor insulators, and insulated wires for electric power technologies as well as printed circuit boards for electronics.

(2) Insulation could be more compact by using polymer nanocomposites, resulting in overall cost reduction in apparatus and installation.

(3) Reliability could be improved by using polymer nanocomposites, resulting in lower maintenance cost.

(4) Polymer nanocomposites will give much innovation in dielectric and insulation technologies.

Contact: T. Tanaka, t-tanaka@waseda.jp

On-Line Diagnosis for Electrical Equipments

Chairperson:	Katsumi Uchida (Chubu Electric Power Co., Inc.)
Secretary:	Yoshiyasu Ehara (Musashi Institute of Technology)
Secretary:	Tetsuji Sorita (Mitsubisi Electric Co.)
Assistant Secretary:	Yukihiro Yagi (The Furukawa Electric Co., Ltd.)

Recently, the cable and the electric apparatus that the company installed at high-growth period of the Japanese economy will pass for 30 to 40 years, and is seeing an updating term. By understanding quantities about an insulation performance, there is a strong request to use electric equipment to a life limit. Check, diagnosis and updating time are managed intentionally, and to prevent the big trouble of electric apparatus is also desired. In order to meet these requests, it is required to understand as correctly as possible the insulation performance under on-line of a cable and electric apparatus.

This committee aimed at investigating the judgment standard which both also includes the new measurement method and trend monitoring of a formula focusing on comparison with off-line measurement and on-line measurement about the insulated degradation diagnostic technology of a cable and various electric apparatus used for power generation, power transmission, and power distribution equipment.

This committee was established in January 2003 with a total of 29 persons' composition of a university, a cable and an electric power apparatus manufactures, an electric power company, a research institute, a diagnostic company, and a user. An activity schedule is for three years.

The main investigations of the committee are as follows;

(1) Investigation of the newest insulation degradation measurement technology of dielectric and electrical insulating materials.

(2) Investigation of the newest insulation degradation diagnostic technology by on-line measurement and off-line measurement of the insulating property of a cable and electric apparatus

(3) Comparison of the system of off-line measurement and on-line measurement, trend monitoring, a judgment standard, etc.

The committee has held 10 meetings. Survey of published papers was advanced focusing on the operated situation using the newest diagnostic methods and those diagnostic methods of each apparatus. The committee planned investigation tours on on-line diagnosis for electrical equipments and held the study meeting with degradation phenomena and diagnosis technologies for power cable and electrical insulating materials in January 2004. The final technical report will be issued from IEE Japan.

Degradation of Insulating Properties and Endurance of Impulse Surge for Printed Wiring Board

Chairperson:	Yoshiaki Yamano (Chiba University)
Secretary:	Katsuhiko Shutoh (Tokyo Science University)
Secretary:	Shouzo Yoda (Hioki Electric Co. Ltd.)
Assistant Secretary:	Katsuhiro Okamoto (National Research Institute of Police Science, Japan)

Electronic equipment is becoming small in size, light in weight, and high in performance. The printed wiring boards for the equipment are designed in fine and high density with multi-layers, which result in small distance and high electric field strength between the foil conductors on the board. The insulating failures may occur on the board under such conditions mentioned above. Therefore, an insulating reliability for the board comes up to an important problem for the design of electronic equipment and systems. However, the study on the insulating reliability for the printed wiring board has not yet been systematically carried out.

One of the reasons for this comes from a low operating voltage in the electronic circuit. Furthermore, it may be impossible to evaluate the long term reliability of the board, because the electronic products today must be designed within short-range term due to a request of market and high speed development of new devices.

From these viewpoints, a new investigation committee has started in April 2002 with 24 members. The main subjects of the committee are as follows.

(1) Systematical survey on the insulating failures due to the ionic migration for printed wiring boards, including test methods for the evaluation of the board and its mechanisms for the migration process.
(2) Study on an insulating strength between the conductors at the high voltage surge application (surge endurance), basing on the data obtained from the cooperation test by the members.

Now we are discussing on the results of the cooperate test with the surge endurance between the wirings on the board. The studies on the ionic migration endurance tests have been also carried out. The final technical report will be issued from IEE Japan in 2005.

Charge Behavior Associated with Interfaces under High Electric Field

Chair person:	Masayuki Nagao (Toyohashi University of Technology)
Secretary:	Naohiro Hozumi (Toyohashi University of Technology)
Secretary:	Yoshinao Murata (J-power Systems Corp.)
Assistant Secretary:	Yoshinobu Mizutani (Central Research Institute of Electric Power Industry)

Objective

Recent electric and electronic devices are being designed more and more compact. Therefore solid insulating materials in such devices are subjected to a very high electric field. It is often as high as the level of the breakdown field. On the other hand, in practical use of insulation materials, there always exist interface either with metallic material or different type of insulating material. A specific charge behavior may be brought by such an interface, the behavior being different from that in a uniform medium. As recent insulation materials tend to be used nearly ultimate condition as a simple substance, the key point for the future improvement of insulation performance may be found at the interfaces with different materials.

Furthermore in conventional insulation systems, performances like breakdown field used to be determined by such as impurities, foreign substances and protrusions that basically should not be existent in the system, however, these kinds of undesired factors have been ultimately eliminated in the progress of recent manufacturing technology. This means that the intrinsic characteristics of materials and related phenomena at the interface determine the performance of the system. There is a strong requirement for the clarification of carrier injection from the electrode and phenomena at the interface with different kind of material. This trend is true not only in high voltage insulations but in electronic insulation and functional materials.

Most of classic studies in this point of view have been assuming a certain unconformity, which may cause such as partial discharges. However, recent progress in space charge measurement technique is

making it possible to discuss the detail of interfacial phenomena as well. This investigation committee focuses on the relation between interface and charge behavior under high field in order to approach the intrinsic interfacial phenomenon.

Activities

The committee is composed of about 30 members and investigating the following.

Summary of methodologies for the observation of charge behavior

Charge behavior at metal-insulation interface

Relation between breakdown and charge behavior at interface and bulk

Relation between degradation and charge behavior at interface and bulk

Simulation of charge behavior at interface and bulk

The committee is characterized by deep discussion of each topic. It is being held every two or three months. A number of speakers have been invited to give a lecture on their specific work.

The committee has started for the preparation of the final report. The report will involve the assessment of interfacial phenomena from practical point of view, as well as fundamental behavior of charges at the interface.

Term of investigation

August 2002 to July 2005 (three years)

Evaluation of Discharge Property and Degradation Phenomenon on the Surface of Polymer Insulating Materials

Chairperson:	Kazutoshi Goto (Consultant)
Secretary:	Tetsuro Tokoro (Gifu National College of Technology)
Secretary:	Hiroya Homma (Central Research Institute of Electric Power Industry)
Assistant Secretary:	Yoshihiko Hirano (Toshiba Corporation)

Application of polymer insulators has already expanded in the field of power supply and distribution systems all over the world. Compared to porcelain insulators, however, polymer insulators have been demanded to solve the challenging subjects on long-term reliability and diagnosis techniques in service conditions.

From April 1st of 2002, a new investigation committee started with 23 members. In 2004, the members have become 25 researchers. 12 members of them are from universities and 13 members are from electric power utilities and manufactures. Using 8 kinds of plane type and rod type common samples of silicone rubbers, all members are investigating the degradation properties of the polymer insulating materials by using their own advanced measurement techniques.

The former related WG issued several useful results on the round robin test conducted by CIGRE, fog chamber tests and measurement techniques of leakage current for polymer specimens. These techniques are also used in this committee.

The main subjects of the committee are summarized as follows.

1. Discharge mechanism and recovery mechanism of hydrophobicity at the surface of polymer insulating materials.
2. Degradation mechanisms of the target materials and their evaluation techniques.
3. Leakage current measurement techniques.
4. Accelerated ageing test and Exposure test.

This committee is focusing to investigate the polymer's long-term ability by the relation between the discharge amount and the degradation phenomenon of the material's surface. The separation measurement of the leakage current to conduction, partial discharge and arc currents are also investigated to improve the diagnosis technique of polymer's long-term reliability.

The final technical report will be issued from IEE Japan in 2005. This committee is also related to CIGRE WG D1.14, "Material properties for nonceramic outdoor insulation".

Computational Electromagnetics

Chairperson: M. Koshiba (Hokkaido University)
Secretary: N. Yoshida (Hokkaido University)

Purpose of establishment

The committee started in January 2003 to investigate and discuss the fundamentals and applications of computational electromagnetics, and will be continued until December 2005.

Computational electromagnetics has become an essential tool in modern microwave, antenna, and lightwave technologies, and many successful numerical methods have been proposed. Numerical procedures have attracted a great deal of attention in the scientific and industrial communities related to wireless and photonic network systems, as evidenced by the great amount of published materials, conferences, workshops, and short courses specifically devoted to this subject.

The committee members are now investigating the present status and prospects of computational electromagnetics, especially placing emphasis on

1. Fundamentals of finite element method (FEM) and boundary element method (BEM)
2. Fundamentals of method of moment (MoM)
3. Fundamentals of finite-difference time-domain method (FDTD)
4. Fundamentals of other numerical methods
5. Commercially available software packages
6. Related topics

Activity

The committee meeting was held 4 times up to July 2004 and the 1st seminar on Computational Electromagnetics entitled "FDTD for Three-Dimensional Problems" was held at Nihon University on December 5, 2003. We had three lectures as follows:

1. Fundamentals of FDTD
   Tatsuya Kashiwa, Kitami Institute of Technology
2. Application of FDTD to Waveguide Problems
   Yoshihiro Naka, Kumamoto University
3. Application of FDTD to Scattering Problems
   Akimasa Hirata, Osaka University

We have been able to welcome a total of about 60 participants. The 2nd Seminar on Computational Electromagnetics entitled "Thorough Study and Application of FDTD" will be held at Nihon University on December 3, 2004. Three lectures are now planned as follows:

1. Fundamentals of FDTD
   Tatsuya Kashiwa, Kitami Institute of Technology
2. Treatment for Boundary Conditions in FDTD
   Yoshihiro Naka, Kumamoto University
3. Application of FDTD to Antenna Problems
   Akimasa Hirata, Osaka University

The three-years activity of the committee will be published in Technical Report of IEEJ.

Natural Electromagnetic Phenomena and Electromagnetic Theory

Chairperson: M. Hayakawa (The University of Electro-Communications)
Secretary: Y. Ando (The University of Electro-Communications)

Purpose of establishment

New findings have been observed in the nature electromagnetic (and plasma) phenomena, and we review new physical aspects of those terrestrial electromagnetic phenomena. These include (1)atmospheric phenomena related to lightning (e.g. mesospheric optical emissions, ionospheric perturbations, etc.), (2)seismo-electromagnetic phenomena (electromagnetic phenomena associated with earthquakes, taking place not only in the lithosphere, but also in the atmosphere and ionosphere), (3)plasma and wave phenomena in the Earth's ionosphere and magnetosphere, (4)electrodynamic coupling among different regions. Especially the subjects (1), (2) and (4) are extremely new, so that the generation mechanisms of these phenomena are quite poorly understood. The essential point of the mechanism can be well examined with the use of modern electromagnetic theory (especially with the use of modern computational electromagnetic methods). The collaboration between the workers on natural electromagnetic phenomena and those working on computational electromagnetics, is the key factor for this investigating committee.

Activity

This investigating committee started in January

2003 and will terminated in December 2005.

We have several meetings several times a year. In addition to those regular meetings, we plan to have a special session in the annual IEE meeting. The 2005 International Symposium on Seismo Electromagnetics (IWSE2005) in March, 2005 will be held under the cosponsorship of our committee.

The three years activity will be summarized as a Technical Report (probably in English) at the end of the term.

Electromagnetic Fields of Nanometer Electromagnetic Waves and X-ray

Chairperson: M. Agu (Fukushima National College of Technology)
Secretary: T. Mizumoto (Tokyo Institute of Technology),
Secretary: N. Gotoh (Toyohashi University of Technology)

Purpose of establishment

Coherent X-ray electromagnetic waves which are nanometer electromagnetic waves, will be a new wave engineering technology and will be useful in a new electromagnetic technology for material, medical and biosciences. This investigating committee aims to research on functional devices of coherent X-ray for efficient generation, electromagnetic field technology of low-loss X-ray fibers, applications in nanometer space phenomena, and new information communication technology concerned with coherent X-ray waves of nanometer electromagnetic waves.

The research fields include the followings:

Investigation of highly-efficienct, compact and high-functional SOR system

Investigation of highly-efficienct, compact and high-functional X-ray laser

Study of electromagnetic analysis of interaction between radiation wave / X-ray wave and nanometer electromagnetic materials

Study of electromagnetic analysis of interaction between microwave and particle beam

Study of electromagnetic analysis of X-ray resonator

Electromagnetic analysis and designing of high-frequency waveguide for accelerator

Electromagnetic analysis and designing of X-ray separator, filter, reflector and deflector

Investigation of high-resolution lithography and high-precision manufacturing

Electromagnetic analysis of X-ray microscope and X-ray probe for bio technology

Investigation of new information communication technology using X-ray

Activity

This investigating committee started in January 2003 and will terminate in December 2005. We have meetings several times a year. We had a special session at the IEE technical meeting on electromagnetic theory in November 2003. The three-year activity will be summarized as a Technical Report at the end of the term.

EINA Committee

Chairperson: T.Tanaka (Waseda University)
Secretary: Y. Maruyama (Furukawa Electric Co. Ltd.)
M. Kozako (Waseda University)
H. Kaneiwa (Toshiba Corporation)

1. Object

EINA Committee, or the IEEJ Committee for Electrical Insulation News in Asia, is aiming at construction of an international interactive channel for information exchange in the field of dielectrics and electrical insulation in the Pan-pacific regions. We are currently providing an annual issue of EINA Magazine as well as EINA Website.

2. History of Committee

Preceding committee (Cooperative Research Committee (CRC) of Asian Interlink on Dielectrics and Electrical Insulation) worked from Jan. 1991 to Dec. 1992. The committee reviewed the present status of scientific and technical cooperation in the field of dielectrics and electrical insulation among Japan and Asian countries and sought the appropriate ways to promote it.

As an important activity discussed in the committee, “CRC of Electrical Insulation News in Asia” (the chairman of the committee was Prof. H. Yamashita, Keio Univ.) was established in Apr. 1994 and edited and published "Electrical Insulation News in Asia (EINA)" No. 1 (Sept. 1994), and No. 2 (Sept. 1995). As the EINA magazine was hoped to continue to be published, Prof. Yamashita chaired the CRC from 1994 to 1999 and published EINA magazines to No. 6.

In 2000, Prof. T. Tanaka succeeded to the activity and established a new CRC of EINA Magazine.

3. Recent activity

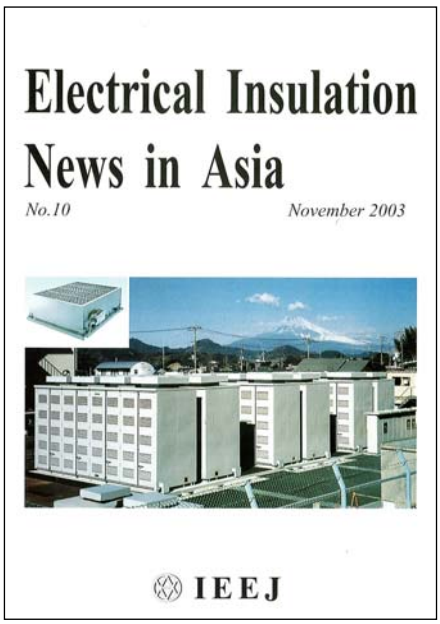
Our present committee consists of Chairman, 3 Secretaries and 32 Members. One general meeting and three sectary meetings are held annually to plan, do and check its activities. To our surprise, we set up EINA International Advisory Committee to strengthen our activities to make much more services to EINA Magazine subscribers. EINA Magazine No. 10 was issued in November 2003, as you might know. And our activity is now backed by an exciting new internet tool. Please visit our Website:

http://eina.ws/

It was open in March 2001. We have decided to make it a rule to update the Website as frequently as possible to provide you with vivid and brand new news, and then to edit EINA Magazine based on the information that we have gathered until then. Next issue will appear in November 2005 as No. 12.

On June 2, 2003, the second international EINA meeting in the 7th ICPADM was held for information exchange and human contact among researchers of Pan-pacific regions in the field of electrical insulation. You can see more about that in EINA No.10. 22 participants gathered from domestic and overseas. Utility of the activity was identified and continued expansive activity was demanded.

Since September 2004, EINA committee has newly started its activity under the umbrella of the committee of international activities in IEEJ Fundamentals and Materials Society.



Front Cover of No.10 (2003)

RESEARCH ACTIVITIES AND TECHNICAL EXCHANGES IN ASIAN COUNTRIES

Conference Records

The 2nd International Conference on Insulation Condition Monitoring of Electrical Plants and 2003 Asian Conference on Electrical Insulation Diagnosis (ICMEP-ACEID '2003)

The 2nd International Conference on Insulation Condition Monitoring on Electrical Plant (ICMEP) was jointly held in Chongqing, China from 26th to 30th , October, 2003, with 2003 Asian Conference on Electrical Insulation Diagnosis (ACEID), in conjunction with CIGRE Study Committee A2 Transformer Tutorial, which are sponsored by Chinese Society for Electrical Engineering (CSEE), with technical co-sponsorship of IEEE Dielectric and Electrical Insulation Society (DEIS) and CIGRE Study Committee A2 Transformers. The 1st ICMEP was held in Wuhan in 2000, meanwhile, ACEID was established by expansion of "China- Japan Conference on Electrical Insulation Diagnosis" in 1999. The purpose of those conferences is to provide an opportunity for researchers, scientists and engineers to exchange and discuss their experiences and recent research in concerned field.

Unfortunately, ICMEP-ACEID 2003 was very much affected by SARS. Regretfully, the conference was postponed by the decision of International Advisory Committee from April to October. In spite of such situation, there were over 110 participants.

131 papers (Tutorial: 5, Oral session: 89, Poster session: 38) from around 16 countries and regions and 5 keynote speeches are published in the proceedings. A total 13 lectures and sessions involved the papers covering the topics such as advanced insulation monitoring techniques, incipient fault diagnosis using artificial intelligence, effect of high electric field on solid and liquid dielectrics, insulation aging, pre-breakdown and breakdown phenomena, insulation remaining life prediction and estimation, partial discharge detection, location and pattern analysis, and so on.

On the day of 28th and 30th, two technical tours were organized by the conference. They were to Chongqing ABB transformer Co. Ltd. and The Key Laboratory of High Voltage Engineering and Electrical New Technology, Ministry of Education, Chongqing University. On the 27th and 30th, two cultural programs were also carried out. They were to an evening boat excursion at the confluence of the Yangtze and Jialing River and Dazu Rock Carvings, which is world cultural heritage.

In the International Advisory Committee held during the conference, the combination of ICMEP and ACEID and new conference's name, which is " International Conference on Insulation Diagnosis and Condition Monitoring (IDCM)", was decided, and Changwon, Korea was chosen as the site of the 1st IDCM in 2006.

K. Uchida (Chubu Electric Power Co., Ltd.)

International Conference on Electrical Engineering 2004 (ICEE2004)

The International Conference on Electrical Engineering (ICEE) 2004 was held at the Sapporo Convention Center, in Sapporo, Japan, from July 4 to 6, 2004, in conjunction with Asia-Pacific Conference of Transducers and Micro-Nano Technology (APCOT/MNT).

ICEE aims at providing a forum for sharing knowledge, experiences and ideas among worldwide electrical engineers, and has been held once a year hosted in turn by the Institute of Electrical Engineers of Japan (IEEJ), the Korean Institute of Electrical Engineers (KIEE), the Chinese Society for Electrical Engineering (CSEE), and the Hong Kong Institute of Engineers (HKIE). ICEE2004 was organized by IEEJ and co-organized by KIEE, CSEE, and HKIE. 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 Topics

After the opening address entitled "The Institute of Electrical Engineers of Japan in the 21st Century Society" by Dr. Kawamura, Prof. Shimozawa gave the keynote speech related to future technology with biology. In the conference, the plenary speeches are also made on the following interesting subjects: electric vehicles, the Korean electricity market, and the reliability of power grid line in China. Many questions and answers were exchanged on these topics.

There were 816 participants including 448 people from Japan. 847 abstracts (ICEE: 582, APCOT/ MNT: 265) were submitted, and finally 649 papers (ICEE: 422, APCOT/MNT: 227) including 263 papers from Japan, were accepted as listed in Table 1. 54 oral, 3 poster, and 3 panel sessions were held, and active presentations and discussions were made throughout the sessions. The joint style with APCOT/MNT brought activity successfully.


Discussions in a Poster Session

Table 1. Country and Region of Papers

Country/Region	ICEE	APCOT /MNT	Total
Japan	181	82	263
Korea	175	39	214
China	30	19	49
Taiwan	6	40	46
Singapore	1	23	24
Hong Kong	13	7	20
Thailand	6	2	8
Others	10	15	25
Total	422	227	649

Table 2. Participants of ICEE

Year	City	Partici-pants	Paper
1994	Tokyo (Japan)	N/A	55
1995	Tejon (Korea)	217	148
1996	Beijing (China)	343	350
1997	Matsue (Japan)	288	182
1998	Kyongju (Korea)	441	476
1999	Hong Kong	340	328
2000	Kitakyushu (Japan)	379	288
2001	Xi'an (China)	378	419
2002	Jeju Island (Korea)	549	563
2003	Hong Kong	235	236
2004	Sapporo (Japan)	816	649*
2005	Kunming (China)		

*Counted in conjunction with APCOT/MNT

The exhibition, banquet, and the technical tour to the Research Center of Hokkaido University were also held. Many participants, more than expected, joined these social events. In the banquet at Royton Sapporo Hotel, excellent papers were awarded.

ICEE2005 will be held by CSEE at Kunming in China, from July 10, 2005.

A. Kumada (The University of Tokyo)

The 8th Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering (2003 J-K Symposium on ED & HVE)

The 8th Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering was held on Nov. 6-7, 2003, in Nagasaki University, Nagasaki, Japan. The first symposium was held in Kumi, Korea, in 1996, and since then it has been held every year in Japan and Korea by turns, organized by the Electrical Discharge and High Voltage Society of the Korean Institute of Electrical Engineers (KIEE) and the Technical Committee on Electrical Discharge of the Institute of Electrical Engineers of Japan (IEEJ). The Chairperson, Co-chairperson, and Local Executive Committee Chairperson of the symposium were served by Prof. M. Yumoto of Musashi Institute of technology, Prof. J. Y. Koo of Hangyang University, and Prof. T. Matsuo of Nagasaki University, respectively. The symposium has been planned to provide the opportunity for scientists and engineers, especially for the Master and Doctor Course students as well as younger researchers in each county, to mutually exchange and discuss the scientific and technological ideas, practical experiences on electrical discharge and high voltage engineering research field they are involved.

One hundred thirteen researchers (Japan: 74, Korea: 39) attended the symposium, and 47 % of them are students. Eighty nine papers (Japan: 53 including an Invited Paper, Korea: 36 including an Invited Paper) were finally accepted and published in *the proceedings of 2003 Japan - Korea Joint Symposium on Electrical Discharge and High Voltage Engineering*. Two Invited Papers were presented by Prof. S. Matsumoto of Kyushu Institute of Technology and Prof. J. Y. Koo of Hangyang University.

The symposium papers cover the following wide topics.

(1) Electric Field and Magnetic Field Calculation
(2) High Voltage Testing and Measuring Techniques
(3) Partial Discharge and Diagnostic Techniques
(4) Electrical Breakdown in Vacuum, Gases, Liquids and Solids
(5) Electrical Discharge and Their Applications
(6) Electric Fields and Their Applications
(7) Electrical Insulation and Dielectric Materials
(8) Lightning (9) EMF, EMC and Others
(10) High Voltage Apparatus
(11) Plasma Applications (12) Industrial Applications

The next Korea-Japan Joint Symposium on ED & HVE will be held in Korea in 2005. The details will be decided in the future.

By Masahiro KOZAKO（Waseda University）

Fig. 1 Photograph of all participants in 2003 J-K Joint Symposium on ED & HVE

Announcement of International Conference to be held in Asia

2005 International Symposium on Electrical Insulating Materials

2005 International Symposium on Electrical Insulating Materials (ISEIM2005) will be held at the Kitakyushu International Conference Center in Kitakyushu City, Japan, from June 5 to 9, 2005.

You are invited to submit an abstract of not more than 200 words to the Secretariat preferably via e-mail by October 29, 2004. Acceptance or rejection notices will be mailed by the end of November 2004 to the corresponding authors. The authors of accepted papers will be requested to electronically submit camera-ready manuscripts by January 10, 2005.

Detail information can be obtained from the web site,
http://www.waseda.jp/assoc-ISEIM/ISEIM2005/index.html

Secretariat:
Dr. Toshihiro. Takahashi
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International Conference on Electrical Engineering 2005 (ICEE2005)

The conference will be held in Sapporo Convention Center, Kunming, China on July 10—14, 2005.
Organized by The Chinese Society for Electrical Engineering (CSEE)
co-organized The Institute of Electrical Engineers of Japan (IEEJ)
The Korean Institute of Electrical Engineers (KIEE)
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 2005 is “Step Towards the Future Electrical Engineering”.

Electrical & Optical Materials Lab.
Wonkwang University, Korea

Prof. Dae-Hee Park
School of Electrical, Electronic and Information Engineering
WonKwang University, Korea

This laboratory is studying HV (high voltage) and discharge. One of research group is material properties and applications of insulation material in the high voltage. The other is the next-generation light sources. The basic characterization of HV insulating material were carried out the electrical breakdown in polymer, the interface phenomena between polymer-polymer/metal -polymer, the treeing phenomenon, the diagnosis, the statistical evaluation, the partial discharge and the space charge.

The basic experiment of optoelectronics and light sources are disciplining oneself in Organic/Inorganic electroluminescence and photoelectron device for fiber optic communication. Additionally, it is carried the fundamental researches about suitable gas discharge condition, structure design and evaluation technology in electrodeless light source using RF or microwave.

Members

Electrical & Optical Material Laboratory (ENOM) currently consists of a full professor (Dr. Dae-Hee Park), a cooperative professor (Key-Mahn Han), a research professor (Dr. Yong-Sung Choi), a senior researcher (Dr. Jong-Chan Lee), a doctorial candidate, eight master course students, and three undergraduate students. Experts in HV & discharge are participating in various fields.

Research Equipments

Measuring equipments about electrical breakdown, diagnosis, volume resistance, leakage current, tracking, thermal conductivity and electrical conductivity are equipped for basic material characterization of HV insulating materials. Also, electromagnetic simulator (Ansoft), gas discharge simulator (CFD-RC), plasma discharge equipment, gas flowing system, spin coater, optical emission spectrum analyzer and UV monochrometer are equipped for new light-sources

Research Activities on HV Insulated Materials and System

The interface phenomena between polymer-polymer/metal -polymer, the electrical breakdown, the treeing phenomenon, the diagnosis, the statistical evaluation, the partial discharge and the space charge were carried out. The following is brief introduction about HV field recently.

1. Elastic Epoxy for Insulating Materials and Components

1) Motivation
A reliability elevation of the insulating material and an improvement of performance are necessary in order to reduce the electrical accident along an increase of electric power demand and large capacity of electric power equipment. With these motivations, the elastic epoxy is researching by blend of modifier to conventional epoxy plastic in this Lab. Formative, electrical, thermal, mechanical properties of elastic epoxy are evaluating. The application of elastic epoxy is going to grope in EVT and ECT

2) Procedures
The mixing properties in elastic epoxy between epoxy and modifiers are evaluating. Electrical, thermal and mechanical properties are analyzing according to the contained quantity of modifiers. An application to electrical insulation material will be investigated by electromagnetic simulation and analysis about EVT and ECT as well.

3) Future schemes
The suitable insulating polymer and manufacturing process to EVT and ECT will be investigated by the results based on researched material properties of elastic epoxy. Then, CT and PT having a new concept will be fabricated and its physical properties also will be analyzed.

Electrical Breakdown Equipment

Diagnosis System for HV Equipments

Measuring Equipments for Volume Resistance and Leakage Current

2. Partial Discharge Sensor and Application Development for Underground Electric Power Transmission & Distribution Lines

1) Motivation
HV power equipments request the high reliability according to industry growing up. Therefore, the diagnosis of HV power system can more contribute to safety of equipments before an accident of power equipments caused by insulation problem. An overhead electric power line is mainly changed to an underground electric power line because of environmental beautification in large city. As for the underground electric power line because of a lot of recovering time, the acknowledgment about progress of aging can give help in order to prevent an electricity accident. Therefore for the prevention of electric insulation accident, we want to develop the partial discharge monitoring sensor that are not affected to an external noise and have a high sensitivity.

2) Procedures
The diagnosis system of electric power equipment can divide the off-line and on-line measuring system. DC leakage current, tan delta and partial discharge measurement are researched in On/Off-line of electric power lines.

3) Future schemes
In future, we will find the way that can evaluate the aging evidence and is going to evaluate an aging degree of electric power cables.

3. Responsibility Improvement (resistant of water absorption) of Semiconductor Material in XLPE Electric Power Cable for Underground Transmission Line

1) Motivation
To improve the responsibility of semiconductor material in XLPE electric power cable for underground transmission line, the resistant property about water absorption and temperature dependence of the volume resistance are investigated, and we want to improve the smoothness property between XLPE and semiconductor as well.

2) Procedures
After adjusting about quantity of carbon black in semiconductor, the basic material properties and the resistant property about water absorption are investigated. Then a temperature dependence of the volume resistance using properly selected semiconductor material, and the interface properties as like smoothness between XLPE and semiconductor are investigated in 154/345kV power cables.

3) Future schemes
The researched semiconductor properties in 22.9kV XLPE electric power cable for underground distribution line and 154/345kV XLPE electric power cable for underground transmission line are going to apply and examine. Therefore, it is a plan to insure the lifetime and reliability of electric power cables.

Research Activities on New Light-Source using Plasma

The basic experiment of optoelectronics and light sources are disciplining oneself in Organic/Inorganic electroluminescence and photoelectron device for fiber optic communication. Additionally, the fundamental researches about the suitable gas mixture for discharge condition, the structure design for sputtering resistant, and the evaluation technology for new light sources are carried out.

1. Design Technology for Tubular and Ring-shaped Electrodeless Fluorescent Lamps

1) Motivation
To fabricate the electrodeless lamp having a good characteristic as a high CRI, efficiency, and long life-time, the fundamental technology about the optimal condition for gas discharge, the situation for maximum radiation, and the structure design for sputtering resistant is researched.

2) Procedures
The indispensable variables for the light emission are investigated and analyzed by the acknowledgement about energy distribution of plasma using electromagnetic and computational fluidic dynamic simulator. The impedance according to the number of winding coil is measured to analyze the parameter changes of magnetic core. I-V characterization curve of Ar gas according to the input power is measured to analyze the discharge properties of inactive gases and excitons.

3) Future schemes
The inactive mixed gas properties of He, Ne, Ar, Kr, and Xe are going to experiment to establish the optimal condition of gas discharge. The kinds, mixed ratio and pressure of optimal gases will be presented with a standard capacity. We will understand the variables to remove the EMI/EMS mode.

Gas Discharge Simulator (CFD-ACE)

Plasma Discharge Equipment

Optical Emission Spectrum analyzer

2. Standardization and Evaluation of Components at Microwave Discharged Electrodeless Light Source

1) Motivation
High temperature plasma is formed if microwave enter into gas sealed quartz bulb in cavity, and Light emission is formed by absorption and emission of energy. We want to make the standard of microwave discharged electrodeless lamp, to propose the evaluation technology of this light source, and to set up the standard of evaluation method.

2) Procedures
Electrical, structural, optical and electromagnetic appropriateness are described based on the main performance of microwave discharged electrodeless light source, efficiency, life-time, CRI, etc.

3) Future schemes
We will propose a standard written a Korean industry standard with a base through a meeting of a standard establishment committee concretely. The proposed standard will be modified through experimentation of a manufacturer or an examination. It reflects an opinion of microwave discharged electrodeless light source system related organ through a public hearing and does a proposal in order to be able to become a group standards.

Acknowledgement

Thank you for the opportunity to introduce our laboratory via the EINA magazine. Personally, it is our great pleasure to have a request from Mr. Yoshio Maruyama, a secretary and editor of EINA magazine of IEEJ, to write an article on Electrical & Optical Materials Lab., which is a good chance for us to enhance cooperation activities with other University in the world.

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High Voltage and EMC Laboratory：Beijing Key Laboratory

C. R. Li, Lijian Ding

High Voltage and EMC Laboratory
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China

It is our great pleasure to have a request from Dr. Prof. Tatsuo Takada, to write an introduction material of our laboratory. Thanks a lot for the opportunity to introduce our laboratory via the EINA magazine. It is a good chance for us to start and enhance cooperation activities with other laboratories.

Background

High Voltage and EMC Laboratory of North China Electric Power University was founded in 1996, and was branded as a Key Laboratory of BEIJING in the early of this year (2004). The university is one of the key universities in China with a history of more than 45 years, which is proud of her influence on China Power System.

Our laboratory currently have four full professors, two associate professors, one senior engineer, three lecturers, one assistant, one postdoctoral researcher, six doctorial candidates, and forty-five postgraduate students in master programs. There are about thirty undergraduate students working on their graduation projects in high voltage and EMC laboratory every year.

Some staffs in HV & EMC Laboratory

Research activities

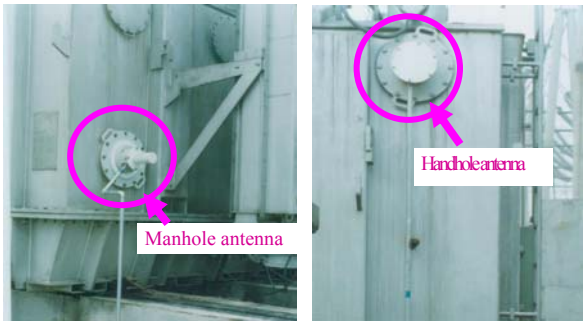
In our laboratory, there are three research teams: Condition Monitoring and Diagnosis Technology in HV Apparatus, Dielectrics and Electrical Discharge, EMC in Power System. The laboratory has attracted about US$ 1.2 million in research funding from government and companies in recent 3 years. The research activities are described briefly as follows:

A. Condition Monitoring and Diagnosis Technology in HV Apparatus

We have done many research works on condition monitoring and diagnosis technology for large power transformer, GIS, generators, power cable, high voltage PT, high voltage CT and composite insulator. Based on the experience of the diagnosis on partial discharge of varied apparatus, we have developed a set of monitoring and diagnosis technology of partial discharge which features largely in using UHF/VHF technology. For transformers, we do monitoring and diagnosis based on UHF sensors combined with traditional monitoring methods like the dissolved gas in oil. We use UHF combined with VHF technology for power cable, use direction sensors and vibration sensors for generators, use VHF and vibration sensors for GIS, use acoustic technology for the monitoring of high voltage PT, CT, lightning arrester, use electrical field technology for the faulty composite insulators examination. Some technology has been used in the field. For example, 5 sets of devices have been installed at Puyang ZhenXing Substation (220kV transformer), Kaifeng LanKao Substation (110kV transformer), Nanyang Binhe Substation (110kV GIS) in Henan province respectively. Especially, the fault of 220kV transformer at Puyang Zhenxing substation was detected and finally was verified.

Recently, our research is focused on the development of partial discharge location technology for transformers using UHF sensors. According to the shortest optical path principle, it is possible to localize the PD source by measuring the time-flight of the incident UHF signals captured by multiple sensors theoretically, but it is still left unknown because of the complicity of the power transformer. The key point is the location of PD

which occurs inner of coil because of the shielding of conducting obstacles. However, the experiments on our transformer model show that the PD location is possible because of the EM propagation through the oil channel. The relationship of the time-flight and the length of the propagation path are being investigated carefully.



UHF sensors installed on the 220kV transformer at Puyang ZhenXing Substation, Henan Province.

110kV GIS apparatus for partial discharge research at laboratory

B. Dielectrics and Electrical Discharge

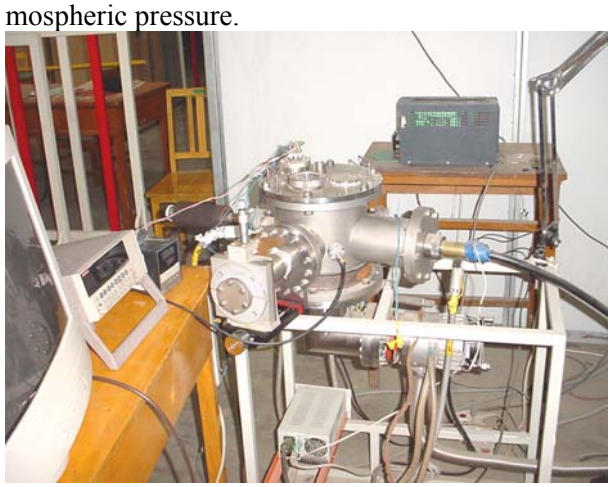
It is almost about 10 years that we devoted to study the flashover of insulators in vacuum, which includes the mechanism of flashover, the influence factors on flashover, etc. For example, based on our investigation, it was concluded that the surface charging characteristic of Alumina insulators would influence the flashover performance of insulators in vacuum. Now the study on the influence of the trap characteristic of insulators on the flashover performance is carried out under the support by NSFC (National Nature Science Foundation Committee).

Recently we have also started to investigate the influence of space charge in dielectric on flashover performance. We think that the charge motion is the most important things during the whole procedure of discharge. If the charge motion in the discharge procedure could be observed and recorded, the procedure of discharge could be explained more easily, and also the mechanism of discharge would be much more clearly. Through the work on space charge in dielectrics, we want to make an effort to develop the discharge mechanism in dielectrics.

We are also doing experiments on the space charge distribution of composite insulators under the condition of corona, and try to find the relationship between the space charge distribution characteristic and the aging of composite insulators.

Not only the space charge plays an important role in the procedure of discharge, but also the space charge plays an important role in the sensors' dielectrics for the signal conversion. The more clearly information of charge motion could be got; the higher signal conversion performance could be expected.

In addition, a study on atmospheric pressure glow discharges has also been carried out by the support from NSFC and MOE (Ministry of Education). It is focused on formation of a glow discharge in atmospheric pressure.



TSC experimental device
for flashover of insulators in vacuum

C. EMC in Power System

EMC is a very active research field in the world. Based on our background of power system, we do EMC research featured in high intensive field grade. Besides the regular measurement and analysis equipments, now we also have an EMP (Electrical and Magnetic Pulse) simulator, which can set up an electrical field as high as 75kV/m with the shape of 10/100ns waveform. Accordingly, we have a transient 3D EF probe and one transient 1D MF probe. The transient EMP simulator and the transient EM measurement equipments are the unique among the laboratories of university in

China. These equipments provide a complete platform to study the EMC performance of power substation.

With the help of this simulator and the measurement system, we have finished the research work on the EMC subject of 750kV substation and transmission line, which is aimed to help the design of the first 750kV transmission system in China.

EMP simulator and transient 3D EF probe

Academic exchanges and cooperation

With the support of laboratory, we have frequent international academic exchanges and cooperation. We frequently sent our staffs to attend international academic conference and symposiums, such as CEIDP, ISDEIV, ICPADM, ISEI, ISEIM, ACEID, etc. and also invite active professors/researchers in worldwide to visit us and make academic exchange/cooperation. For example, recently we have cooperated with ABB to do some research on the new insulation system for GIS, and also started to cooperate with Musashi Institute of Technology on space charge measurement technology.

At the end of this introduction, we wish we can keep innovation and make more contributions on high voltage engineering and EMC fields in the future. Finally, we sincerely invite specialists to visit us and make cooperation together.

Biography

Professor C. R. Li received his doctor degree in electrical engineering in Tsinghua University in 1989. He started his professional electrical engineering career in 1978. He worked 26 years in academic institutions. He is now a professor in Department of Electrical Engineering in North China Electric Power University. He is the director of High Voltage and EMC Laboratory. He worked with University of South Carolina in USA as a post-doctor research fellow for about three years and worked as a Visiting Professor at Rensselaer Polytechnic Institute of USA in 2001. He is very active in professional society activities. He is the Vice President of High Voltage Committee of Beijing Society for Electrical Engineering and the Vice President of High Voltage New Technology Committee of Chinese Society for Electrical Engineering. He is also a Fellow of IEE and a Senior Member of IEEE. He can be reached by lcr@ncepubj.edu.cn.

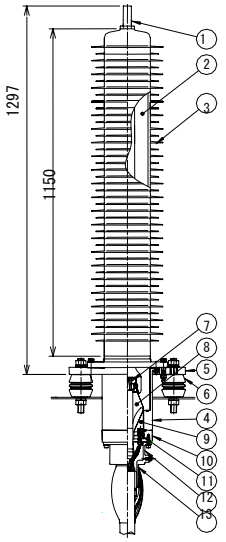
Dr. Lijian Ding was born in 1970, received his master degree in electrical engineering in Harbin Institute of Electrical Technology in 1995, and got his doctor degree in 2000 in North China Electrical Power University. He is now a professor in Electrical Engineering Department. He is the assistant director of High Voltage and EMC Laboratory. His research interest is on dielectrics and electrical insulation. He has published more than 40 academic papers. He can be reached by ljding@ieee.org.

Development of Direct Molded Outdoor Sealing End for 66/77kV XLPE Cable

1. Outline

The current outdoor sealing end for 66/77kV XLPE cables uses heavy weight porcelain bushings and insulation oil for internal insulation, and all of its parts are assembled at the site. Thus, shortening the work time and labor-saving at the site has been desired.

To meet the above requirements, we have developed and put into practice use a completely dry air termination sealing end of solid insulation construction (solid composite type) formed by directly molding silicone rubber on the surface of an epoxy bushing. This sealing end has a drastically reduced weight and uses neither insulation oil nor gas, realizing shorter assembly time and cost reduction.



1. Internal conductor
2. Epoxy bushing
3. Silicone rubber mold
4. Lower fittings
5. Lower flange
6. Supporting insulator
7. Plug
8. Stress relief cone
9. Press-fittings
10. Flange of press-fitting
11. Spring
12. Protective fittings
13. Water-proof layer

Fig.1 Direct molded outdoor sealing end

2. Features of the direct molded outdoor sealing end

The direct molded outdoor sealing end has the following features.

① An outdoor sealing end of solid insulation construction formed by directly molding silicone rubber on the surface of an epoxy bushing. (Fig.1).

② Can be installed also either horizontally or upside-down without using special fittings, because it is a completely dry type using neither oil nor gas for internal insulation. (Fig.2)

③ High reliability, because its body is pre-assembled and inspected at the factory before shipment for all products. (Fig.3)

④ Employing Plug-in construction has reduced the quantity of parts to be assembled at the site, thus greatly shortening the work time. (Fig.4)

⑤ Reduced in weight to less than half of the current sealing end, being in far easier to handle.

⑥ High dielectric characteristic for pollution, being usable in ultra heavy pollution environment with the same length as the current sealing end for light pollution environment.

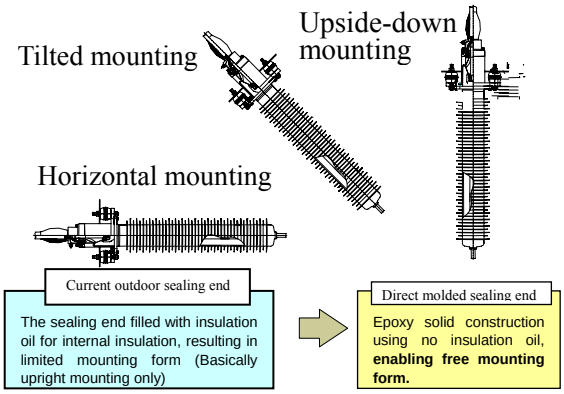


Fig.2 Free mounting form

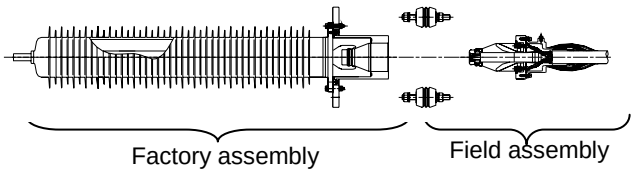


Fig.3 Plug-in construction

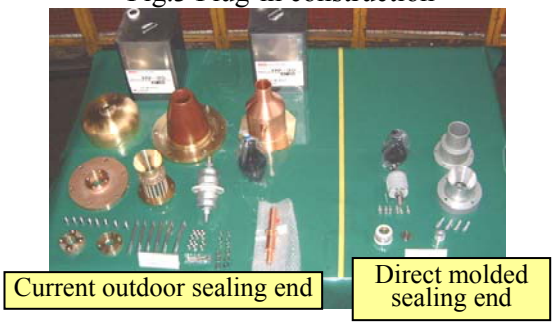
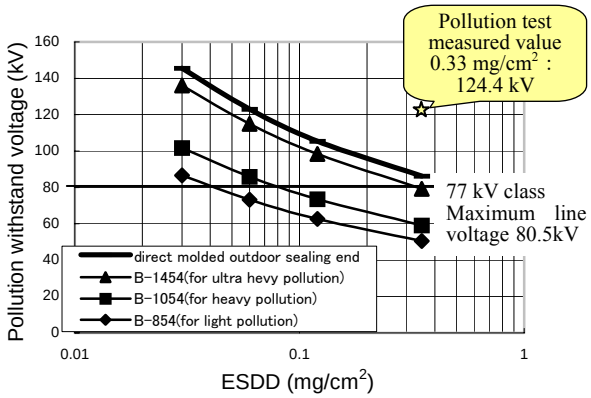


Fig.4 Comparison of assembly parts at the site

Table 1 Comparison of outdoor sealing ends

Item	porcelain bushing in current use		Developed direct mold
	light pollution	ultra heavy pollution	
Weight	About 180kg	About 235kg	About 80kg
Average radius	265mm	265mm	195mm
Overall length	1322mm	1897mm	1297mm
Leakage distance	2600mm	4080mm	3973mm



From Journal of Electrical Study Vol. 35, No. 3

Fig.5 Comparison of withstand voltage to Equivalent salt deposit density (ESDD)

Fig.6 Long period heating-cycle voltage test

Fig.7 Bending load test

3. Development inspection

3-1 Electrical test

We have conducted the initial and development tests in accordance with JEC-3408 and verified that the direct molded outdoor sealing end has sufficient performance as a 66/77kV outdoor sealing end. We also have conducted a long period heating-cycle voltage test and verified that the direct molded outdoor sealing end has the same performance after the test as the initial performance. (Fig.6)

3.2 Article pollution test

To verify the dielectric characteristic for pollution, we conducted an article pollution test by equivalent fog flashover test. In ultra heavy pollution state [the equivalent salt deposit density (ESDD): 0.33 mg/cm^2] the equivalent fog 5% flashover voltage was 124.4 kV (Fig.5). This voltage is far higher than the maximum voltage, 80.5kV, of the 77kV class line. This proves that the sealing end has excellent dielectric characteristic for pollution.

3-3 Mechanical test

Considering a possible total load of wind pressure, earthquake, and short-circuit electromotive force, we conducted a withstand voltage test after applying a bending load of 2940N (300kgf), two times or more the possible total load, to the sealing end and found that no partial discharge occurred (Fig.7).

4. Conclusion

To reduce weight, assembly time, and costs, we developed a direct molded outdoor sealing end formed by directly molding silicone rubber on the surface of epoxy bushing, and verified that it has sufficient performance as a 66/77kV class sealing end.

The sealing end reduces the line shutdown time. Having excellent dielectric characteristic for pollution, it eliminates the need for selecting the bushing as performed before according to the environmental conditions.

We expect that the sealing end will make the electrical equipment smaller and simpler.

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1-1 MINAMI-HASHIMOTO 4-CHOME SAGAMIHARA-SHI KANAGAWA 229-1133 JAPAN
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Wire and Cable Combustion Testing Equipments in JECTEC, Japan

Fig.1 JECTEC Main Office and Labs

Japan Electric Cable Technology Center, Inc. (JECTEC), is located at Hamamatsu, Shizuoka, Japan(Fig.1). The JECTEC was established in 1991 as a co-operative testing and research organization of the electric wire and cable industry. Testing Dept. of JECTEC consists of Fire Protection Dept., Electrical & Physical Dept. and Materials & Chemicals Dept. Fire Protection Dept. is mainly engaged in the combustion tests which include electric insulation tests and insulation efficiency evaluation. Main testing facilities are noted below.

Small Scale and Large Scale Fire Resistant Test Furnaces as shown in Fig.2 are used to test the combustion characteristics of fire-resistant cables and heat-resistant cables. Insulation efficiency is evaluated at the temperature of up to 840℃ (1,544F). Heating condition is based on JIS A 1304. Fig.3 shows the standard heating curve specified in JIS A1304. This test method is in accordance with Fire and Disaster Management Notice 10 in Japan. Large Scale Test Furnace is used for fire resistant test of large size cable, bus-duct and joint-box, etc. Heating curve up to 1,200℃ (2,192°F) is applicable in case of cable protection tube.

↑ Large scale furnace
←Small scale furnace

Fig.2 Fire Resistant Test Furnaces

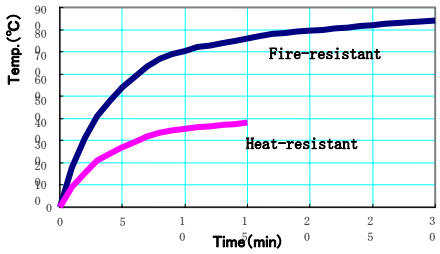


Fig.3 JIS A 1304 standard heating

Steiner Tunnel Flammability Testing Facility is used to measure flame propagation distance and smoke density of bundle cables installed in horizontal duct or plenum and also used to test surface burning characteristics of building materials. This Facility meets UL910, NFPA262 and ASTM E84.

Steiner Tunnel Riser

Fig.4 Testing facilities besed on UL specifications

In addition to above-mentioned facilities, JECTEC has testing equipments, such as Combustion Testing Equipments to meet IEC60332 and 61034 standards, specific flammability testing facilities under a guiding agreement with UL, i.e., Riser Shaft,VW-1, etc. and various material analyzers to measure fundamental flammability characteristics, for instance cone-calorimeter used to analyze not only cable insulation materials but also construction and buildings materials and so on.

↑ Combustion cell under testing

Fig.5 Cone-calorimeter

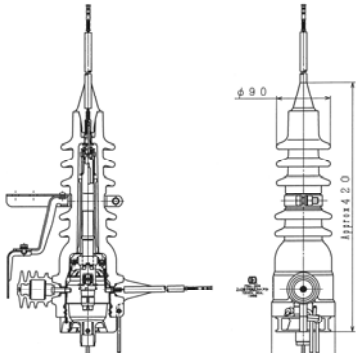
These equipments are available for the tests of the clients in Japan and the Asian countries.

By Minoru Umeda
Japan Electric Cable Technology Center, Inc., Japan

An Advanced Distribution Equipment

Enclosed Type Fuse Cutout with arrester

Enclosed type fuse cutout provides excellent anti-contamination performance and enhances safety for operating personnel due to no exposure of energizing part. Also, built-in arrester simplifies pole arrangement of equipment.



The cutout has the following features.
(1) Excellent anti-contamination performance
(2) Clear indication at fuse operation
(3) Highly reliable ZnO arrester with gap
(4) Compact and light weight

<Ratings>

Rated Voltage	7.2kV	
Rated Current	50A	30A
Rated Breaking Current	12.5kA	
Applicable Fuse Link	1 to 50A	1 to 30A
Pollution Level	Level Ⅳ-IEC60815 (for very heavy pollution level)	
Nominal Discharge Current of Arrester Unit	2.5kA (8/20 μ A)	
Weight	Approx. 4kg	

Over Current Indicator for Fault Location

Over Current Indicator (OCI) reduces outage time and improves utilization of operating personnel. It indicates the presence of fault on down-stream line.

This device does not require both power source and maintenance work.

Without fault detection

After fault detection

OCI has the following features.
(1) Clear indication
(2) Automatic reset of indication
(3) No power supply required
(4) Easy installation
(5) Maintenance free
(6) Compact and light weight

<Ratings>

Rated Current	300A	600A
Min. Detection Current	250A	550A
Reset Method	Indication is automatically reset after 5 hours	
Applicable Wire Dia.	5 to 20mm	
Weight	1.6kg	

By NGK INSULATORS, LTD. , and ENERGY SUPPORT CORPORATION
http://www.ngk.co.jp/english/

Material Technology for Solid Insulated Switchgear

Introduction

SF_6 gas is applied widely to medium voltage switchgear because of its high insulation reliability and down-sizing ability. However, SF_6 gas is not desirable because of the environmental problem. An alternative is the solid insulated system achieved by molding all main circuits with epoxy resin. This newly developed 24kV Solid Insulated Switchgear (SIS) is shown in Fig.1. The switchgear has the advantage of being SF_6 gas-free, compact and maintenance-free. The new material is developed and applied to the SIS, which has an excellent balance of mechanical strength, thermal resistance and productivity.

Materials

The material compositions are shown in Table 1. The conventional material consists of bisphenol-type epoxy resin, phthalic acid anhydride and amorphous silica filler. This type of material is widely used for high speed casting by the automatic pressure gelation method. The developed material consists of another type of bisphenol epoxy resin and phthalic acid anhydride, and is filled with a great deal of spherical silica and a small amount of rubber particles. The cross sections of the materials are shown in Fig.2.

Fig.1 24kV Solid Insulated Switchgear

Table 1 Compositions of epoxy casting resin (phr**)

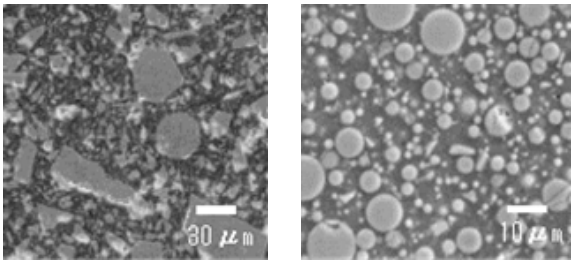
Material	Conventional material	Developed material
Epoxy Resin	Bisphenol I 100	Bisphenol II 100
Hardener	Acid anhydride I 80	Acid anhydride II 85
Silica filler	Amorphous 390	Spherical 530
Elastomer	-	Rubber particle

**) per hundred of resin by weight

Properties

The general properties of the conventional material and the developed material are compared in Table 2. Filling of spherical silica shows lower viscosity of resin so that the developed material could be filled with a great deal of filler. As a result, the developed material has higher mechanical strength and a lower thermal expansion coefficient. The new combination of resin and hardener is selected for the developed material to increase the glass transition temperature (Tg). The dielectric properties are excellent in the developed material.

The temperature dependence of tensile strength is shown in Fig.3. The developed material has excellent mechanical strength and thermal resistance. The former is dominated by spherical silica with high packing density. The latter is brought about by the high Tg of the matrix resin.



Conventional material Developed material

Fig.2 Material configurations

One of the most important material properties for SIS is crack resistance. Crack resistance was measured by the Olyphant Washer Method. The steel washer was molded with resin. The test specimen after molding was ϕ 55mm in diameter and 14.1mm thick. The thermal cycle test was carried out on each specimen step by step, and the crack index was determined when a crack was observed in the specimen during the thermal cycle test. The results are summarized in Table 3. The reference material has the same composition as the developed material, except that it does not contain any elastomer. Crack resistance is dominated by the thermal expansion coefficient, Tg, and mechanical strength. Generally speaking, a higher Tg makes the epoxy resin brittle. However, the developed material has outstanding crack resistance. It has a lower thermal expansion coefficient to reduce the thermal stress when metals or ceramics are molded. Compared with the reference material, it is found that adding elastomer also increases fracture toughness.

Table 2 General material properties

Property	Conventional	Developed
Tensile strength(MPa)	79	**102**
Tensile modulus(GPa)	12.5	14.7
Flexural strength(MPa)	118	**151**
Flexural modulus(GPa)	12.1	12.2
Tg (ºC)	108	**136**
Volume resistivity(Ω･cm)	8.2×10^{16}	8.5×10^{15}
Dielectric constant	3.5	3.4
Dielectric loss (%)	0.30	**0.13**
Dielectric strength (kV/mm)	18.6	**20.0**
Specific gravity	1.77	1.80
Viscosity @60ºC (mPa･s)	8300	7000

Table 3 Crack resistance of materials

Material	Conventional	Developed	Reference
Thermal expansion coefficient (10^{-5}/K)	2.1	1.8	1.8
Tg (ºC)	108	136	136
Fracture toughness K_{IC} (MPa-$m^{0.5}$)	2.5	2.5	1.8
Crack index	11.0	16.0	10.0

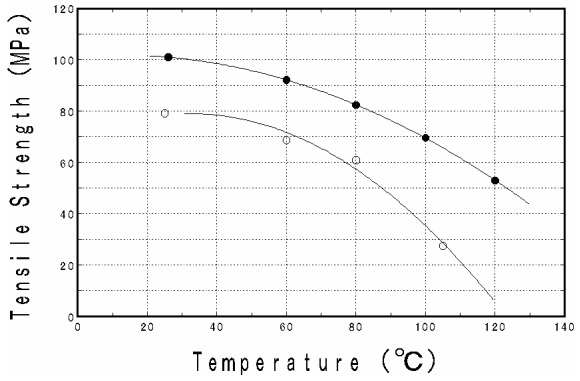
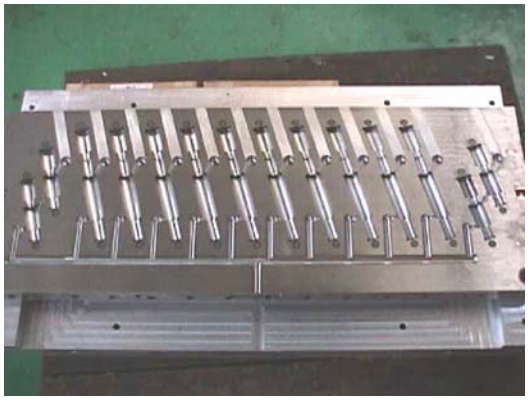


Fig.3 Temperature Dependence of Tensile Strength

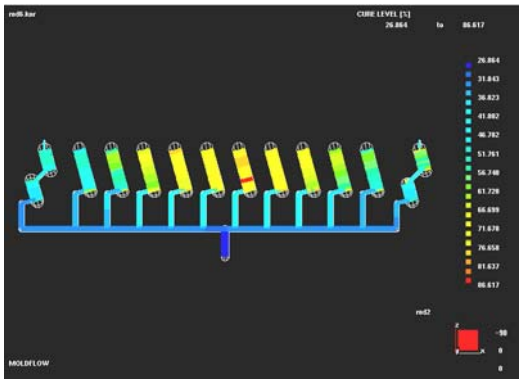
○ : Conventional ● : Developed

Manufacturing Process

High speed casting with the pressure gelation method has been applied to manufacture the molded component for the SIS. For the maximum productivity, several components are molded in a mold at the same time. A casting mold for 14 operating rods is shown in Fig.4 (a) as an example. It is very difficult for all rods to be controlled under suitable curing conditions. The resin may cure in the small inlet before it completely fills in the rod cavity. The best mold structure conditions, curing temperature and time were determined by computer simulation of cure and flow analysis. The cure level distribution of resin in the mold is shown in Fig.4 (b). The analysis is very effective in visualizing the curing sate of resin and in reducing the casting trial.



(a) Casting mold (long:10, short:4)



(b) Flow and Cure Simulation
(Cure level distribution)

Fig.4 Mold for Two Kinds of Operating Rods

Conclusion

The new material and the simulation technology have been applied to manufacture the Solid Insulated Switchgear. The new epoxy resin filled with spherical silica and elastomer has been developed. This material has excellent properties of mechanical strength, thermal resistance and productivity. To obtain maximum productivity, cure and flow analysis was utilized.

By Power and Industrial System R&D Center
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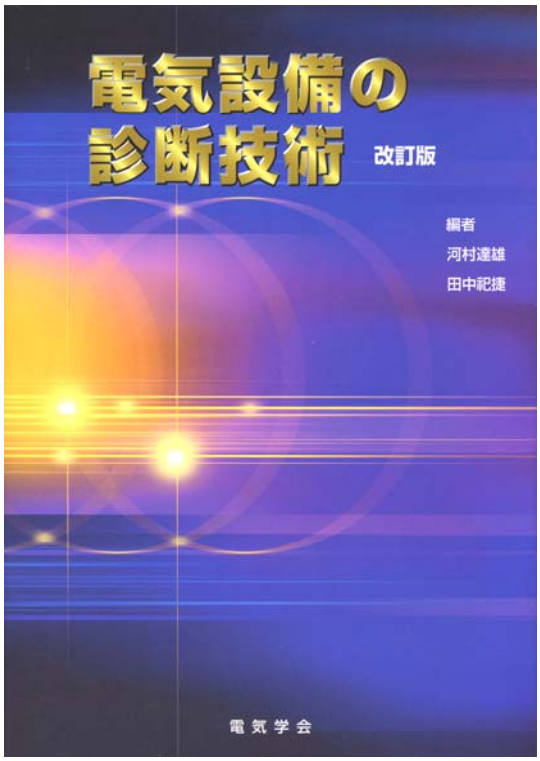
BOOK REVIEW

Tatsuo Kawamura and Toshikatsu Tanaka (ed.), "Diagnostics of Power Apparatus and Cables", IEEJ Press, pp.1- 344, 2003.



The authors got an award of "Excellent Book" from IEE of Japan in 2004 because of this book. It sells best. Two editors and 34 authors were diligently engaged in their work to make the book public. It is really a timely publication, as preventive maintenance become more needed than ever before. Electric power demands as well as economics slow down, and then longer use of power apparatus and cables are more desirable than before.

Imagine how important preventive maintenance for supervision of electrical equipments, and then you may recognize that concept of this book lies in preventive maintenance, as you read Chapter "Introduction: Evolution into Preventive Maintenance". The book consists of three parts: I. Fundamentals, II. Applications, and III. Future Prospects.

A book with the same name was published 25 years ago. Completely revised version is the present book. It is characterized by a new concept focusing on "Preventive Maintenance" and an added part of "Future Prospects" that is still changing day by day.

I. Fundamentals
- Chapter 1: Initial Soundness and Inspection and Testing Technologies
- Chapter 2: Statistical Procedures for Data of Aging and Reliability
- Chapter 3: Aging and Diagnostic Parameters
- Chapter 4: Diagnostics of Aging and Expert Systems

II. Applications
- Chapter 1: Diagnostics of Power Generating Apparatus
- Chapter 2: Diagnostics of Substation Equipments
- Chapter 3: Diagnostics of Underground Transmission Lines
- Chapter 4: Diagnostics of Overhead Transmission Lines
- Chapter 5: Diagnostics of Industry Use Motors

III. Future Prospects
- Chapter 1: Trends of Preventive Maintenance toward New Era
- Chapter 2: Effects of Cost Suppression by Diagnostics
- Chapter 3: Future of On-line Diagnostics

Toshikatsu Tanaka, Waseda University

MISCELLANEOUS

Photos on Front and Rear Covers

Front Cover: Tsinghua University and Wuhan University (China)

<Left figures>

Graduate School at Shenzhen Tsinghua University

Two photographs on the cover page show the campus of Graduate School at Shenzhen, Tsinghua University (referred to as "The School") and a facility of Laboratory of Advanced Technology of Power & Electric Engineering. The School was inaugurated in June, 2001 and moved to the new campus in October, 2003. Prof. Guan Zhicheng is the Dean of The School. He is also the chairman of ACED2004, Shenzhen, and ISH 2005, Beijing. Following is a message from the Dean, Prof. Guan Zhicheng:

Graduate School at Shenzhen, Tsinghua University, is a new campus of Tsinghua University. The School carries forward the long-standing traditional learning style of the main campus: "Rigorous, Diligent, Realistic and Creative", and follows the inspiring motto "Self-discipline and Social Commitment". The School encourages "hard-working and enterprising spirit", "boldness in exploring and making innovations", "pursuit of excellence and devotion to work", "team play with dedication and honesty", and "belief that action speaks louder than voice". As an institution for higher education, the School's first and most important mission is to train professionals with capability of leadership, international vision, entrepreneurship, as well as wide-range knowledge and skills. The second most essential mission of the School is to serve the national economic development by carrying on original and interdisciplinary researches in frontier areas, facilitating the technology transfer to the industry, and offering best social services. The School is building up its competitive research strengths and developing at a fast pace by focusing on key disciplines, recruiting top-brains and establishing well equipped laboratories.

The Laboratory of Advanced Technology of Electrical Engineering & Energy (LATEEE) is one of the research groups in The School. The group's research activities include Method and Apparatus for Glow Discharge Plasma Treatment of Polymer and Fabrics Materials at Atmospheric Pressure, Healthy Fruit and Vegetable Juices Processing by Using High Voltage Pulsed Electrical and Magnetic Field Technique, Treatment of Vehicle Exhaust Gas with High-voltage Pulse Discharge, Effects of Pulsed Magnetic Fields on Osteoporosis, Compact Transmission Line, Mechanism of Gas Discharge and Electric Power Insulation Problems at High Altitude Area, Outdoor Insulation On-line Monitoring Technology, Expert Evaluating System of HV Out Insulation, and Outdoor Insulation Technology.

<Right figure>

Wuhan University

A photograph on cover page shows a demonstration of lighting for artificial human body at the facility of high voltage laboratory in Wuhan University. Following is an introduction of Wuhan University (from the catalogue of Wuhan University):

Wuhan University is located in Wuhan, the capital of Hubei Province, known as "the thoroughfare leading to nine provinces. "It is a key university directly under the administration of the Ministry of Education of the People's Republic of China. Since it has a beautiful landscape and an atmosphere of humanity, the University has been renowned as "one of the most beautiful universities in the world "and "the cradle of innovative talents."

Wuhan University dates back to Hubei Ziqiang Institute, which was founded in 1893 by Zhang

Zhidong, Governor of Hubei and Hunan Provinces in the late Qing Dynasty after his memorial to throne, was approved by the then Qing government. It had changed its name several times (Hubei Foreign Languages Institute, National Wuchang Higher Normal College, National Wuchang Normal Zhongshan University) before it was named National Wuhan University in 1928, and was among the first group of national universities in modern China. The new Wuhan University, founded on August 2nd, 2000, is an amalgamation of the original Wuhan University, Wuhan University of Hydraulic and Electric Engineering, Wuhan Technical University of Surveying and Mapping, and Hubei Medical University. Since then, it has become an institution of higher learning with a complete system of disciplines, the excellent staff, an attractive landscape, and more widespread fame both at home and abroad.

High Voltage & Insulation Laboratory of Wuhan University

High voltage and insulation laboratory is a key laboratory. It was founded in 1950s in in Harbin and was moved to Beijing and Wuhan finally in 1960s.

High Voltage & Insulation Laboratory of Wuhan University was established in 1952, which is the earliest and biggest high voltage laboratory in Chinese universities.

There are many advanced equipments and instruments in the laboratory. The research covers air discharge、EMC、lightning、insulation and over-voltage, etc.

There are nine special laboratories as follows:

(1) High voltage testing hall with 42m long × 18m wide × 18m high.

There are 2,000,kVA/1,000,kV power frequency transformer, 1,200,kV/20,mA DC voltage generator, 120,kA impulse current generator with six kinds of waveforms, 2,400kV and 800kV impulse voltage generator in this hall.

(2) 220kV testing substation with continuous regulation of three phases voltage from 0 to 220kV.

This substation is not only a general 220kV substation with a set of high voltage equipment and low voltage control system for teaching and study, but also a continuous voltage regulation testing system of three phases source from 0 to 220kV for research and on-line monitoring.

(3) Electromagnetic compatibility laboratory with immunity testing system, harmonic power source, frequency spectrum analyzer and analysis software.

(4) Interior over-voltage laboratory with TNA and distribution electric power network interior over-voltage simulation devices

(5) Pollution laboratory with 4.7m × 3.6m × 4.5m frog chamber and pollution test system.

(6) Gas discharge laboratory with high speed camera and vacuum test equipment.

(7) Insulation material laboratory with partial discharge and insulation material parameter measurement devices.

(8) grounding technology laboratory with 8m×4m×2.5m grounding testing pool and developed computation software.

(9) High voltage measurement laboratory with TDS684B digital oscilloscope, AWG2041 arbitrary waveform generator, FLUKE 5500A and RIC422 reference source.

The research is divided into the following fields:

(1) Over-voltage and over-voltage protection in electric power system and electronic system;

(2) Ultra and extra high voltage transmission system technology;

(3) New type insulation material, characteristics and diagnosis;

(4) Electromagnetic compatibility and electro magnetic interfere protection.

Rear Cover: Charge Chromatography (Toyohashi University of Technology, Toyohashi, Japan)

The figure represents "charge chromatography", in which the generation and traveling processes of charge carriers are visualized by the pulsed electroacoustic method. The detailed process of the measurement is as follows: A DC bias voltage was applied until the stable space charge distribution was established. A square pulse was then applied in order to excite carriers. An excess carrier generation took place during the application of this excitation pulse. The space charge transient after the pulse application was observed under constant bias voltage. After the excitation pulse ended, a charge packet of the injected carrier was driven by the bias field and moved toward the counter electrode. The transient space charge measurement made it possible to determine the velocity of the carrier under the bias field and also the point where the carrier was generated. A subtraction treatment might be carried out in order to make it easy to observe the motion of the charge packet.

In the figure, carriers in ethylene-vinylacetate copolymer were generated by applying a short voltage pulse and swept by a bias voltage. Two kinds of carriers were injected from electrodes. The trace initiated at the center of the insulation might be attributed to the field associated dissociation, although the corresponding negative carrier is not clearly seen.

(Prof.M.Nagao & Dr.N.Hozumi,
Toyohashi University of Technology)

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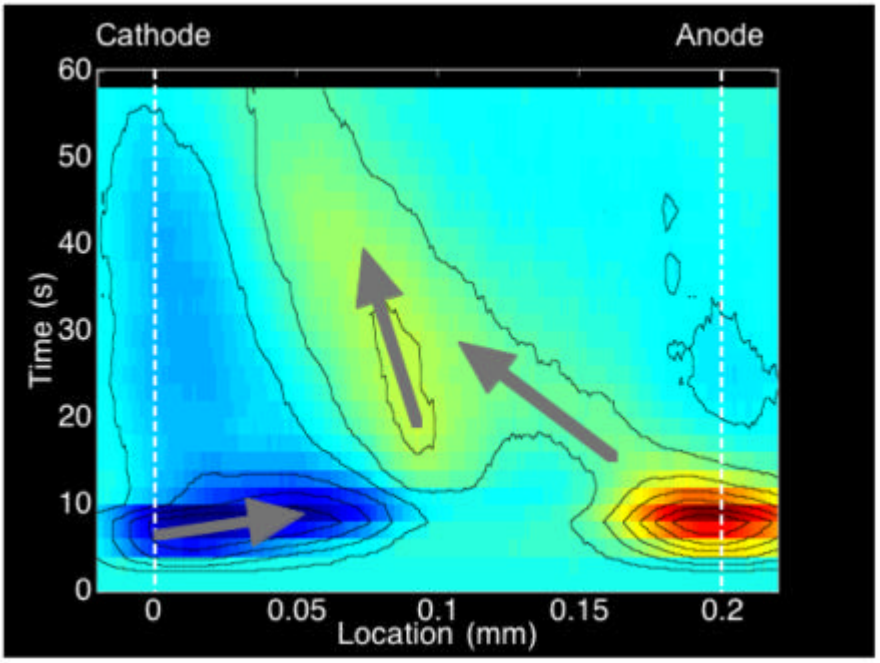

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