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PREFACE

Prof. Y. Ohki

Collaborative Researches

I am belonging to Waseda University, a private university in Japan. In Japan, the amount of financial support from the government to a private university is totally different from its amount to a national university. Consequently, a research fund in a private university is generally very limited. Secondly, my campus is in Shinjuku, the Tokyo's busiest downtown. Therefore, the campus has already been highly utilized, and there is almost no space to install a new large-size experimental apparatus.

On the other hand, I am at present in charge of research and education of three Ph. D. candidates, 15 master students, and 12 undergraduates on the topics of optical and electrical properties in organic and inorganic insulating and dielectric materials. As you know, researches on material characterization, especially those on their optical properties need much money and large-scale and expensive apparatus to carry out. How can I let my many students do expensive researches in my narrow laboratory with a limited fund? Combination of acquisition of funds from outside and practice of collaborative researches with other institutes is certainly only a possible solution. In this preface, I briefly explain my research topics and collaboration institutes.

The researches carrying out in my laboratory are as follows.

(1) Development of a new production method of optical fiber gratings

Based on our patent that optical fiber gratings can be made by implantation of ions into silica, a new production method is being developed in collaboration of NEDO (New Energy and Industrial Technology Development Organization) and four private companies (KDDI, Fujikura, Showa Electric Wire and Cable, and Ion Emerging Technologies) with a total fund of about 200 Million Yen in 3 Years. Some related cooperative researches are being carried out in National Institute of Advanced Industrial Science and Technology (AIST), Shibaura Institute of Technology, and Japan Atomic Energy Research Institute.

(2) Fabrication of nano-structures in TiO2

This project is aiming at making photonic crystal devices by fabricating nano-structures in TiO2 by use of x-ray lithography. Figure 1 shows nano-structures made by collaboration with AIST, Keio University, the University of Tsukuba, and Sumitomo Heavy Industries.

(3) Fabrication of ferroelectric thin films

This project is aiming at development of proper materials and their processing methods for ferroelectric memories. It is cooperative work with Korea University through Japan-Korea Joint Research Scheme of the Japan Society for the Promotion of Science. The Institute of Physical and Chemical Research (RIKEN) is also playing a significant role in this project.

(4) Development of high-k dielectrics for future LSIs

As a cooperative research with UV-SOR Facility in the Institute for Molecular Science and AIST, properties of hafnium silicate and other high-k dielectrics are being examined.

(5) Basic researches on polymeric materials for electrical insulation

Under this project, water treeing in polyethylene, interfacial breakdown at epoxy/rubber interfaces, and three dimensional space charge distribution analy-

ses are being examined at Railway Technical Research Institute, Central Research Institute of Electric Power Industry, and Communications Research Laboratory, respectively.

(6) Eco-friendly polymer and polymer nano-composite

As new materials that are potentially adequate for future electrical insulation, environmentally friendly biodegradable polymers and polyamide nano-composites are attracting much attention. Dielectric properties of the former are being examined as a cooperative research with Tokyo Electric Power with the aid of Yamagata University, while partial discharge characteristics of the latter are being analyzed with Prof. T. Tanaka of the Graduate School of Information, Production, and Systems, Waseda University.

Twenty-five years have passed since I became a staff of Waseda. In early years, no collaborative researches were possible. During those years, I tried even more to get as many grants and to graduate as many students (especially, Ph. Ds.) as possible. Throughout these processes, it seems for me that the above-mentioned collaborative researches have naturally become possible. Except for the one with Korea University, all of the above researches are collaborative only with Japanese domestic institutes. I hope that this small article in EINA Magazine can make my collaboration more international in the near future.

Dr. Yoshimichi Ohki

(Professor, Department of Electrical Engineering and Bioscience, Waseda University)

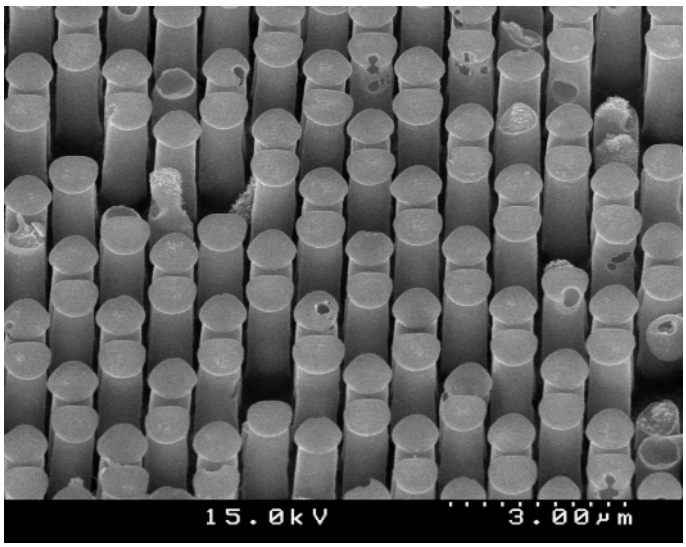


Fig. 1. Periodical nano-structures fabricated in TiO2 by use of X-ray lithography.

OUTLINE OF TECHNICAL COMMITTEES ON DEI AND RELATED TC IN IEEJ

Technical Committee on Dielectrics and Electrical Insulation (DEI)

Chairperson:	T. Okamoto (CRIEPI)
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, formerly called Symposium on Electrical Insulating Materials. The 34th Symposium is to be held at Niigata University on November 14-15, 2002. Prof. Gulski of Delft University of Technology and Dr. Weijun Yin from Phelips Dogde made invited presentations on recent topics. On June 1-5, 2003 the 7th International Conference on Properties and Applications of Dielectric Materials (ICPADM) was held at Nagoya with more than 300 papers. ICPADM was sponsored by IEEE DEIS and cosponsored by IEE Japan. The TC-DEI is planning to organize the 36th Symposium to be held at Shibaura Institute of Technology, Tokyo and also 2005 (International Symposium on Electrical Insulating Materials (ISEIM) in Kitakyusyu-shi, Japan. The TC-DEI currently runs seven Investigating Committees (IC) which organize Technical Meetings and one Cooperative Research Committee (CRC) which edits and publishes this EINA.

Table 1 Investigation and Cooperative Research Committees in TC-DEI

Research Subject	Chairperson
Development of Dielectric and Electrical Insulation Technology to Organic Molecular Device Engineering (3 years from January 2000)	M. Iwamoto (Tokyo Institute of Technology)
Environment-friendly Materials and Systems for Electrical and Electronic Engineering (2 years from March 2002)	Y. Suzuoki (Nagoya University)
Degradation of Insulating Properties and Endurance of Impulse Surge for Printed Wiring Board (3 years from April 2002)	Y. Yamano (Chiba University)
Evaluation of Discharge Property and Degradation Phenomenon on the Surface of Polymer Insulating Materials (3 years from April 2002)	K. Gotoh (Consultant)
Charge Behavior Associated with Interfaces under High Electric Field (3 years from July 2002)	M. Nagao (Toyohashi University of Technology)
On-Line Diagnosis for Electrical Equipments (2 years from January 2003)	K. Uchida (Chubu Electric Power Co., Inc.)
Application of Nanocomposite Materials to the Field of Dielectrics and Electrical Insulation (3 years from October 2002)	T. Tanaka (Waseda University)
EINA Magazine (2 years from April 2002)	T. Tanaka (Waseda University)

Technical Committee on Electrical Discharge (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 Discharge (TC-ED) belongs to the Fundamentals and Materials Society (A-Society) of the IEE of Japan. The activities of the Committee have been covering a wide field from physics of electrical discharges in vacuum, gas, liquid and on surface of materials to their technologies.

A few investigation committees are organized in the TC-ED every year to survey the up-to-date subject and their activities continue for three years normally. Now, 5 investigation committees are running for survey of the subjects listed in Table2.

The TC-ED received the draft of a report from the ad-hoc committee last autumn, new investigation committees are organized now, for example a field of micro-electronics in vacuum and/or a field concerned with the purification technology of environmental pollutants.

The TC-ED is supporting about ten domestic technical meetings on electrical discharges every year where researchers, engineers, university professors and students report more than 200 full papers from both academic and industrial sides. Some of these meetings are cooperated with the TCs on Dielectrics and Electrical Insulation, on High Voltage Engineering and on Switchgear and Protection. From last year, poster session which is linked up with the technical meeting, has been held to encourage the young students and researchers. More than 20 papers were presented at the poster session of the technical meeting held in Hokkaido University this summer.

The international conference is also promoted by the TC-EC. “Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering” will be held on November 5-6, 2003 in Nagasaki. More than 90 papers are submitted and fruitful discussion will be done. Selected papers will be published as the special issue on the Trans.A of IEEJ, next July.

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 discuss about topics related to electrical discharges for two days. The seminar will be held at Kiroro-resort close to Otaru in Hokkaido on November 14 and 15.

Table 2 Investigation Committees in TE-ED

Research Subject	Chairperson
Partial Discharge Phenomena in Gas Insulation Apparatus and their Diagnosis Technology (3years from January 2001)	H.Fujii (Nara National College of Technology)
Interaction Effect Between Charged/ Excited Particles and Atoms/ Molecules (3years from October 2001)	Y.Nakamura (Keio University)
Electrical Discharge in Nitrogen Gas and its Application Technology to Plasma Processing	Y.Kondo (Daido Institute of Technology)
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)

Technical Committee on Pulsed Electromagnetic Energy (PEE)

Chairperson:	Kiyoshi Yatsui (Nagaoka University of Technology)
Secretaries:	Kazuhiko Horioka (Tokyo Institute of Technology)
	Weihua Jiang (Nagaoka University of Technology)
Assistant Secretary:	Hidekazu Tsuchida (Central Res. Inst. 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, and so on.

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 will be held in Nagaoka on Oct. 20 and 21, 2003. 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 next one will be also held in Hawai, possible on Aug. 5-7, 2004.

As of 2001, there is one investigation committee in TC-PEE, the name of which is "Generation and Control of Pulsed Electromagnetic Energy". The chairperson, secretary and assistant secretary are Weihua Jiang (Nagaoka University of Technology), Sunao Katsuki (Kumamoto University), and Hidekazu Tsuchida (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.

Technical Committee on High Voltage Engineering (HV)

Chairperson: S. Yokoyama (Kyushu University / Central Research Instituteof Electric Power Industry)
Secretaries: T. Inoue (TM T&D), I. 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 1 are active in September 2003.

The 3rd International Workshop on High Voltage Engineering (IWHV 2003) was held in Fukuoka city, following the 1st IWHV at Okinawa in 1999 and 2nd IWHV at Tottori in 2000.

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.

One hundred and twenty six participants joined the IWHV 2003. The number of participants is the most of previous workshops. There were 8 sessions, where 57 papers were presented orally for two days. All speakers presented their paper in English, following fruitful discussions.

The workshop banquet was held at Japanese traditional restaurant “Sanshiro”, where 70 participants exchanged various information on the world wide technology of electric power industries and research activities in electric discharge phenomena while enjoying the food (and history) of Fukuoka city.

The next IWHV will be held in Sapporo In October 2004. We hope the next IWHV 2004 will also be a 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 is planned in Okinawa.

TC on High Voltage Engineering meets four times a year. One of the meetings is associated with a technical visit to Nagoya area.

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

Table 3 Investigation Committees in TC-HV

Research Subject	Chairperson
Analyzing Methods on Surges in Power Systems Incorporating New-Type Power Apparatuses.	T. Hara (Kansai University)
Recent Trends and Tasks in Power System Insulation Coordination.	K. Hidaka (The University of Tokyo)
Selection of Lightning Parameters for Protection of Power System Apparatuses.	S. Yokoyama (Kyushu University / CRIEPI)
Insulator Contamination (performance measurement technology)	K. Takasu (CRIEPI)
Mechanism of Lightning Outages on Distribution Lines.	Y. Moro-oka (Kyushu Electric Power company)

Technical Committee on Electrical Wire and Cables (EWC)

Chairperson: Takahisa Imajo (Central Research Institute of Electric Power Industry)
Secretaries: Katsuji Nakaya (Exsym Corporation)
Assistant Secretary: Fuminori Tateno (Viscas 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 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 July 18, 2003, in Tokyo, and focused on the subject of "Space Charges and Cable Insulation". 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 two investigation committees have been finished. The name and chairpersons of the committees are listed in Table 4. These committees are writing their technical report.

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 Japan Electric Cable Technology Center, Inc. to observe the recycle technology of power cables.

Table 4 Investigation Committee in TC-EWC

Research Subject	Chairperson
Investigation Committee for Degradation and Corrosion of Wires for Overhead Power Transmission Lines	T. Kikuchi
Investigation Committee for Cables and Accessories for 20kV Power Distribution Cable Lines	S. Nishimura

IEC Japanese National Committees Related to Electrical Insulating Materials

IEC TC10 Japanese National Committee

Chairperson: T. Ishii (Yuka Industries Co.,Ltd)
Secretary: T. Takahashi (Fujikura Ltd)

Standardization of fluids (insulating oil and SF6) applying to electrical equipments such transformer, cable, condenser and switchgear is dealt with in IEC TC10, whose Japanese National Committee consists of 19 experts. The standards under latest main revised work are IEC60422(maintenance guide for mineral insulating oil), IEC60480(guide for the checking of SF6 from electrical equipments), IEC60567(guide for dissolved gases analysis of oil-filled electrical equipments), IEC60599(guide for the interpretation of dissolved gases analysis) and IEC60836(specification of silicone oil) etc, and revised standard of IEC60296(specification for mineral insulating oil) is published soon. As related activity, IEC TC10 National Committee is in corporation with JPI(Japanese Petroleum Institute).

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 cure 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, the number of active documents for standardization sent from Central Office totaled about 50 including CD, CDV and FDIS, all of which are deliberated in the meetings of the national committee. Furthermore, 35 voting results or compiled comments, and 38 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 Frankfurt. In the year after next, the meeting is scheduled in Tokyo Japan,

IEC TC98 Japanese National Committee

Chairperson: T. Okamoto (Central Research Institute of Electric Power Industry)
Secretaries: K. Kimura (Kyushu Institute of Technology),
K. Haga (Fuji Electric Co., Ltd)

IEC TC98 was established in 1994 after disbanded TC63 to prepare IEC documents on Electrical Insulation Systems (EIS). TC98 plays an important role as Horizontal Technical Committee. The international meeting of TC98 has been held once a year since 1995. Recently TC98 International Meetings were held in Graz, Austria, in 2002. It is scheduled to be held in Montreal, Canada in 2003. TC98 Japanese National Committee consists of experts from METI (Ministry of Economy, Trade and Industry), universities, laboratories and manufacturers of power apparatus, cables and instruments. The Japanese committee has large contribution to WG activities on thermal evaluation (WG6) and voltage endurance of EIS under repetitive impulses from power electronics (WG4) and Maintenance Team 7 and 8.

CIGRE SC D1 Japanese National Committee
(Materials and Emerging Technologies)

Chairperson:	M. Nagao (Toyohashi University of Technology)
Secretary:	F. Endo (Hitachi Co.Ltd.)
Associate 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 based in France. It was founded in 1921 and aims to :

1. Facilitate and develop the exchange of engineering knowledge and information, between engineering personnel and technical specialists in all countries as regards generation and high voltage transmission of electricity.
2. Add value to the knowledge and information exchanged by synthesizing state-of-the-art and world practices.
3. Make managers, decision-makers and regulators aware of the synthesis of CIGRE's work, in the area of electric power.

The previous 15 study committees were reconstructed to the following 16 Study Committees belonging to 4 Categories in 2002 CIGRE Paris meeting. 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).

In this restructuring, the previous SC15 (Materials for Electrotechnology) expands the field of activity by including the emerging technologies for power systems and became SC D1 (Materials and Emerging Technologies). SC D1 has now 13 Working Groups (WG) and Task Forces (TF); WG D1.01 (Fluid-Impregnated Insulating Systems), WG D1.02 (Dielectric Liquids), 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 D1.13 (Statistical evaluation, Weibull statistics), 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), SCTF D1.00.02 (Energy services in 2020) and SCTF D1.00.03 (Data mining & material insight). In 2003 we had a regular meeting in Turku, Finland from September 1st to 5th and the next meeting is scheduled in Paris from August 29th to September 3rd, 2004. JNC SC D1 has usually 4 meetings a year.

ACTIVITIES OF THE TECHNICAL COMMITTEES ON DEI IN IEEJ

Digest Reports of Investigation Committees in DEI

Investigating Committee on Development of Dielectric and Electrical Insulation Technology to Organic Molecular Device Engineering

Mitsumasa Iwamoto (Tokyo Institute of Technology),
Mitsuyoshi Onoda (HimejiInstitute of Technology)

Purpose of establishment

The committee started in January 2000 by 22 members to investigate and the interfacial electronic phenomena and functional properties of organic thin films and will be continued until 2002.

As organic materials have excellent insulating and dielectric abilities, they play an important role as covering and insulating materials for power and communication cables and other electrical equipment. However, recently the techniques of constructing highly-ordered and super-structured organic films have developed rapidly and its achievements and also essential electronically and optically functionality of organic materials have become a center of attraction. In order to utilize their functions sufficiently, the understanding on the electronic phenomena and electronic energy states on the order of nanometer scale at the molecular films/electrode interface and between quite different molecular films interface is indispensable. It seems to be the most probable that highly-ordered organic thin films will be put to practical use as an intellectual films with learning effects, etc. from the completely new viewpoints in the electrical and electronic field. In the present situation, we are under investigation mainly that what the electronic and optical properties at the interface of highly controlled organic thin films were clarified by what kind of techniques so far, what types of their intellectual functionality were studied so far from the viewpoints of the electronic and optical properties and then what are the subjects of this matter for a future study, etc. That is,

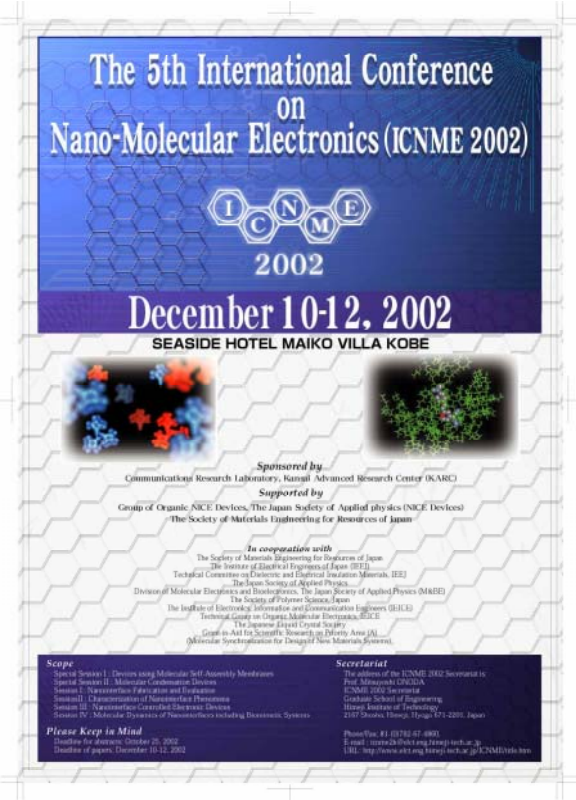
1. Trends and topics on the nanometric interfacial controlled molecular devices.
2. Control and electronic and optical functions on charge transfer at the nanometric molecular-interfaces and trends and topics on their evaluation techniques.
3. Relationship between electronic states and injection mechanism at the nanometric molecular-interfaces and topics on the injection type organic devices.
4. Trends and topics on the molecular dynamics and modification of organic materials.
5. Trends and topics on the interfacial phenomena in the dielectric and electrical insulation technology.
6. Trends and topics on the fabrication of the organic molecular devices and their application to information systems.
7. Other trends and topics concerning the interfacial phenomena for organic materials.

Activity

Since the establishment of this committee, the study meeting was held 16 times up to December 2002. In April 20, 2001, this committee gave a course in trends and topics on the electrical and optical functionality and evaluating technique for highly-controlled organic alignment films sponsored by Tokyo chapter, IEEJ. Furthermore, the special issue entitled “Present Status and Future Scope of Organic Molecular and Material Electronics” had been published in the Transaction of IEEJ, part A in July, 2001, and also The 1st International Discussion & Conference on Nano-Interface Electronic (IDC-NICE) Devices had been held at KyongJu, Korea, on July 16-20, 2001 (The papers presented there had been published in a special issue of *KIEE International Transactions on Electrophysics and Applications* on April, 2002, and The 2nd IDC-NICE Devices had been held at Busan, Korea on October 28-30, 2002. The 3rd IDC-NICE Devices will be held at Tokyo, Japan this coming December 18-20. Then, the 5th International Conference on Nano-Molecular Electronics (ICNME 2002) had

been held from December 10 to 12, 2002 at Kobe, Japan (The selected papers presented there had been published in a special issue of *Thin Solid Films* on August, 2003). The main purpose of this conference was to provide the participants a good opportunity to discuss the ideas and experimental results with other scientists for further development of nano-molecular electronics. Moreover, the papers presented in the International Workshop on Nanotechnology and NICE Devices (IWNND 2002) had been published as a book entitled "*Nanotechnology and Nano-Interface Controlled Electronic Devices*" (Ed. by M.Iwamoto, K.Kaneo and S.Mashiko, *North-Holland*, Amsterdam, 2003(Elsevier.B.V.). The three years activity of the committee had already been published in Technical Report of IEEJ (No. 910) on February, 2003.

The nanotechnology is extremely important for the realization of organic optoelectronic devices. The Investigating Committee on Development of Organic Electrical and Electronic Materials with Flexible Structure to Nanotechnology will be started soon.



Abstracts of the ICNME2002

Investigation Committee on Environmentally Friendly Materials and Systems for Electrical and Electronic Engineering

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

To cope with the increasing environmental problems, environmentally friendly technologies for materials, devices, apparatuses and systems have become increasingly important. Efforts have been made to develop some measures against environmental problems. They have, however, just started and in many cases remain within the framework of the existing present technologies. The objectives of this committee are to make systematic investigation on the state of the art and the trend of the measures against environmental problems and to clarify the guiding principle for the research and development of the environmentally friendly future technologies in the field of materials and systems for electrical and electronic engineering.

The committee is to investigate the following.

1. Trend of environmentally friendly technologies for material and apparatus production
2. Trend of environmentally friendly technologies for material development and apparatus design
3. Environmental impact of apparatus operation
4. Trend of environmentally friendly technologies for dismantling, disposal and recycling
5. Possibility of establishing new cooperative research projects

The committee started in March, 2002 with the term of two years. The 17 members are from universities and industries. The committee chair is Prof. Yasuo Suzuoki of Nagoya University, the secretaries are Prof. Masayoshi Ishida of University of Tsukuba and Dr. Ryozo Takeuchi of Hitachi

Ltd. and the assistant secretary is Assist. Prof. Takeyoshi Kato of Nagoya University.

Up to September 2003, the committee started systematic survey of published papers and articles, made two investigative tours to Tokyo Eco Recycle Co. Ltd. and Kitakyushu Eco Town and held a study meeting. In the investigative tours, the committee visited recycling facilities for household appliances, PET bottles, fluorescent lamps and cooking oil and the research facility for garbage-based production of biodegradable polymer.

The study meeting was held in January 2003. Five presentations made were titled "Ecomaterials", "Recycling and materials suitable for environment", Operation performance and impact of home appliances recycling plant", Technical movement of ecological (EM) wire and cable" and "Environmental assessment of transformer & switchgear for power system". The main points reported and discussed are as follows. For the development of eco-materials, the following four distinctive viewpoints are important: hazardous substance free, green environmental profile, higher material recyclability, and higher material efficiency. It is also important to combine the development of eco-materials with the change in design concept of apparatuses and systems and to set proper targets for material development in the three directions, i.e. environmental compatibility, performance and amenity. For recycling, issues are dismantling-oriented design, standardization of parts and materials, material separation, enlargement of the outlet for recovered materials, and effectiveness of recycling itself as well.

In consequence of the above preliminary investigations, the committee has launched three working groups for the detailed investigation on (1) electrical properties of environmentally friendly materials, (2) life cycle assessment and (3) alternatives to conventional thermosetting insulating resins.

The final results of the investigation are to be reported not in the form of a usual technical report but to be presented at a symposium during the Annual Convention of IEE of Japan and at other research meetings.

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

Yoshiaki Yamano (Chiba University)
Katsuhiko Shutoh (Tokyo Science University)
Shouzo Yoda (Hioki Electric Co. Ltd.)
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 comes up to an important factor for the design of electronic equipments 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 may come from 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 the market demands 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 the reliable data for insulating strength between the conductors at the high voltage surge application (surge endurance), including the round robin test by the members.

We have held seven meetings up to August 2003. Now we are investigating and compiling the papers and reports on the ionic migration. Furthermore, the round robin test for the surge endurance of the board has started. The test is focused to the board for the extremely small gap

distance (30mm) with backing foil conductor.

The final technical report will be issued from IEE Japan in 2005.

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

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

Already, the application of polymer insulator has been expanded in the filed of power supply and distribution system all over the world. Compared to porcelain insulator, however, polymer insulator has been demanded to solve the challenging subjects on a long-term reliability and diagnosis techniques in the real application field.

From April 1st 2002, the new investigation committee started with 23 members. In 2003, it becomes 24 members. 11 members are from universities and 13 members are from electric power utilities and manufactures. Using 8 kinds of plane type and rod type common samples, all members are investigating the degradation properties of polymer insulator material with using their own advancing measurement techniques.

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

The main subjects of the committee are as follows.

1. Discharge mechanism and Recovery mechanism of hydrophobicity at the surface of polymer insulating materials.
2. Degradation mechanism of the target materials.
3. Leakage current measurement technique.
4. Evaluation technique of the degradation.
5. 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 current 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 WG15.14, "Material properties for non-ceramic outdoor insulation"

Investigation Committee on Charge Behavior Associated with Interfaces under High Electric Field

Masayuki Nagao (Toyohashi University of Technology)
Naohiro Hozumi (Toyohashi University of Technology)
Yoshinao Murata (J-power Systems Corp.)
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 kind 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 he 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

In the activity, the committee is planning to pigeonhole the characteristics and understand their physics. The committee is composed of about 30 members and investigating the following.

(1) Summary of methodologies for the observation of charge behavior

(2) Charge behavior at metal-insulation interface

(3) Relation between breakdown and charge behavior at interface and bulk

(4) Relation between degradation and charge behavior at interface and bulk

(5) Simulation of charge behavior at interface and bulk

Expected impact

Clarification of charge behavior associated with "interface" will lead to intrinsic understanding of high field phenomena. In practical point of view, this will give a guideline in the development of a new materials and design of insulation system using the materials, as well as rationalizing the insulation design.

Term of investigation

August 2002 to July 2005 (three years)

Investigation Committee on On-Line Diagnosis for Electrical Equipments

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

The committee was established in January 2003 with the term of three years. The committee consisted of 30 members from universities, research institutes, electric power companies, power apparatus manufactures and user companies of electric power. An on-line diagnosis of insulating performance in power cable and power apparatus is very important, the manufactures and utilities have been demanding an establishment of consistent on-line insulating diagnosis due to anticipate and prevent the outbreak of large-scale accident. The main investigations of the committee are as follows;

(1) New technologies for the degradation of dielectric and electrical insulating materials.

(2) On-line diagnosis technologies of insulation performance for power cable and power apparatus.

(3) Comparison between on-line and off-line measurement for the methods, trend monitoring and judging standards.

The committee has held 4 meetings. The committee has started systematic survey of published papers and articles at the beginning, and has planned investigation tours on on-line diagnosis for electrical equipments. The committee will promote 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.

Investigation Committee on Application of Nanocomposite Materials to the Field of Dielectrics and Electrical Insulation

Toshikatsu Tanaka (Waseda University)
Mikimasa Iwata (CRIEPI)
Masahiro Kozako (Waseda University)

Big Paradigm Shift

Share with us a sense of nanotechnology that has been emerging with much expectation as a future crucial technology. You might recognize it as a collective terminology for science and technology in nanometer size, which ranges from materials to biology. It might deal with mesoscopic structures and thereby generated macroscopic characteristics. Nanoscale is larger than atomic scale but smaller than bulk size. Atoms themselves in atomic scale would not exhibit any material characteristics, but their nanoscale disposition would function new material touch performances that come up with the quantum mechanics. Self-assembly is also an important key word as material fabrication.

The advent of nanomaterials is what you have to watch, if you are materials scientists or engineers, and/or if you are interested in new materials for your own applications. Those would bring you a new paradigm shift. You might depict completely different picture of materials.

For materials scientists and electrical engineers like you in the field of dielectrics and electrical insulation, the micrometers to nanometers transition would be a big paradigm shift, i.e., the Debye culture to the nano-culture, as pointed out by Professor T. J. Lewis of University of Bangor, UK. In dielectrics terminology, you might agree to the statement that the former is expressed by statistical average, while the latter is strongly reflected by phenomena in molecular order.

Nanocomposites are a big challenge!

You might come across a new word such as nocomposites, or nanocomposite materials. This is

a new challenge that you are willing to face. All you have to do now is enter the new paradigm to cultivate them, and you shall be able to enjoy full exploitation of their near future fruits. Nanocomposites include inorganic-inorganic and organic-inorganic combinations.

With this in mind, we have got together to form an investigation committee to collect information, publicize the emergence of a new class of materials, and help in direction of R&D.

IEEJ Committee on Nanodielectrics & Plans

"Why don't we gather to discuss the future nanocomposites?" was an initial start for our activities. It led us to organize an investigation committee in October 2002. Active persons counted 27 including Chair and two Secretaries. What are the objects? The kick-off meeting guided us to a roadmap to:

(1) Clarify the status of nanocomposites in nanotechnology field.
(2) Investigate manufacturing methods.
(3) Characterize various performances.
(4) Create application.

Then almost one year has passed, and five meetings have been held, since we gathered to talk on the nature and behavior of materials at the micro-, meso- and atomic scales. Outstanding specialists were invited and a laboratory was visited once, in order to scrutinize relevant information. Workshop on nanodielectrics was held in collaboration with CIGRE in June 2003. We are planning to hold a symposium next March 2004, and a special session at International Symposium on Electrical Insulating Materials to be held in Kitakyushu, Japan in June 2005.

Knowledge Introduced from Outside

Almost no activity of nanocomposites has been done until recently in the field of dielectrics and electrical insulation. We needed inputs from outside. Then we invited specialists from outside of dielectrics and electrical insulation to give us lectures on nanocomposites. So far Mr. K. Chujo of K.C. Research, Professor S. Murase of Tokyo University of Agriculture and Technology, and Professor Y. Chujo of Kyoto University gave us their talk on "Review of polymer nanocomposites", "Mechanisms of nanomaterial functions", and "Organic-inorganic polymer hybrids", respectively. We visited AIST-Center of Macromolecular Technology to exchange views with Dr. S. Nakamura and Dr. G. Kojima.

Symposia on Nanocomposites

Looking beyond our territory of dielectrics, it is increasingly clear that interdisciplinary forums have been devised to exchange relevant expertise among chemists, physicists, engineers and biologists. Then you may notice that several symposia on such cutting edge technologies have been held recently, as indicated below:

(1) Biennial Symposium "Polymeric Nanomaterials", CA, USA, Nov, 17-20, 2002.
(2) Symposium "Polymer Nanocomposites", Quebec, Canada, Oct. 6-8, 2003.
(3) Symposium "Nanocomposites", CA, USA, Nov. 10-12, 2003.

As for symposium (1), sixty papers were presented. Dr. A. Usuki of Toyota Central Research and Development Laboratory reviewed some of them and got in touch with clays such as montmorillonite or layered silicate, ion exchange in montmorillonite, and synthesis methods and characterization for clay composites with not only homopolymers such as nylon 6, polypropylene, polystylene and EPDM, but also polymer alloys and copolymers such as ABS and SEBS.

Symposium (2) was concerned with the following aspects:

(1) Nano-reinforcements based on silicates (natural and synthetic) and carbon (nanotubes and nanofibers).
(2) Theoretical aspects of intercalation, exfoliation, and dispersion.
(3) Novel modification or exfoliation techniques.
(4) Comparison of experiment and theory with respect to key properties of nanocomposites.

Eighty-one papers were presented from 21 countries.

Symposium (3) formed its sessions as follows:

(1) Novel manufacturing techniques of nanocomposites.
(2) Innovations in nanoparticles, nannotubes, and nano-wires.
(3) Properties and characterization of nanocomposites.
(4) Fire retardancy of nanocomposites.
(5) Functional nanocomposites: from quantum size confined to mesostructures.
(6) Medical, biomaterials, and specialty applications of nanocomposites.
(7) Emerging commercial applications and new markets for nanocomposites.

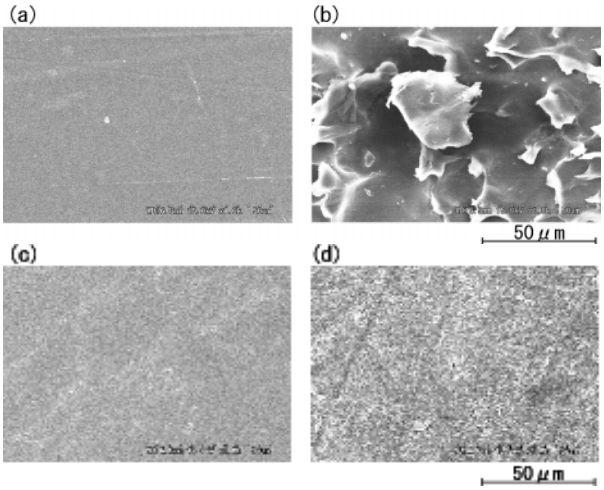
Nanocomposites as Dielectrics

Now you come back to your expertise and see several original papers in dielectrics arena submitted from Japan.

(1) "Inverter surge voltage resistance enameled wire for high reliability inverter-fed motor" by Hitachi Cable.
(2) "High thermal conductive epoxy resins with controlled high order structures" by Hitachi.

(3) "Synthesis of alumina ultra fine powder by transferred arc plasma" by CRIEPI.
(4) "Preparation and properties of epoxy-organically modified layered silicate nanocomposites" by Toshiba.
(5) "Surface change of polyamide nanocomposites caused by partial discharges" by Waseda University.

Paper (5) demonstrates that a surprisingly big difference is recognized in surface roughness caused by exposure to partial discharges between polyamide without fillers and polyamide with a small amount of nano-fillers. Much improvement of PD resistance can be obtained by only few % addition of nano-fillers (synthetic layered silicates). You will confirm this by photos with some explanation as shown below:



Upper: Polyamide free of additives, (a) Original and (b) Degraded by partial discharges
Lower: Polyamide with 5% synthetic clay, (c) Original and (d) Degraded by partial discharges
Figure: Surface degradation (SEM) caused by partial discharge using IEC(b) electrode (Va = 10 kVrms, 60Hz, t = 5 h)

Now fly over to China. It seems that they are also active in nanocomposites as dielectrics. ICPADM, ISH and CEIDP are targets for demonstration to show their brand-new results as follws:
(1) "Effect of space charge in nanocomposite of LDPE/TiO2" by Shanghai Jiatong University.
(2) "The effect of α and γ phase nano Al2O3 on mechanical properties of EPDM using in high voltage power cables" by Shanghai Jiaotong University.
(3) "Synthesis and characteristics of corona resistant nanocluster trapped polyimaide/silica composites" by Harbin University of Science and Technology.
(4) "Study on corona resistance of polyimade nano inorganic composites" by Harbin University of Science and Technology.
(5) "Study of the properties RTV nanocomposite coatings" by Wuhan University.
(6) "The electrical conductionin polyimids nanocomposites" by Xi'an Jiaotong University.

Invitation to Nanocomposites

Come and join us in such emerging field, and you will mine precious diamonds that still remain undiscovered under the ground. Certainly, you will be successful if you have much enthusiasm and competence, or perhaps a bit of knowledge-based new ideas.

Contact: t-tanaka@waseda.jp

Cooperative Research Committee on EINA Magazine

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

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”.

ACTIVITY OF COMMITTEE

The present committee has a Chairman, 3 secretaries and 28 members. It has a general meeting and two or three secretary meetings a year and discusses the activity and contents for the next edition.

The committee published EINA No.9 in November, 2002 and opened an EINA WEB SITE (**http://www.eina.ws/**) in March, 2001.

The committee will publish EINA No.10 (this EINA) in November, 2003 and enrich the content of the WEB page.

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 will see more about that later in this EINA No.10.

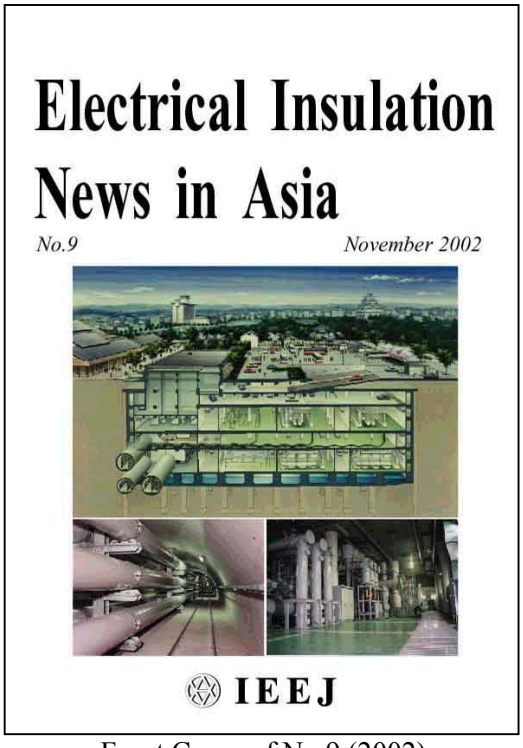
MAIN SUBJECTS OF EINA

Main subjects of EINA are as follows:

- Preface
- Outline of technical committees on Dielectric and Electric Insulation (DEI) and related TCs in IEEJ
- Activities of the Technical Committee on DEI
- Technologies for Tomorrow
- Technical Exchanges between Asian Countries
- Records and announcements of international conferences in Asia
- Introduction of laboratories in Asia
- Letters from readers
- Front and rear covers show color photos of the state of the art industrial products or experimental facilities and fundamental research achievements

Last year International advisory committee was organized. Now the members are 15 persons in Asian countries. They are expected to give valuable advice to EINA, and to initiate much more interaction in Asian activities for electrical insulation and related matters.

EINA Newsletter will be issued every two months to deliver fresh news that might attract many subscribers much more.



Front Cover of No.9 (2002)

INTERNATIONAL EINA MEETING IN ICPADM 2003

The International EINA Meeting was held for information exchange and human contact among researchers of Pan-pacific regions in the field of electrical insulation. By taking the liberty of the occasion of the 7th ICPADM that was held on Nagoya, Japan on June 1 to 5, 2003, we got together. We actively exchanged information and opinions of each other there.

Date and Time:

June 2, Monday, 2003, 7:30 --- 8:45 PM.

Venue:

Conference Room at Meitetsu New Grand Hotel, Nagoya, Japan (the same place as ICPADM 2003).

Participants:

22 participants (Korea: 4, Australia: 3, India: 1, Poland: 1, Denmark: 1, Pakistan: 1, Japan: 11) attended the meeting.

Agenda:

1. Recent activity of EINA to be introduced by Prof. T. Tanaka. (10 min)
2. EINA website to be demonstrated by Prof. M. Nagao. (20 min)
3. Discussion and information exchange. (45 min)

The content of discussion and information exchange in the meeting is shown as follows:

① We hope EINA have links to the Inst. of Electrical Engineers of each country.
② EINA might be able to related closely to the Inst. of Electrical Engineers of Korea.
③ Electrical Insulation Conference in Poland is also held in every two years.
④ The organization like EINA exists also in Scandinavia.
⑤ Change the name? e.g. “EIN in the World”
⑥ Continuance of the magazine was strongly demanded by many people.
⑦ Further enhancement of the EINA web site was requested.

(By Masahiro Kozako, Waseda University, Japan)

Photo : All participants

RESEARCH ACTIVITIES AND TECHNICAL EXCHANGES IN ASIAN COUNTRIES

Conference Records

The 7th International Conference on Properties and Applications of Dielectric Materials (ICPADM2003)

The 7th International Conference on Properties and Applications of Dielectric Materials (ICPADM2003) was held in Nagoya, Japan on June 1 through 5, 2003. The first ICPADM was held in Xi'an in 1985 and has been held every three years. The purpose of ICPADM is to provide a forum for researchers, scientists and engineers from all over the world to exchange ideas and discuss recent progress in electrical insulation, dielectric materials, test and measurement techniques, and related problems from basic properties to practical applications. The general chairman of the organizing committee was Prof. T. Mizutani of Nagoya University.
Unfortunately, the ICPADM 2003 was very much affected by SARS. The organizing committee had no choice but to give top priority to the safety of the conference participants and regretfully decided not accept attendance of anyone from the SARS affected areas. In spite of the fact that colleagues in China or Toronto could not attend the conference due to SARS, however, there were over 260 participants.

There were 307 papers submitted from 32 countries. The conference started with two memorial lectures. The Liu Ziyu Memorial Lecture was delivered by Prof. W. Boeck of the Institute for High Voltage Engineering and Electric Power Transmission, Technical University of Munich, Germany. The title of his lecture was Solutions of Essential Problems of Gas Insulated Systems for Substation (GIS) and Lines (GIL). The Ieda Memorial Lecture was delivered by President M. Kosaki of Gifu National College of Technology, Japan. The title was Super Electrical Insulation of Polymers in Cryogenic Region.

These were followed by 24 oral sessions and 4 poster sessions, among which 3 were jointly organized with CIGRE Working Groups D1-03 (Gas Insulation) and D1-12 (Materials for DC Applications). The sessions were:

Session 1	GIS
Session 2	Photonics
Session 3	Insulation Diagnosis of GIS & Cables
Session 4	Electronics
Session 5	Environmental Issues
Session 6	New Measurement and Evaluation Methods
Session 7	Partial Discharge
Session 8	Space Charge Measurement
Session 9	Treeing
Session 10	Space Charge Application
Session 11	Ageing and Life Time Estimation
Session 12	Conduction and Breakdown in Solids
Session 13	Asset Management
Session 14	Conduction and Breakdown in Liquids and Gases
Session 15	Insulators
Session 16	Dielectric Phenomena
Session 17	Rotating Machines
Session 18	Thin Films
Session 19	Insulation Diagnosis of Transformers & Rotating Machines
Session 20	Nano-Composites and New Materials
Session 21	Transformers
Session 22	New Insulation Technology
Session 23	Power Cable (Including Recycle)
Session 24	Surface & Interface

Two satellite meetings were also held just before and after the conference. One was CIGRE Workshop on Nanodielectrics organized by Prof. Toshikatsu Tanaka of Waseda University (CIGRE WG D1-16) and was held on June 1 just before the conference. The other was Workshop on Future Electric Power Equipment and Electrical Insulation Techniques organized by Prof. H. Okubo of Nagoya University (CIGRE WG D1-03) and was held on June 6 after the conference.

Three technical tours were organized by the conference. They were to Toyota Motor Corp. (Production Line and Visitor Center), Chubu Electric Power Co. (Advanced Combined-cycle Power Plant & 275 kV XLPE cables) and NGK Insulators, Ltd. (High Voltage Laboratory and Insulator

Plant). The conference banquet was held after the technical tours. At the beginning, Prof. Mizutani, the General Conference Chairman, presented the memorial lecture awards to Prof. Boeck and President Kosaki. This was followed by a presentation of traditional mechanical puppets by a group from Inuyama, a city near Nagoya. The marionettes were 230 years old. The highlight of the show was the puppet climbing up stairs without being manipulated by strings from above. After the presentation, the performers demonstrated the mechanism of the puppets and how to manipulate them. The banquet ended with President Kosaki teaching the participants the Japanese custom of ending a party by everyone clapping 3, 3, and 4 for three times.

In the International Advisory Committee held during the conference, a ballot was taken and Bali, Indonesia was chosen as the site of the next ICPADM in 2006.

Opening Ceremony (Prof. T. Mizutani, General Chairman)

Poster Session

Presentation of memorial lecture awards to Prof. Boeck and President Kosaki.


The people from Inuyama City explaining the mechanism of 230 year old mechanical puppet.


Clapping hands to end the banquet.

Prof. Suwarno from Indonesia inviting all to the next ICPADM 2006 in Bali.

The 11th Asian Conference on Electrical Discharge

This conference is a combined conference of 'The 11th Asian Conference on Electrical Discharge (ACED)' and 'The 7th Korea-Japan Joint Symposium on Electrical Discharge and High Voltage Engineering (K-J Joint Sympo.)'. The aim of those conferences is to provide an opportunity for the scientists and engineers to exchange and share their experiences and research achievements related to the fundamentals and applications of the concerned field. ACED was established in 1988 and has been directed toward a particular purpose for the development of the study on electrical discharge phenomena. Meanwhile, K-J was initiated in 1996 to enhance the mutual exchanges of the experts in the concerned field from the manufactures and utilities between two countries. In 2002, these two international conferences have been jointly held at Soongsil University in Seoul in Korea on Nov. 18-20 and hosted by the Study Committee of High Voltage Engineering & Discharge Applications of KIEE.

Two hundred sixteen researchers (Korea: 120, Japan: 83, China: 4, Indonesia: 4, Thailand: 2, Canada: 2, Netherlands: 1) attended the symposium, and 30% of them are younger researchers including students. One hundred sixty nine papers (Invited Papers: 2, Tutorial: 1, Oral Session: 33, Poster Session: 133) are finally accepted and published in the proceedings of 2002 Joint Conference of ACED & K-J Symposium on ED and HVE.

A total of eleven lectures and sessions involved the papers (Oral: 36, Poster: 133) covering the wide variety of topics such as electric and magnetic fields and their applications, high voltage testing and measurements, partial discharge and diagnostic techniques, electrical discharges and their applications, electrical insulation and dielectric materials, lightning and over-voltages, plasma and its apparatus, power apparatus and their monitoring, EMI/EMC, and so on. After the presentations, the Committee awarded 'Best Paper Presentation Award for Young Researchers' to eleven researchers in praise of their splendid achievements. Four Japanese students out of 11 in total are awarded.

On the day of 20th, technical visit was realized at the 765kV UHV substation site for which 43 participants has attended. The construction of the 765kV transmission line was realized in 2001 and then the line has been under commercial service since this May. This is the highest level of transmission voltage commercialized in Asia.

(By Dr. Shoji HAMADA, Kyoto University, and Noriyuki HAYASHI, Kyushu University)

Photo: All Participants

International Conference on Electrical Engineering 2003 (ICEE2003)

The International Conference on Electrical Engineering (ICEE) 2003 was held from 6 to 10 July at the Kowloon Shngri-La Hotel with the theme "Intelligent, Clean, Efficient Electricity for the 21st century. ICEE 2003 was attended by over 250 delegates from Hong Kong, China, Japan, Korea, India, UK and USA. It was hosted by the HKIE and jointly organized with the Chinese Society for Electrical Engineering, Korean Institute of Electrical Engineers and the Institute of Electrical Engineers of Japan.

Announcement of International Conference to be held in Asia

The 7th Korea-Japan Joint Symposium on Electrical Discharge and High Voltage Engineering

The 7th Korea-Japan Joint Symposium on Electrical Discharge and High Voltage Engineering (J-K2003) will be held in Nagasaki, Japan, from Nov. 5 to 7, 2003, and be chaired by Prof. M. Matsuo, Nagasaki University, Japan.

Detail information can be obtained from Internet of http://emf.ence.kyushu-u.ac.jp/jk2003/ .
Secretariat:

・Technical Program and Award Committee (Regarding with Abstract/Papers Submissions, Program, Review, Transactions, and Award):

Prof. Masayuki Hikita
Dept. Electrical Engineering, Faculty of Engineering
Kyushu Institute of Technology
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Tel & Fax: +81-93-884-3241
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・Local Executive Committee (Regarding with Others):

Prof. Takahiko Yamashita
Dept. Electrical & Electronic Engineering
Nagasaki University
1-14, Bunkyo-machi, Nagasaki 852-8521, Japan
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The 12th Asian Conference on Electrical Discharge

The 12th Asian Conference on Electrical Discharge (ACED2004) will be held at Graduate School in Shenzhen, Tsinghua University, Shenzhen, from Nov. 19 to 22, 2004, and be chaired by Prof. Z. C. Guan, Tsinghua University, China.

Detail information can be obtained from Internet of http://aced2004.tsinghua.edu.cn/ .
Secretariat:

Dr. W.D. Shi
HV Lab, Dep. of Electrical Engineering
Tsinghua University, Beijing, China, 100084
Tel: +86-10-62772122, Fax: +86-10-62776999
Email: aced2004@tsinghua.edu.cn

International Conference on Electrical Engineering 2004 (ICEE2004)

The conference will be held in Sapporo Convention Center, Sapporo, Japan on July 4—8, 2004.
Organized by The Institute of Electrical Engineers of Japan (IEEJ)
co-organized The Korean Institute of Electrical Engineers (KIEE)
The Chinese Society for Electrical Engineering (CSEE)
The Hong Kong Institution of Engineers (HKIE)
Joint Conference with Asia-Pacific Conference of Transducers and Micro-Nano Technology (APCOT MNT) will be held at the same time.

Introduction to Electronic Ceramics Research Laboratory
(http://mse.kaist.ac.kr/~ecrl/)

Prof. Ho-Gi Kim, Ph. D.
Department of Materials Science and Engineering
Korea Advanced Institute of Science and Technology, Daejeon 373-1,
Korea

Thank you for the opportunity to introduce my laboratory via the EINA magazine. Personally, it is my great pleasure to have a request from Dr. Toshikatsu Tanaka, Chairman of EINA Magazine Committee, to write an article on "Introduction to Electronic Ceramic Research Laboratory", which is a good chance for me to enhance cooperation activities with other laboratories in Asia.

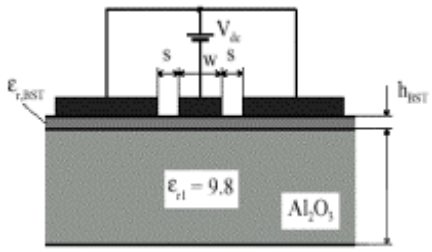
Members

Electronic Ceramics Research Laboratory (ECRL) currently consists of a full professor, nine doctorial candidates, and four students in master courses.

Research activities

Our laboratory has been studied on electronic ceramic materials since 1983, which professor Ho-Gi Kim was newly appointed. Looking into the major research field, our group has been working on electronic components, e.g. dielectrics, piezoelectrics, superconductor, high frequency component, PTC, Lithium rechargeable battery.

a. Thin film ferroelectric microwave devices



The field of microwaves has come to a stage of rapid growth because of the demand to enter the high frequency regime, and other technologies such as computers and integrated circuitry are ready to overcome many old design difficulties. There are ongoing trend in all communications; radar and digital electronics to higher frequencies, higher band-width and higher data rates; The cellular phone and the PCS phone use microwave frequency of 800 MHz and 1.8 GHz, respectively. And upcoming IMT 2000 will use the frequency of ~2.3 GHz. Much higher frequencies above 50GHz also are to be developed and used in the applications such as traffic information services (~60 GHz) and anti-collision system (~77GHz). Demands for the higher frequencies will be on the rise rapidly in proportion to the tremendous increase of the information. To meet the demands, therefore, performance of the conventional components should be improved along with the development of new devices and systems. Some ferroelectrics are promising materials for the microwave device applications. When an electric field is applied to a ferroelectric material, the microwave permittivity undergoes a substantial change. This change in permittivity can be utilized in microwave devices to produce frequency-agile function. Some materials which have shown a variable permittivity with electric field are $SrTiO_3$, $(Ba,Sr)TiO_3$, $(Pb,Sr)TiO_3$, $(Pb,Ca)TiO_3$. In our laboratory, we focus on the dielectric properties of the $(Ba,Sr)TiO_3$ (henceforth BST) ferroelectric thin film. Especially, dopants are introduced into pure BST to attempt to improve the microwave dielectric properties, and there has been some success at reducing the loss tangent.

□ Ref .) M.J. Lancaster and J. Powell, Supercond. Sci. Technol. 11 (1998) , pp.1323

b. Rechargeable Li-ion Battery

Rechargeable Li-ion cells are key components of the portable, entertainment, computing and telecommunication equipment required by today`s information-rich, mobile society.

Despite the impressive growth in sales of batteries worldwide, the science underlying battery technology is often criticized for its slow advancement.

A battery is composed of several electrochemical cells that are connected in series and/or in parallel to provide the required voltage and capacity, respectively. Each cell consists of a positive and a negative electrode separated by an electrolyte solution containing dissociated salts, which enable ion transfer between the two electrodes. Once these electrodes are connected externally, the chemical reactions proceed in tandem at both electrodes, thereby liberating electrons and enabling the current to be tapped by the user.

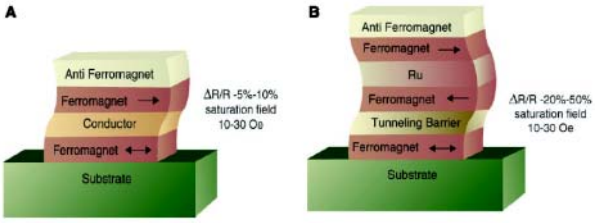
The choice of the positive electrode depends on whether we are dealing with rechargeable Li-metal or Li-ion batteries.

For rechargeable Li batteries, owing to the use of metallic Li as the negative electrode, the positive electrode does not need to be lithiated before cell assembly. In contrast, for Li-ion batteries, because the carbon negative electrode is empty (no Li), the positive one must act as a source of Li, thus requiring use of air-stable Li-based intercalation compounds to facilitate the cell assembly.

We make a special study of synthesis and characterization of cathode materials which are $LiMn_2O_4$, $LiCoO_2$, $LiFePO_4$, K_2FeO_4, and so on.

※ Ref.) J.-M. Tarascon and M. Armand, Nature, Vol 141(14), 2001, pp.359

c. Spintronics



Spintronics describes a new paradigm of electronics based on the spin degree of freedom of the electron. Either adding the spin degree of freedom to conventional charge-based electronic devices or using the spin alone has the potential advantages of nonvolatility, increased data processing speed, decreased electric power consumption, and increased integration densities compared with conventional semiconductor devices. To successfully incorporate spins into existing semiconductor technology, one has to resolve technical issues such as efficient injection, transport, control and manipulation, and detection of spin polarization as well as spin-polarized currents. Recent advances in new materials engineering hold the promise of realizing spintronic devices in the near future.

※ Ref.) S. A. Wolf et al., "Spintronics: A Spin-Based Electronics Vision for the Future", *SCIENCE,* VOL 294, 2001, pp.1488

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Instrumentation

- PLD (pulsed laser deposition) system
- RF/DC magnetron sputtering system
- Spin Coater for sol-gel process
- ECR-PECVD
- Impedance Analyzer : HP 4192A, USA
- Dry Box : VAC, USA
- Gain phase/Impedance Analyzer : Solatron, UK
- Ellipsometer : Gaeterner, USA
- Particle Size Analyzer
- Optical Microscope : ZEISS, etc.
- 16 channel Multi-Potentiostat : Wona-Tech., WBCS3000

Xi'an Electroceramic Research Institute, China

Sun Xi-chang and Li Zhu-zhu

Xi'an Electroceramic Research Institute (XECRI), founded in 1958, is a national research institution for applied science and technology. The president of XECRI is Sun Xi-chang.

The institute, being technical-administrative institute for insulator and surge arrester industry in China, is an independent, judicial body and serves as the center of technology, new product development and technical information for power transmission and distribution industry in China. Meanwhile, she acts as the administrative organization of Chinese Technical Standardization Committee for both insulators and surge arresters. Inside the institute, the China National Center for Quality Supervision and Testing of Insulators and Surge Arresters is set up.

The institute is also in charge of Chinese National Committees of TC 36(insulator) and TC 37(surge arrester) of International Electro-technical Commission (IEC). A regular international collaboration and exchange with foreign colleagues is under way.

XECRI occupies a total area of 4.2ha and is located at the middle of Daqing Lu, the western suburb of Xi'an city, from where the famous, ancient silk road starts. It has nearly 400 employees, of which 70% are technical staffs, including a number of highly qualified engineers and professional pioneers.

The institute possesses advanced equipment and instruments such as:

(1) Manufacturing equipment for surge arresters introduced from Hitachi Corp., Japan.
(2) Key equipment for polymer insulator production, e.g. injection mould press introduced from REP Co. France, and Taiwan, China.
(3) Testing and measuring instruments introduced from Germany and Switzerland. It has collected the most complete testing facilities with the highest parameters in China for testing of insulators and surge arresters, and is capable to execute various scientific experiments and testing. It is also the only laboratory in China that can perform full type test on insulators and surge arresters, both ceramic and polymeric, in accordance with IEC standards.

XECRI is engaged mainly in the research work and development on insulator, surge arrester and specialized processing facilities. The main products consist of surge arresters, polymer insulators and bushings, and exceed 50 lines, such as:

a. Metal oxide surge arresters 3-500kV, porcelain housed
b. Polymeric surge arresters 6-500kV
c. SF6 tank type surge arrester 60-220kV
d. Metal oxide surge arresters for DC application 1.5-500kV
e. Polymer rod insulators 35-500kV
f. Polymer arm insulators 35-220kV
g. Polymer post insulators 10-500kV
h. Polymer insulators for rail traction lines and locomotives
i. Oil impregnated condenser wall bushings 126-252kV
j. Polymer hollow insulators 110-500kV
k. Composite dry type bushings 40.5-126kV
l. Polymeric housed SF6 instrument transformers
m. ZnO varistors for AC and DC application with diameter of 35-115mm and various heights
n. Harmonic suppressor, 6-35kV and sic resistors

Being new generation products for HV transmission lines, the XECRI insulators feature small volume, light in weight, high strength, resistance to heavy pollution and easy maintenance. The key parameter of polymer insulation, i.e., the tracking and erosion level, reaches the highest class of IEC standard. After 1000h accelerated aging test and natural exposure aging test for several years, it shows no apparent degradation in performance. The complete injection molding technique is used first in China, and excludes the possibility of interface breakdown, the key problem for insulator reliability. The unique connecting design ensures the intactness of FRP rod and thus the full utilization of the mechanical strength of FRP rod. All surge arrester products feature excellent protective performance, reliable pressure release device and unique sealing.

The ZnO varistors, both of disc and ring shapes, can meet all specification requirements for full lines of surge arrester products. At present, re-

search work on varistors with high electric stress and large discharge capacity is under way.

All products of 110kV and above are jointly accredited by the Ministry of Electric Power and the Ministry of Machinery-Building to ensure the safety and reliability for transmission & distribution facilities. All products are manufactured in accordance with either domestic or international standards (IEC). In 1998, the institute successfully passed certification upon ISO9001 quality management system standard, and made a solid foundation for enhancing product quality and broadening overseas market. The XECRI products can be found in all provinces and cities in China except Taiwan, and are sold well to Russia, Nepal, Vietnam, Thailand, Bangladesh, etc, meeting the market demands from both home and abroad.

The China National Center for Quality Supervision and Test of Insulators and Surge Arresters (CNCQSTISA), which is set inside XECRI, has passed accreditation by Chinese National Laboratory Accreditation Committee. It is the only state authorized center for quality supervision and test of insulators and surge arresters, an accredit institution authorized by State Science Commission for accreditation of scientific and technological achievements, and also a registration institution authorized by China Economic and Trade Commission for registration of product type.

The main business of CNCQSTISA cover the testing and inspection on insulators and surge arresters by client commitments from both home and abroad, the inspection on import and export goods, as well as the supervision, examination and evaluation on domestic, scientific and technological achievements.

Possessing abundant technical strength and up-to-date instruments, CNCQSTISA is authorized to carry out all tests on h.v. & l.v. insulators and surge arresters in accordance with Chinese, IEC and other international standards. So far she has undertaken many times of state inspection, all kinds of tests and verifications by commitments of all domestic manufacturers and users, type test on (10-500)kV surge arresters from Toshiba, Fuji Co (Japan), ABB(Sweden), Joslyn (US), supervision test on cap and pin type insulators from NGK(Japan), DAE(Italy), and (70-400)kN glass insulator from the former Soviet Union.

CNCQSTISA has well cooperated with international famous laboratories. It begins to conduct, in cooperation with a Dutch laboratory, KEMA, overall type accreditation on insulators and surge arresters in accordance with international standards for world-wide manufacturers.

As the competent authority designated by the nation for insulator and surge arrester industry, XECRI is in charge of drafting and revising the national or industrial standards and specifications. Being technical information center of insulators and surge arresters, XECRI is the editor and publisher of some periodic magazines such as “Insulators and surge arresters”, “News of insulators and surge arresters”, “Translation works on insulators and surge arresters”, “Academic papers on surge arresters and insulators”. She is the sponsor of annual academic forums on insulators and surge arresters.

In the course of construction and development for more than 40 years, XECRI comes out as a comprehensive institution engaged in R&D, technological deployment and technical service. In the new century, XECRI will keep to innovation, keep-up to date and make even more contributions to domestic and world electric power industry with more reliable products and satisfactory technical service.

Biography

Sun Xi-chang was born in 1953. He is a senior engineer and presently is the president of Xi'an Electrocermic Research Institute.

Li Zhu-zhu was born in 1959. She is an engineer and presently is the director of the administration office.

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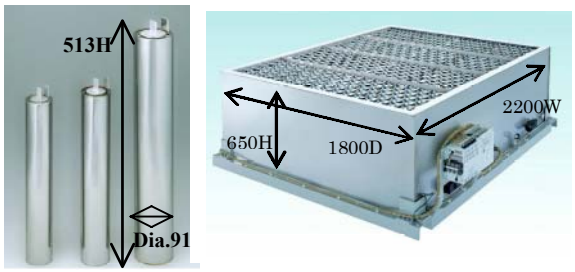
Recent Status of Sodium-Sulfur Battery

The Sodium-Sulfur (NAS) Battery is a secondary battery jointly developed by the Tokyo Electric Power Company (TEPCO) and NGK Insulators, Ltd. (NGK). In April 2003, NGK started operation of their new manufacturing facilities which can produce 65MW of NAS batteries per year. The most important technology of this battery is the low resistance and high strength beta-Alumina ceramic tube, which is the solid electrolyte that separates a central sodium negative electrode and an outside sulfur positive electrode. These materials are housed within a cylindrical aluminum container, and each electrode is insulated by an alpha-Alumina ring.

Photo1 shows the NAS cell and module.



[Single Cell] [Module]

Photo.1 View of NAS Cell and Module

Single cells are designed with a lifetime of 15 years, and cycle life is 4500 cycles keeping designed capacity. Cells in series and/or parallel, resistance heaters to maintain temperature at about 300 degrees C while in standby, and sand for added thermal capacitance plus protection are placed in the thermal enclosure, called a NAS module.

NAS Modules can be divided into two types by single cell connections. The Peak Shaving (PS) module connects cells by 8 series x 5(6)parallels x 8blocks for total of 320(384)cells. The Peak Quality (PQ) module connects 320 cells all in series.

The application of the PS Module is to store surplus energy at night-time and discharge during the daytime such that the maximum load to the Electric Power Company is not exceeded. Figure 1 shows such a 500kW NAS system at NGK's office building. Figure 2 shows the typical load change due to applying such a NAS system. The NAS battery could decrease the peak load of this office building and reduce the costs of electric power. The PS Module can also be applied for an Emergency Power Supply (EPS) application. For this application, the NAS system has to reduce the peak shaving energy for the increased EPS reserve.

The application of the PQ Module is to store surplus energy at night-time that can be discharged at 3 to 5 times nominal power for 30 seconds duration in the case of short-term power disturbance plus operate as a peak shaving module as well. Figure 3 shows an example of PS operation and 30sec PQ operation for 30sec using a 50kW PQ module.

Fig. 1 PS NAS System

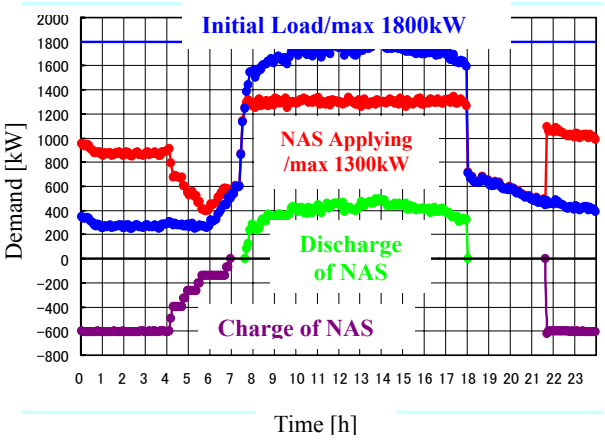


Fig. 2 PS Application Example of NAS system

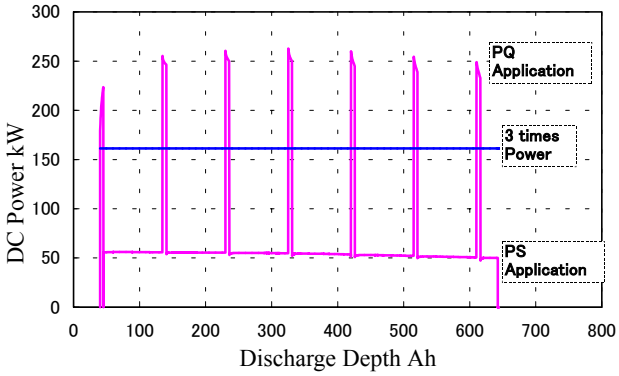


Fig.3 Application Example of 50kW PQ Module

NAS systems have broad applications and about 50MW will be installed this year in Japan.

By Sodium Sulfur Battery Division
NGK Insulators, LTD
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On-site Diagnostic Method for Water Treed XLPE Cable by Harmonics in AC Loss Current

Water tree is one of the degradation aspects of XLPE cables used for under-ground distribution or transmission lines. Water trees are generated from voids or impurities in the insulation, or protrusions of the semi-conductive layer of the insulation of XLPE cables. The growth of them lowers the performance of the insulation of XLPE cables, causes the accidents of power operation by insulation breakdown at last. Therefore, there are many needs for the diagnostic techniques to detect the water tree degradation. Some diagnostic methods have been developed, but the sensitivity of them is not sufficient for 22kV/66kV class XLPE cables. The reason is that the conventional methods are based on detecting signals from water trees bridged over insulation layer. In case of 22kV/66kV class cables, even unbridged water trees will be harmful because of their higher operating stress, so that there are demands on highly reliable new diagnostic methods for such class cables.

Most part of the current in the insulation of an XLPE cable applied with an AC voltage, is a capacitive current 90 degrees in phase angle leading the voltage, as shown in Fig. 1. But then, a trace of current is still in phase with the voltage. This faint current is called "Loss Current" because of its being related to the power loss in the insulation. The ratio of Loss Current/ Capacitive Current is represented by " tanδ" (dielectric loss) is a significant index for rating the insulation performance.

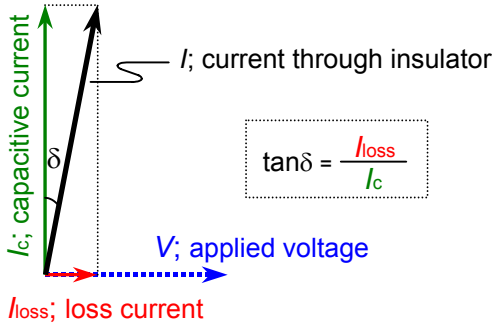

Fig. 1 Vector diagram of current in the insulation

Fig. 2 outlines a loss current measuring circuit. The setting of a sample under test in parallel with a no-loss standard capacitor, is designed to form a bridge circuit which makes both the currents equilibrate with each other. The loss current result from the current through the sample minus the capacitive current. Loss current waveforms in the form of discrete numeric data are taken in by a digital oscilloscope, and separated into fundamental and harmonic components by FFT analysis.

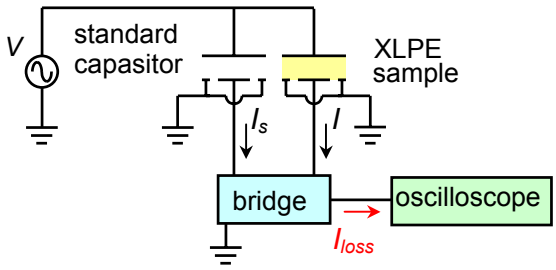

Fig. 2 Loss current measurement circuit

Fig. 3 plots loss current waveforms resulted from samples in which water trees were made to emerge: each was a sheet sample of XLPE (0.5mm thick) attached with a liquid electrode of 1 mol/l of NaCl solution on one of the face. A 1kHz high-frequency voltage was applied for 0, 100, 300, 500 hours, each, to give birth to water trees. The loss current was measured under a test voltage of 1kV/50Hz.Despite of the applied voltage with sinusoidal waves at a single frequency, as the water tree deterioration deepens, the loss current waveform gets distorted to demonstration.

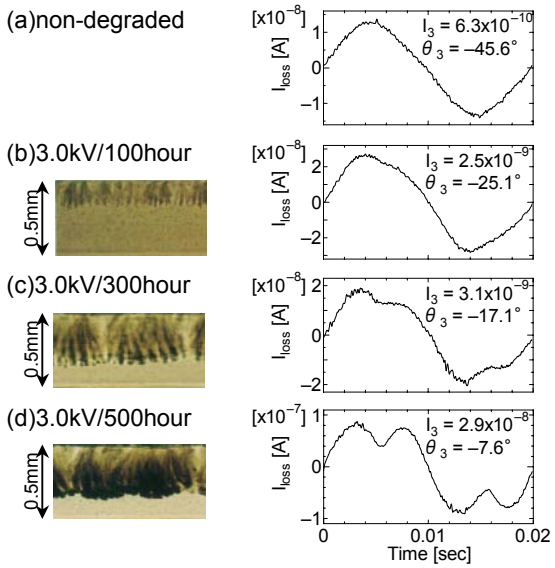

Fig. 3 Water tree deterioration and loss current waveforms

The waveform distortion stems mainly from third harmonic components arising in the AC loss current. FFT analysis of waveform parameters for third harmonic components (amplitude I_3, phase angle θ_3, for instance) brings out a turn of θ_3 to shift in a certain direction abreast with an increment of I_3, The turn was similarly found on a sample cable which incurred

some water tree deterioration, and precision, by examining third harmonic components in AC loss current.

We made the on-site diagnostic system based on those results. The system consists of a signal generator which can generate a sinusoidal wave at any frequency, a power amplifier to amplify the power of output of the signal generator, a testing transformer, a reactor to reduce the reactive power, a standard capacitor and a current transformer to obtain the current through the cable insulation. The maximam output voltage of the system is 20kV at 50Hz. The acceptable load capacity is up to 1μF which is equal to the capacity of about from 3 to 4 km of 66kV class XLPE cables. The system is less than 4,000kg weight and can be carried by car in the condition that the equipment is complete. For measuring the on-site cables, it is need to separate the measured cable from the power network, but it is not need to remove any earth lines which connect between the cable shield and the earth.

Many actual 66kV XLPE cable lines have been measured by the system in Japan. After on-site measurement, some cables were removed and the performance of them was investigated in detail in a laboratory. As the result, we have established the suitable logic to diagnose the degradation of XLPE cables.

Table 1 Main features of on-site diagnostic system

Objects	66 – 77kV XLPE cables
Output voltage	0 – 20 kV (50 Hz) (Test voltage:18kV)
Maximum load	1 μF
Size	・L: 7m, D:2.2m, H: 3.3m ・Test equipment weight: Less than 4000kg ・Total weight: Less than 8000kg including truck weight ・All equipment is loaded and wired on the trailer ruck
Input power	・3ϕ 200V 30A (at maximum load and output on basic measurement)
Features	・Low distortion output voltage ・Current detector located on high voltage side ->It is not necessary to disconnect the ground wires of cable lines ・On-site setup is only to connect the lead cable to the test object, and to secure the input power ->Short measurement time ・Test voltage applied with a tri-axial cable up to 200m ->Safety and high precision ・All of operation, measurements and analysis are carried out in the car

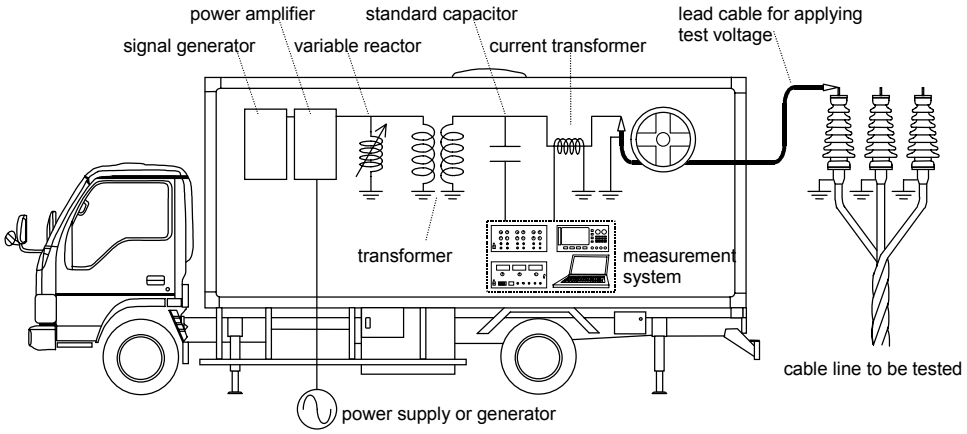

Fig. 4 On-site diagnostic system

By Tanaka Atsushi*, Yagi Yukihiro** and Tanaka Hideo***
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a) Insulation diagnosis for XLPE cable with residual charge method

"Residual charge method" is a hopeful technique for diagnosing non-bridged water tree deterioration of over 22kV class XLPE cables, and we have advanced this method for applying to onsite cable.

Fig.1 shows measurement circuit. First, DC voltage (V_{dc}) is applied to cable (C_A), next, conductor and shield are earthed, and AC voltage (V_{ac}) is applied. $V_d(t)$ is detected in detection condenser (C_d)

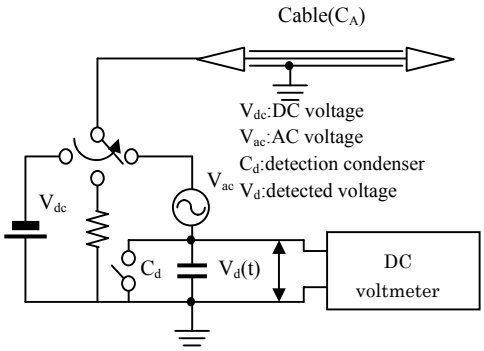


Fig.1 Measurement circuit

during AC application. Here, Q(t) is lead from $V_d(t)$ ($Q(t)=C_dV_d(t)$).

The source of residual charge is not only hazardous water tree but also components unrelated to deterioration such as different kinds of insulation interface (e.g. normal joint), the surface of cable head, or non-hazardous short water tree. These cause error in deterioration diagnosis to reduce measurement reliability, discrimination of degradation signal and error signal is required. For this reason, each feature (time characteristic) of deterioration signal and error signal was investigated, and we have found that residual charge from hazardous water tree responses quickly against AC voltage application, and we've had a knowledge that residual charge from heavily deteriorated XLPE cables relaxes within a few seconds. Based on this knowledge, we have developed the method for extracting only deterioration signal.

Fig.2 shows the advanced AC voltage application method and time domain of residual charge. This is the method which three times of short-term AC lamp voltage is applied. Since residual charge from hazardous water tree shows quick response against AC, deterioration signal Qo, as shown in fig.2, can be extracted from error signal by using this method.

Fig.3 shows the correlation between Qo(Qo/L) and AC breakdown voltage using removed 22kV XLPE cables. There is a good correlation between Qo/L and AC breakdown voltage.

Finally, we have manufactured system for on-site cables. Fig.4 shows the outline of this system. It has been already applied actually, and we have got a lot of measurement results until now.

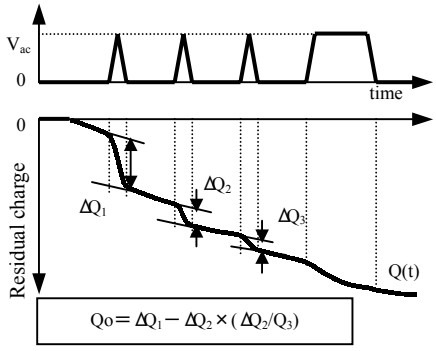


Fig.2 Advanced AC application method

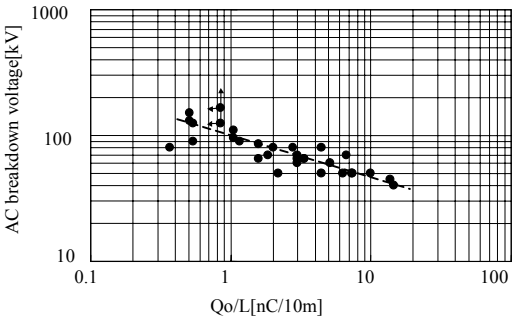
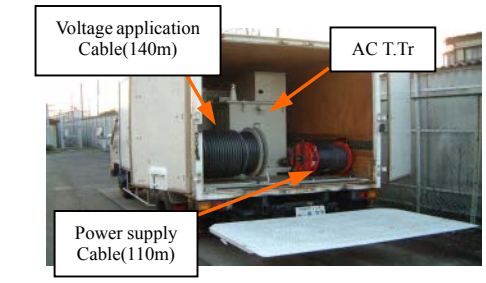
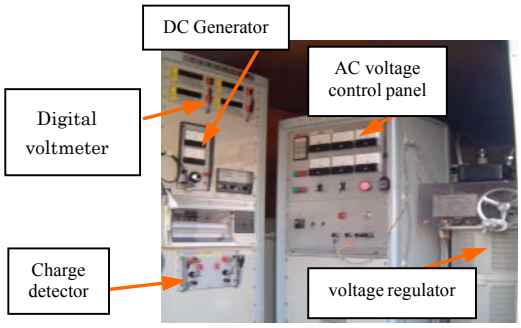


Fig.3 Correlation between residual charge and AC breakdown voltage



Complete view



Interior

Fig.4 Outline of residual charge measurement system

b) Development of cold shrinkable joints for 110-230 kV XLPE cables

Tape-wrapped joints (TJs) have been mostly used for the 66/77kV XLPE cable systems over 30 years in Japan after its development. However, TJs require the certain jointing skills, times for assembly, and the special tools. Cold shrinkable joints of one piece type consisted of silicone or ethylene-propylene rubber are being rapidly used widely in Japan and abroad, and it is extending to the extra high voltage class because of its compact and skill-free merit.

Here, three types of premoulded one-peace type joint have been already developed. One is the type of pre-expanded rubber mould in the factory, which can easily assembly by pulling out spiral core at the site. The next one is the type of rubber mould joints which assembly after expansion at the site. The last one is the direct insertion type to the cable insulator.

Pre-expanded rubber mould joint have the great merit which shortens the assembly time without the special tools only by pulling out the spiral core compared with the another type joint. We have developed the two kinds of cold shrinkable joints covering 110 kV～230kV rated class(for 110 kV and 132kV, for 161kV and 230kV), using the pre-expanded rubber block made of excellent thermal and physical performance silicone rubber.

The initial characteristics were confirmed based on JEC3408, IEC60840, IEC62067. Long-term reliability was confirmed in the 6-months long-term verification test based on JEC3408 for rated 110/132kV joints. For rated 161/230kV joints, 12-months pre-qualification test is progressing based on IEC62067. Fig.5 shows the rubber block before and after expansion by spiral core for 161/230kV. Fig.6 shows the structures of cold shrinkable joint. We have achieved the compact structure compared with the conventional joints.

Fig.5　161/ 230kV Rubber block insulator

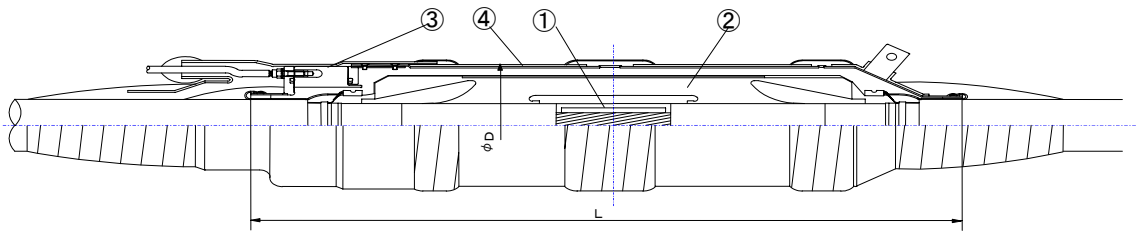


Fig.6　161/230kV Cold Shrinkable Joint

① Connector　② Rubber block
③ Sheath Insulator
④ Protective tube

By　Research and Development Dept.
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URL: http://www.exsym.co.jp

Prof. Xie Hengkun, 1941-2003

It was with great sadness to announce that Prof. Xie Hengkun passed away at the age of 63 on August 1, 2003, because of liver cancer. Prof. Xie was the director of State Key Laboratory of Electrical Insulation for Power Equipment, Xi'an Jiaotong University, China. His early pass was undoubtedly a great loss to the high voltage and electric insulation engineering in China. He had served as the chairman for 1996 Asian International Conference on Dielectrics and Electrical Insulation. His death was also a great loss to the field of dielectrics and electrical insulation technology in Asia.

MISCELLANEOUS

Photos on Front and Rear Covers

Front Cover: 6MW/48MWh NAS Battery System at Ohito Substation (Tokyo Electric Power Co., Inc., Tokyo, Japan)

A substation-use NAS battery system is given an output capacity of 10 to 20% of that of a distribution power substation in order to level off loading and eliminate overloading of equipment.

As on a distribution line, the Ohito system is connected from the bus on the transformer secondary (6.6kV) to the link transformers via circuit breakers, and further to the modular battery groups via AC/DC converters.

A 6MW (48MWh)-class system, having 3 units of 2MW output power, was installed in the Ohito Substation, with Unit 1 put into operation in March, 1999, Unit 2 in June, 1999, and Unit 3 in October, 1999, respectively.

The photo shows the overall view of 6MW NAS battery system at Ohito substation.

The upper left photo shows a Module of NAS Battery for 6MW system.

The specification for 6MW NAS battery system is shown in the following table.

Output power (DC)	2,105 kW / unit
Output capacity (DC)	16,840kWh / unit
Module output (DC)	52.6 kW
No. of Module	40 / unit

The further information is available at the corner of TECHNOLOGIES FOR TOMORROW on this magazine.

(Tokyo Electric Power Co., Inc., Japan)

Rear Cover: Model Specimen of Solid – Solid Internal Interface (Toyohashi University of Technology, Toyohashi, Japan)

The figure shows the model specimen developed for studying electrical insulation properties at solid - solid internal interface, especially modeling the interface in EHV extruded cable splices in connection with the activity of CIGRE WG 15-10 "Solid Insulation Interfaces". The interface itself is not always a weak point, but many defects such as voids, metallic or other contaminants, dusts, are easy to be introduced at the interface. The developed specimen fulfills the following preferable conditions based on the discussion at 1996 CIGRE Paris meeting.

(1) Metal electrode should not attach the interface.
(2) Various simulated defects can be introduced.
(3) Effect of mechanical pressure can be examined.
(4) Interfacial effect of the surface roughness can be examined.
(5) Interfacial effect of silicone oil or other liquid insulants can be examined.

Further the specimen should be with simple preparation, small scatters of data, good reproducibility of data.

Four electrode configuration of the specimen enables to control the electric field direction at the interface with applying appropriate voltages to each electrode.

(by Masayuki Nagao,
Toyohashi University of Technology, Japan)

IEEJ Technical Reports Edited by TC-DEI and Related TCs

Technical reports listed here are made by investigation committees in the technical committee on DEI and related investigation committees since the publication of EINA No.9 (2002). They are described in Japanese.

No. 922 : "Current State and Trend of Technologies for Maintenance of Reliability for Aged Power Transformer"
(B), p.58, Mar., 2003, ¥2,300

No. 916 : "Practice of insulation co-ordination in Japan and worldwide"
(B), p.124, Jan., 2003, ¥2,700

No. 915 : "Various problems concerning reliability of insulation for electronic equipments"
(A), p.44, Mar., 2003, ¥2,200

No. 914 : "Treatment techniques of material surfaces using various plasmas"
(A), p.68, Feb., 2003, ¥2,400

No. 910 : "Development of organic molecular device engineering and its recent trends"
(A), p.94, Feb., 2003, ¥2,800

No. 907 : "Future prospects of academic and technical research on electrical and electronic insulating systems"
(A), p.102, Dec., 2002, ¥2,600

No. 902 : "Current states and research issues of lightning damage on highly-sophisticated information society"
(A), p.56, Nov., 2002, ¥2,300

No. 895 : "Generation of pulsed, extremely high energy-density and associated applications"
(A), p.70, Sep., 2002, ¥2,400

No. 894 : "Novel aspects on physics of ultra-long-gap discharges and lightning"
(A), p.58, Aug., 2002, ¥2,300

No. 893 : "Current state of software development and application in the design, construction, operation, and maintenance of underground power cable lines"
(B), p.72, Nov., 2002, ¥2,400

No. 892 : "Review on Surface Discharge Phenomena and Insulation Technology -CD-ROM version-"
(A), p.14, Sep., 2002, ¥3,500

No. 884 : "Liquid dielectric phenomena and liquid dielectric modeling, and their applied techniques"
(A), p.58, Aug., 2002, ¥2,300

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B: Power and Energy
C: Electronics, Information and System
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By Masahiro Kozako (Waseda University, Japan)

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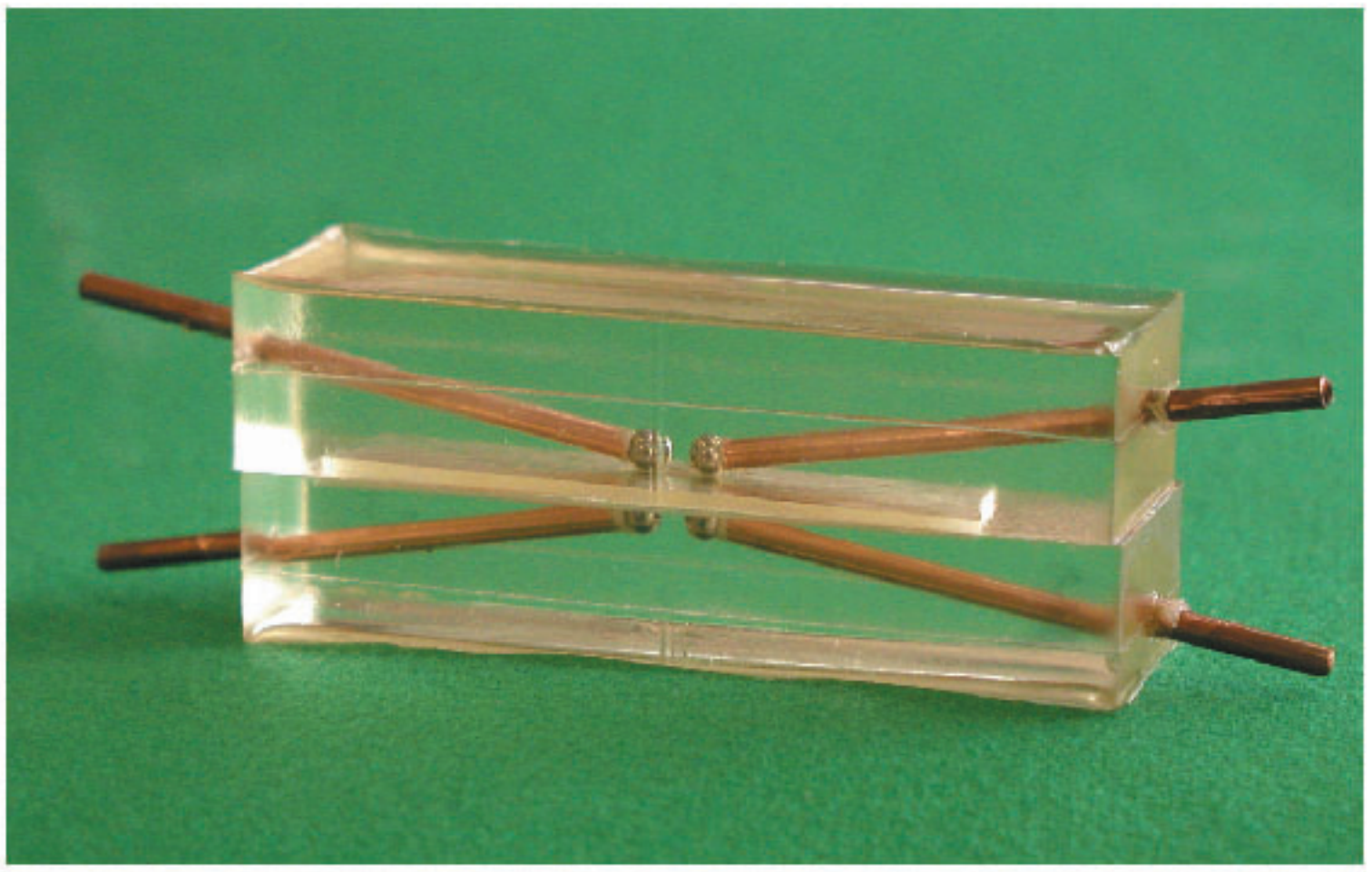

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