Electrical Insulation News in Asia

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IEEJ

CONTENTS

TECHNOLOGIES ALERT

MISCELLANEOUS

PREFACE

Dr. Yoshikazu Shibuya

Importance of Cross-cultural Atmosphere

I am now a retiree after serving in an electrical manufacturer as an engineer over thirty years, and then engaged in teaching electrical engineering for about ten years. From the earlier career, I learned that the practices of engineering should be firmly based upon the fundamental scientific principles. In the later career, I have made efforts to convey this mental posture to young students.

The great scientific and technological advancements in Europe or U.S.A. from the industrial revolution owe to the interchange of thoughts among people of different backgrounds. This will be easily understood when one looks at the early electricity history, which is gradually shaped by the integration of great ideas from British, French, German, Italian, and American pioneers. Having spent two years at a university in England for PhD in 1970s, I myself realized the importance of this cosmopolitan environment or "cross-cultural atmosphere" in deepening and improving the quality of our researches. Since researchers from different countries or from different disciplines are likely to give totally new perspectives to a given problem, the discussions with them can lead our researches to interesting and truly significant directions.

We Asians have learned lots of things from West in every aspect of modern society. In this way, the electrical engineering of our region has seen a remarkable progress in the technology especially in the field of manufacturing. The very high reliability of high voltage apparatus and power equipments is the hallmark of great achievement of Japanese power industry backed by academic activities. Typical examples are the GIS utilizing SF6 gas, the zinc oxide lightning arresters, and the 500 kV XLPE cables. Those progresses hitherto have been made by a hard work and a bit of luck, along the road toward already-known directions. However, our technical road to future is somewhat misty and uncertain nowadays. There is a growing pressure from the concern about global warming and the economical uncertainty such as the ever increasing oil price. The product's high reliability is no longer our only target. I hope the researches in the Asia Pacific region will collaborate in the cross-cultural atmosphere and will lead to innovations in order to solve those difficult problems.

From above viewpoint, the organizers of this brochure had a far-seeing wisdom of first creating this news bulletin and a patience of constantly publishing for 15 years. It is desired that more people understand the significance of this activity and participate in the many related events cited here. In the mean time, the great goal or future innovations will be accomplished thanks to the cross-cultural interchange of ideas being promoted by the present movement.

Dr. Yoshikazu Shibuya
Professor Emeritus,
Shibaura Institute of Technology, Tokyo

OUTLINE OF TECHNICAL COMMITTEES IN IEEJ

Dielectrics and Electrical Insulation (DEI)

Chairperson:	N. Hozumi (Aichi Institute of Technology)
Secretaries:	K. Uchida (Chubu Electric Power Co. Ltd)
	Y.Tanaka (Musashi Institute of Technology)
Assistant Secretaries:	M. Okashita (Showa Cable Systems Co. Ltd)
	H. Takahashi (CRIEPI)

The committee was originally set up in 1979 succeeding the Permanent Committee on Electrical Insulating Materials upon the reorganization of IEEJ. The important activity of TC-DEI is the annual Symposium of Electrical and Electronic Insulating Materials and Applications in Systems (SEEMAS), formerly called Symposium on Electrical Insulating Materials.

In addition, the committee promotes the International Symposium on Electrical Insulating Materials (ISEIM), which is considered as an international version of the SEEMAS. This symposium is being held every three years. The last ISEIM was held on September 7-11, 2008 in Yokkaichi City (located near Nagoya City) with Honorary Chair of Dr. T. Okamoto (CRIEPI) and General Chair of Prof. N. Hozumi (Aichi Institute of Technology). Prof. S. Nakamura (Mie University) chaired the local arrangement committee. The committee members believe that the symposium was flooded with friendship and fruitful discussions, and of satisfactory to all the participants. The detail of the ISEIM is reported on this issue of EINA magazine.

The next ISEIM will be held somewhere in Japan on the year of 2011. We wish all participants would come back Japan with the harvest of coming three years.

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

Macro-view of DEI technology related

> Asset management for power equipment based on insulation diagnosis (04/08-03/11, Chairperson: M. Ikeda (Nippon Oil Corporation)).

New materials including nano-materials related

> Nano-interfacial properties of organic molecular films and organic/inorganic composites, and their application to devices and sensors (10/07 - 09/10, Chairperson: K. Kato (Niigata University)).

> Physics and interfacial design of organic dielectrics and semiconductors (04/07-03/10, Chairperson: M. Iwamoto (Tokyo Institute of Technology))

> Interfacial phenomena and application of nano-composite dielectric materials (01/06-12/08, Chairperson: T.Tanaka (Waseda University)).

Ageing and diagnosis of electric and electronic equipment related

> Degradation diagnostic techniques for power equipment from viewpoints of electrical insulating materials (04/07-03/10, Chairperson: Y. Ehara (Musashi Institute of Technology)).

> Partial discharge measurement under repetitive impulse voltage application (08/07-07/10, Chairperson: M.Hikita (Kyushu Institute of Technology)). The committee is being run cosponsored by the TC-DEI and TC of Electrical Discharge.

Basic dielectric and breakdown phenomena related

> Assessment of interaction between polymeric materials and radiation (06/06-05/08, Chairperson: Y. Tanaka (Musashi Institute of Technology)). The activity has been terminated. The next activity on space charge phenomena is being planned.

> Surface function and long-term performance of outdoor polymer insulation materials (01/06-12/08, Chairperson: H. Homma (CRIEPI)).

Electrical Discharges (ED)

Chairperson:	T. Nakano (National Defense Academy)
Vice-chairperson:	M. Hikita (Kyushu Institute of Technology)
Secretaries:	F. Tochikubo (Tokyo Metropolitan University)
	A. Kumada (University of Tokyo)
Assistant Secretaries:	Y. Yamano (Saitama University)
	M. Sakano (Toshiba Corporation)

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

Several investigation committees, which are the affiliates of the TC-ED, are established every year to survey the up-to-date research subjects. The activities of these committees usually continue for three years. The chairpersons shown in Table 2 currently run seven investigation committees. In addition, the investigation committee for the modeling of lightening strokes to structures is planned and will be established this year.

The TC-ED organizes about six domestic technical meetings on electrical discharges every year. In these meetings, about 200 full papers are presented in total from both academic and industrial sides by researchers, engineers, professors and students.

In order to promote the international activities in electrical discharges, "Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering" has been organized by the TC-EC. The last J-K symposium was held on the November 15-17 of 2007 in Tokyo. The special issue of this symposium was published in the October of 2008. The interesting papers from all the symposium presentations were published in the IEEJ Transactions on Fundamentals and Materials.. The next J-K symposium will be held in Korea, in November, 2009.

The TC-ED also contributes to the organization of a young researcher seminar every year in cooperation with the Institute of Engineers on Electrical Discharges in Japan to encourage the young researchers in the field of electrical discharges. About 40 young researchers and engineers participate in the seminar and discuss vigorously the topics related to electrical discharges for two days. The seminar in this year will be held in November 14-15, 2008 in Tokyo.

Table 2 Investigation Committees in TE-ED

Chairperson	Research subjects and established time
H. Itoh (Chiba Institute of Technology)	Charged species, excited species, dissociated species, photons and the atomic and molecular dynamics (established in January 2006)
T. Oda (University of Tokyo)	Non-equilibrium, atmospheric pressure plasmas and their applications to environment purification (established in January 2006)
S. Matsumoto (Shibaura Institute of Technology)	Present situation of lightening discharge simulation technologies and comparison of the simulation models (established in December 2006)
M. Hikita (Kyushu Institute of Technology)	Measurement of the partial discharges generated by repetitive impulse voltage (established in August 2007)
E. Hotta (Tokyo Institute of Technology)	Generation control and applications of vacuum and low-pressure discharges (established in October 2007)
R. Hanaoka (Kanazawa Institute of Technology)	Discharge phenomena in liquid dielectrics and the technologies of EHD,ER and MR applications (established in December 2007)
M. Amakawa (Central Research Institute of Electric Power Industry)	Technologies of arc and glow discharge applications (established in May 2008)

Plasma Science and Technology (PST)

Chairperson:	K. Yukimura (Doshisya University)
Vice Chairperson:	T. Fujiwara (Iwate University)
Scientific Secretary:	Y. Ono (University of Tokyo)
	K. Teii (Kyusyu University)

Plasma is known to be a fourth state of matter containing abundant charged particles. The plasma is a matter different from the states of solid, liquid and gas, and is generated by supplying extra energy to these matters. Electric and magnetic fields influence the bunch of charged particles in space. In order to realize industrial applications such as material processing and hazard gas procedure, it is important that the electrical and physical characteristics of plasmas should be clarified.

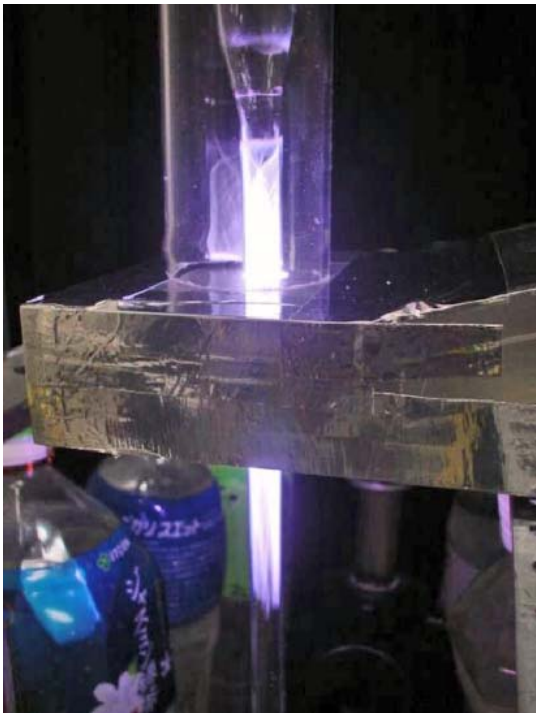
Plasma generation and handling technologies contain mutual interaction of plasmas with electric- and magnetic-field strengths. The interactions bring a high density plasma presenting a high-current beam and a unique crystal structure from dust and powder plasmas. Generation and handling technologies of plasmas are a manufacturing technology to make industrial parts, electrical appliances and so on. The phenomena in artificially-generated plasmas are closely related to the plasmas in space. The development of controlled thermonuclear fusion reactors has been a big project continuing over generation of human beings.

Based on fundamental researches and industrial applications, the plasmas expand to many fields of science and industries.

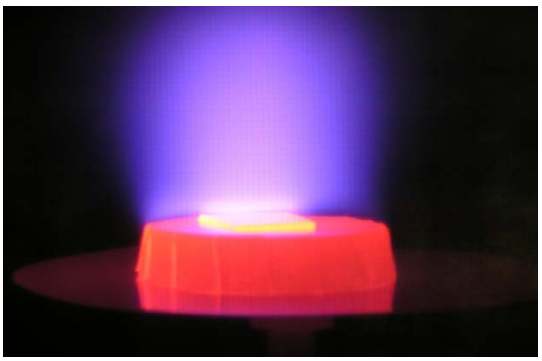
Technical committees of plasma science and technology of IEEJ contributes to the development of fundamental researches and industrial production using plasma technologies. For example, plasma physics to understand the interactions of electric- and magnetic-field strengths, high-current pinch plasma in a pulsed state, nuclear-fusion plasma, ion sheath formation, formation, and disturbances of the waves, environmental gas processing, material creation.

Main research topics are as follows:

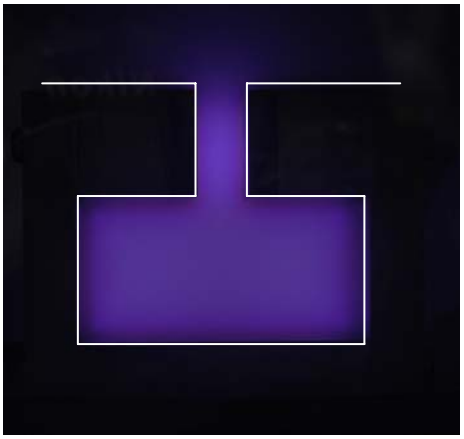
(1) plasma physics, (2) non-linear plasma phenomena, (3) numerical analysis and simulation of plasmas, (4) plasma diagnostics and imaging, (5) corona, glow arc discharge plasmas, (6) electro- and magneto-hydrodynamics, (7) high-density and high-current pinch plasmas, (8) reactive plasmas, (9) astrophysical and space plasmas, (10) fusion plasma confinement physics and engineering, (11) burning plasma research, (12) solid state plasmas, (13) dust- and powder-plasmas, (14) laser induced plasmas, (15) micro plasma technology and plasma display, (16) plasma acceleration technology, (17) light sources by plasmas and radiation, (18) plasma processing for material creation, (19) environmental hazard gas processing, (20) surface modification of medical components and biomaterials, (21) agriculture and fishing industries, (22) electro- and magneto-hydrodynamic plasma technology, (23) nuclear fusion reactor engineering, (24) power source technology for plasma and electro- and magnetic-hydrodynamic wave generation, and (25) strongly-coupled plasma.



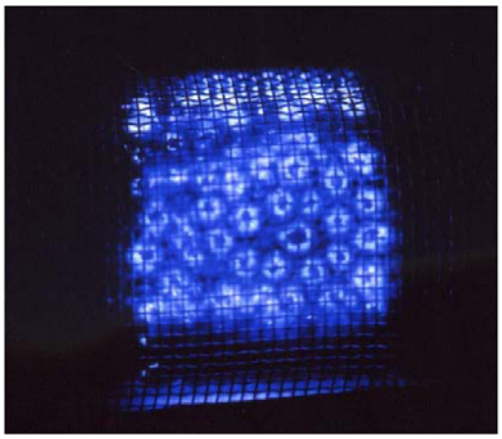
Atmospheric H_2O microwave plasma



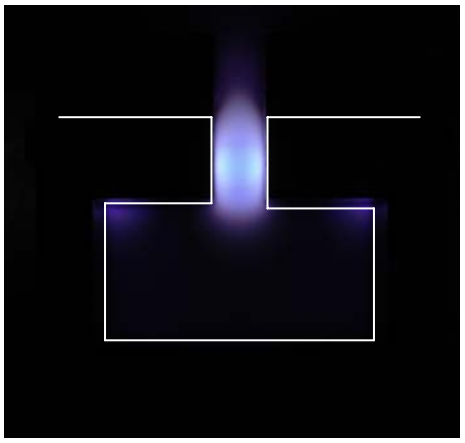
Diamond film preparation



Hollow cathode plasma



Optical emission from nitrogen plasma



Magnetic confined plasma

Pulsed Electromagnetic Energy (PEE)

Chairperson: E. Hottta (Tokyo Institute of Technology)
Vice Chairperson: K. Takaki (Iwate University)
Scientific Secretary: S. Katsuki (Kumamoto University)
Scientific Secretary Assistance: S. Ibuka (Tokyo Institute of Technology)

Pulsed power is a short pulse with a high voltage and/or a large current. A direct or alternating power goes to primary energy storage such as a capacitor, a coil and a generator. The pulse width decreases and the peak power increases with an iteration of an energy transfer from an energy storage element to another one. Finally, a quick transfer of the stored energy to a load generates pulsed power with extremely large peak power and short pulse width as shown in Fig. 1. If the energy is stored with 100 W and 17 minutes and is transformed to a load within 100 ns, the output power is multiplied to be 1 TW which corresponds to the power generated all over the world.

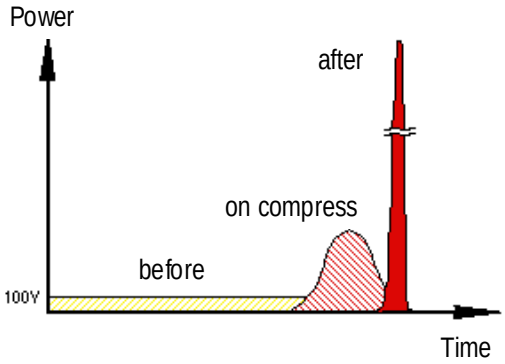


Fig. 1 Pulsed power

The pulse power technology and pulsed magnetic energy has greatly expanded its regime in technological and application field, based on the state-of-the-art technology of power devices, which shifts the trend from a huge machine to high average power devices. The research field is evolving in the electric power engineering, plasma and discharge engineering, high energy density physics, accelerator engineering and also pulse power device itself. By the modification of pulsed electromagnetic energy, we can make an extremely high energy density (high temperature and/or high density) state with well defined condition, which can be utilized for generations of high power lasers, intense radiation sources, high current particle beams and also for formation of new materials. Among others, pulse-power-driven discharge plasma is expected to be a light source (EUV: Extreme Ultra-Violet radiation) for next generation semiconductor lithography. The pulsed power technology is also utilized to environmental applications such as water remediation, flue gas treatment (NOx removal, VOC decomposition, PFCs decomposition etc.), recycling of concrete blocks and circuit boards, ozone synthesis. Recently, application of pulsed high electric field to biological and/or medical field has been proposed. Although interesting, it is still in an infant stage. Then much more efforts are needed for evaluating the usefulness in practical biological fields.

(1) Light source for high resolution imaging:

Figure 2 shows the photograph of pulsed power generator and z-pinch plasma chamber for x-ray radiation. The capacitors are charge up with DC high voltage power supply as primary energy. The energy is transformed from the capacitors to the z-pinch plasma by high-power switches such as spark gap through pulse compressive device such as magnetic cores. A capillary discharges and/or z-pinch plasmas are used to generate intense light emission. Figure 2 shows x-ray radiation from z-pinch plasma produced with large current, 17 kA, driven by the pulsed power generator.

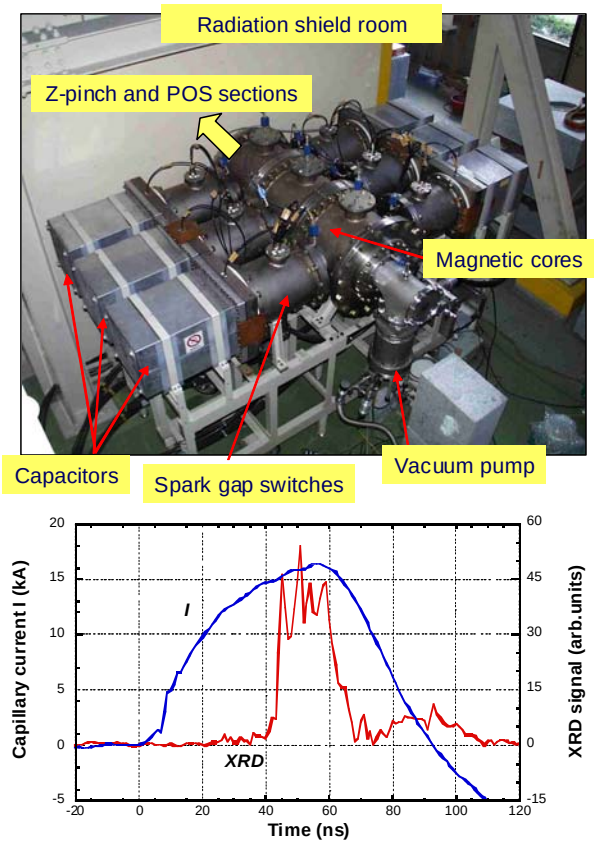


Fig. 2 Pulsed power generator for z-pinch light source and X-ray signal form z-pinch plasma.

(2) Recycling: Figure 3 shows photograph of concrete block recycling by pulsed power discharge. The concrete block is immersed in the water and a large current pulse arc discharge is produced between the metal electrodes set on the surface of the block. A shockwave (pressure wave) is formed with the pulse arc discharge and the concrete block is broken into a large number of fragments and is separated from the steel frame. This technique can be used for recycling of the computer circuit boards. In this case, the pressure wave is formed from vaporization of the thin metal film printed on the boards.

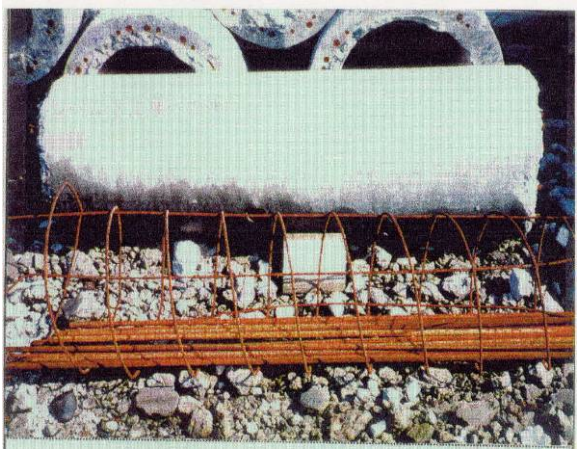


Fig. 3 Recycling of steel framed concrete blocks by the pulsed power discharge.

(3) Water remediation and flue gas treatment: The pulsed power is effective for large volume plasma production in not only atmospheric pressure gas (air) but also in liquid (water) as shown in Fig. 4. This plasma contains large numbers of high energy electron and chemically active species such as radicals, ions, excited state molecules. These active species react with harmful components for human health or environment, as the result, the harmful components is decomposed and changes to harmless components. The pulsed power discharge

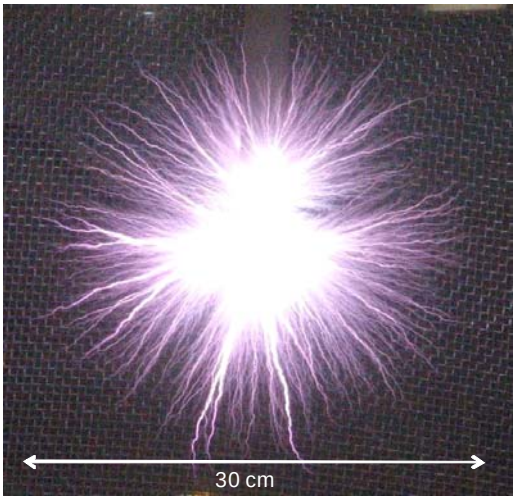


Fig. 4 Large volume plasma in water produced by pulsed power discharge.

plasmas in the atmospheric gas pressure are used for NOx (nitrogen oxide) removal from combustion exhaust gas, VOC (Volatile organic compound) decomposition and ozone synthesis. The large volume plasma in water is used to VOC

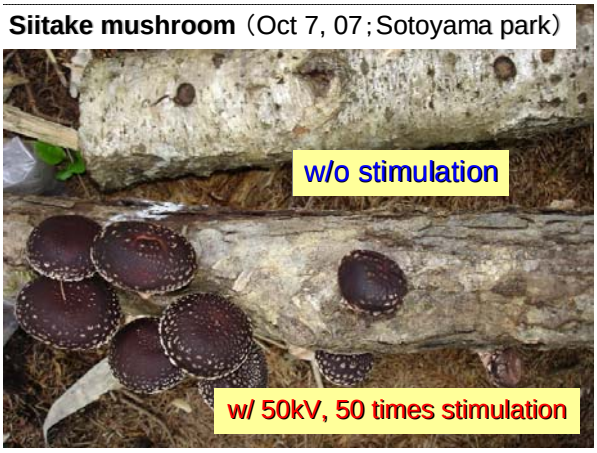


Fig. 5 Typical photographs of cultured *Lentinula edodes* with and without the electric stimulation.

decomposition, sterilization, ion exchange, etc. *Microcystis aeruginosa* also can be removed from surface of lakes or ponds using large volume pulse discharges produced near the water surface.

(4) Biological applications: Biological effects of intense pulsed electric fields (PEFs) have been reported over the past three decades. PEFs with a pulse length of longer than 10 μs are generally used for electroporation because the cell membrane acts as a capacitor and has to be charged to a sufficient voltage to cause membrane defects. Application of nsPEFs to biological cells results in intracellular effects with the intense electric field inside the cell seemingly adding a new stress to the internal biological system which will potentially be used for biotechnology, medical treatment and agricultural applications. Figure 5 shows the typical photograph of effect of high voltage stimulation on mushroom growth.

Continuous efforts have been made to enhance the activities in pulse power technology and high energy density physics, in the Technical Committee on Pulsed Electromagnetic Energy. As the field of high energy density plasma has a multi-disciplinary nature, this committee is providing a forum to discuss important technical developments, their applications, increased understandings, new trends, and also future prospects in the interdisciplinary field. In the committee, industrial applications of highly repetitive pulse-power devices based on recently advanced power modulators, are discussed in addition to the conventional technology. It is predicted that new technological tools should open an innovative application in wider fields; such as materials, energy, environmental, biochemical, medical sciences and technologies.

Electromagnetic Compatibility (EMC)

Chairperson: T. Funaki (Osaka University)
Secretaries: Y. Mizuno (Nagoya Institute of Technology),
T. Ushio (Osaka University)
Y. Taka (Nagoya Institute of Technology)

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

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

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

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

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

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

(1) It does not cause interference with other systems;

(2) It is not susceptible to emissions from other systems;

(3) It does not cause interference with itself.

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

The committee organizes technical conferences annually as the Memory of Kobe Earthquake, which occurred on January 17. 1995. The committee holds some technical conferences, additionally, and those are in September, November, and December for 2007.

1. Investigation Committee on Security Technology for Electromagnetic Wave and Information.

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

1. Surveying the security technology for electromagnetic wave and information, including needs, terminology, and standards,
2. Surveying the eavesdrop by TEMPEST like

technology, including current status, documents, threat, and counter measurement,

3. Surveying the attacking by Intentional-EMI, including current status, documents, threat, and counter measurements.

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

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

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

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

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

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

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

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

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

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

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

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

Light Application and Visual Science (LAV)

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

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

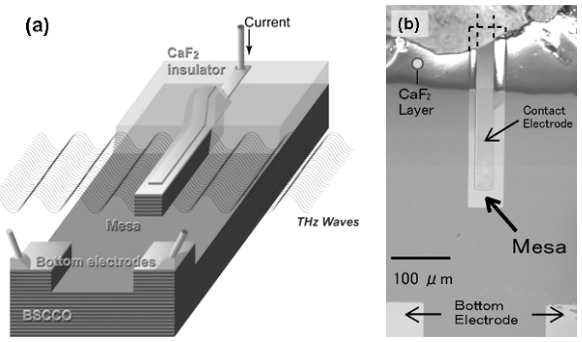


Fig. 1. (a) Device structure of BSCCO mesa for THz emission using current injection, and (b) SEM image of BSCCO mesa(by T.Tachiki, National Defence Academy).

Recently, far-infrared or terahertz (THz) waves have attracted much attention for practical applications such as information and communication technology, medical sciences, non-destructive evaluation and homeland security. Compact solid-state THz sources with continuous waves are necessary for these applications. Intrinsic Josephson junctions (IJJs) in the layered high-temperature superconductors (HTSCs) are considered to be good candidates for THz oscillators in the range from 0.5 THz to 1.5 THz. Recent progress on THz emission from IJJs in HTSCs is summarized by the IC-IRSP.

The IJJs are an atomic-scale junction-array naturally formed in HTSCs such as $Bi_2Sr_2CaCu_2O_x$ (BSCCO), i.e. adjacent CuO_2 superconducting bilayers separated by BiO-SrO insulating layers in BSCCO are coupled through the Josephson effects. Josephson junctions can produce an ac current with a frequency proportional to a voltage across the junction. The voltage of 1 mV per one junction corresponds to the frequency of 0.484 THz. In addition to this fact, a junction-array structure can improve the emission power. Therefore, the IJJs are expected to be THz oscillators with useful emission power. There are three kinds of operational methods that the Josephson plasma is excited inside the IJJs and then the plasma is converted to THz waves outside the IJJs; 'magnetic vortex-flow', 'current injection' and 'microwave excitation'.

Adopting the first method for BSCCO IJJs, Bae *et al*. have detected emission signals with the frequency that is tunable in the range from 0.6 THz to 1 THz. However, the maximum emission power was estimated to be 16 nW, and an external magnetic field of 1 – 4 Tesla was required for creating the magnetic vortices whose motion produces the voltage across the junctions.

The second method that a bias current applied above the critical currents in the IJJs makes the junctions a so-called 'voltage state' and the excited plasma waves resonate in the junction as a cavity. Ozyuzer *et al*. have successfully observed THz emission (0.3 - 0.85 THz) from BSCCO mesas including more than 500 junctions. Figure 1 shows (a) the schematic of the sample and (b) the SEM image of a BSCCO mesa with its device design similar to that of the samples which emit the THz waves. The maximum emission power was 0.5 μW that was highest in superconducting THz oscillators. Moreover, the available power is potentially much higher, since there is evidence that a dc power of 20 μW is pumped into the cavity resonance.

The third method is based on the plasma resonance excited by microwaves whose frequency is much lower than the Josephson plasma frequency. This demonstrates that THz oscillators can be produced using a standard microwave signal generator, rather than requiring an expensive high-field magnet. Tachiki *et al*. have observed microwave-induced steps in *I-V* characteristics of BSCCO IJJs under the irradiation at approximately 7 GHz, and have found that the internal oscillation

frequency corresponding to the maximum step voltage was estimated to be 0.57 THz. Detection of THz emission signals using this method is currently under investigation.

The next major challenge will be to improve the emission power and frequency. The IC-IRSP completed its role in September, 2008, and the next challenge has been taken over by a new investigation committee 'Future Technology for Infrared and Terahertz Waves (IC-FTITW)' established in October in 2008.

Lithography for replying to ultimate miniaturization of semiconductor devices is eagerly discussed in the IC-UTL. Device miniaturization has been continued for more than 30 years with a constant rate called "Moore's law". According to the international technology roadmap for semiconductors, devices with half pitches of 32 and 22 nm are required in 2013 and 2016, respectively.

Though it is absolutely difficult to print such fine patterns using lithography in large volume productions, vigorous research efforts are flung. Expected candidates for the future are extreme ultra violet lithography (EUVL), double patterning lithography, electron beam lithography (EBL) and nano imprint lithography (NIL). EUV is superior to the other candidates on the view point of extendibility for printing various arbitrary finer patterns directly with a high throughput in the next and future generations. For this reason, it is most expectable. However, high output EUV sources, resist with high resolution, high sensitivity and small line-edge roughness, defect-free masks have to be developed, and other various subjects should be improved. If the technological improvements are sufficiently performed in time, patterns in critical layers will be printed by EUVL. However, the worst case in which the EUVL is not ready for the roadmap should also be considered in parallel. If the sufficiently fine patterns are eagerly expected even with low throughputs and with increases of the patterning costs, actually available other lithography methods will be used instead of EUVL. Double patterning lithography reduces the throughput approximately in a half comparing with the conventional one, and the alignment accuracy degrades because the alignment errors between the divided two layers are added. However, the technological applicability to the actual use will be most attainable as an extension of the conventional technology. EBL is always necessary to delineate the reticule patterns. Accordingly, the earnest research should be continued. If the multi-beam EBL is developed in the future, decisively low throughput will be improved. NIL is a new candidate and some peoples are actually applying NIL to the device fabrication. Though the usability for various type patterns and the uniformity in large fields should be improved hereafter, the concerns to NIL gradually become large.

The technology trends should consistently be observed, and the solutions should be found through the eager discussion in the IC-UTL for these 3 years.

The IC-NGLS has started from July, 2008. The aim of the committee is to investigate the research activities in Japan in the field of electrodeless discharge lamps and solid state light sources which are expected to be most promising light sources in the industrial and domestic uses.

The main items investigated by the IC-NGLS are as follows: (1) development and application of electrodeless microwave discharge lamps,
(2) electrodeless discharge lamps developed by capacitively and inductively coupled discharge,
(3) application of microplasmas(dielectric barrier discharge) to electrodeless discharge lamps, (4) trend and problems on solid state light emissive elements, (5) novel measurement method for solid state light emitting elements, (6) development and improvement of high frequency power generator in the solid state and electron tube.

The results obtained by the committee will be served to give the guideline for development of the long lifetime and high lamp efficacy light sources by taking the properties of light sources into account.

It is reported by Dr. Mizojiri that the compact microwave discharge lamp filled with high-pressure mercury for the projector light source can been operated by assisting the effect of antennas which are equipped in the lamp. This type of the microwave discharge is named as antenna excited microwave discharge (AEMD) to reflect the discharge mechanism. The lamp efficacy and luminous flux increases with microwave power from 30 W to 200 W. These are lower than the conventional operation using AC or DC electric power because of low heat production in the AEMD lamps.

Metal and Ceramics (MC)

Chairperson: Ataru Ichinose (Central Research Institute of Electric Power Industry)
Secretary: Akio Kimura (The Furukawa Electric Co., Ltd.)
Assistant Secretary: Yasuzo Tanaka (International Superconductivity Technology Center)

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

Mission of TC-MC

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

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

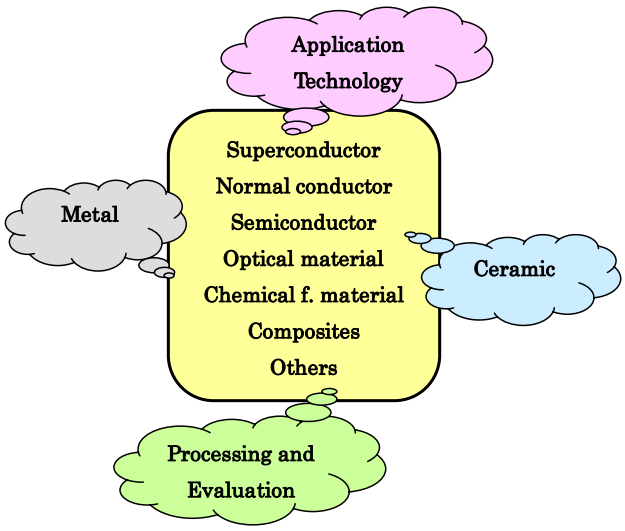


Figure 1 Activity scope of the TC-MC

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

History of TC-MC

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

Recent activities of TC-MC

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

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

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

Last year, two study meetings were held in TC-MC, in which one meeting held on November 28 was jointed with TC-Magnetics.

Table 1 Symposiums in the National Convention of the IEEJ

Theme	Date	Site
Remarkably advanced diamond for electric and electronic materials	2005.03.17	Tokushima University
Electrode materials for fuel cells and the secondary butteries	2006.03.17	Yokohama National University
High magnetic field characteristics and indications for magnetic application of the High-Tc superconducting wires	2008.03.19	Fukuoka Institute of Technology

Table 2 Study Meetings in TC-MC

Theme	Date	Site
Advanced electrode materials for fuel cells and a field trip	2006.12.05	Gas-no-Kagakukan in Tokyo Gas Co., Ltd.
Development of advanced superconducting wires and their future problems	2008.03.14	CRIEPI

Activities of Investigation Committee in TC-MC

As of 2008, there is one investigation committee under TC-MC as shown in Table 3, the name of which is "Structure and composition of advanced superconducting materials". The chairperson and secretary are Prof. Jyun-ichi Shimoyama (University of Tokyo) and Dr. Hiraku Ogino (University of Tokyo), respectively. Regularly, there are four meetings a year.

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

Table 3 Investigation Committees under the TC-MC

Research Subject	Chairperson (Affiliation)	Period	Remarks
Superconducting materials and electronic devices	Nobuyuki Yoshikawa (Yokohama National University)	1999.10-2002.09	Close
Wire and conductor forming of super-conducting materials	Shirabe Akita (CRIEPI)	2001.10-2004.09	Close
Fabrication technologies and characteri-zation of advanced superconducting materials	Hiroaki Kumakura (NIMS)	2004.10-2007.09	Close
Structure, composition and characteri-zation of advanced superconducting materials	Jyun-ichi Shimoyama (University of Tokyo)	2008.10-2011.09	Open

Electrical Wire and Cables (EWC)

Chairperson: Takahisa Imajo (Electric Power Engineering Systems Co., Ltd)
Secretary: Hitoshi.Nojo (J-Power Systems Corporation)
Assistant Secretary: Kazushi Nakaya (EXSYM 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 utilities, the JR railway company, Japan Electric Cable Technology Center（JECTEC）and cable manufacturers. The technical committee holds technical meetings to promote R&D activities in this field and provides an opportunity to present the results of technical achievements. Tree technical meetings was held as the joint meeting with TC-DEI, on February 19, 2008, in Tokyo, and focused on the subject of "Deterioration Diagnosis and Online Monitoring System". The technical committee held Symposium on March 19 2008, in Fukuoka focused on subject of "Technical Trend of Deterioration Diagnosis for Electric Wire and cables", and also held discussion meeting on September 26 2008, in Hiroshima, focused on subject of "Trend and further research of Diagnosis Technology for Electric Wire ,Cables and Electric Equipment". The discussion meeting is shown Fig. 1.

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, the Investigation Committee for Technology of Wires and Associated Accessories for Overhead Transmission Lines, the Investigation Committee for Accessories for 66kV and Higher Voltage XLPE Power Cable, and the Investigation Committee for Technology of XLPE Power Cable and Associated Accessories for underground distribution were organized. This year, an investigation committee is in action. The name and chairperson of the committee are listed in Table 1.

Occasionally a technical visit by the committee members is made to encourage study on the advanced science and technology. This year, the committee members visited Shintoyosu substation of Tokyo Electric Power Company.

Fig.1 Discussion Meeting

Table 1 Investigation Committee in TC-EWC

Research Subject	Chairperson
Technical Trend of Environmental Tests for Insulation Materials of Distribution Wires and Cables	S.Nishimura

IEC Japanese National Committees Related to Electrical Insulating Materials

IEC TC15 Japanese National Committee

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

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

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

Japanese national committee for TC15C held four meetings in a year. Over 25 documents for standardization have been sent from IEC Central Office, including CD, CDV and FDIS, all of which were circulated to the member of the Japanese National committee and discussed. Totally more than 60 reports or documents including voting results, compiled comments and reports concerning to the management were circulated.

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

Japanese national committee is participating to the standardization for new insulating materials of which products are almost from Japan to develop the international standardization in the field of insulating materials.

TC15 meeting has been annually held. The meeting of this year was held on May in Kista, Sweden. Five members from Japan attended to the meeting and WGs.

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

Chairperson: M. Nagao (Toyohashi University of Technology)
Secretary: T. Shimizu (Toshiba Corporation)
N. Hozumi (Aichi Institute of Technology)
Assistant Secretary: T. Takahashi (CRIEPI)

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

SC D1 has now following 7 Advisory Groups (AG): CSAG (Customer and Strategic related), AG D1.01 (Insulating Liquids), AG D1.02 (High Voltage Testing and Diagnostic), AG D1.03 (Insulating Gases), AG D1.04 (Insulating Solids), AG D1.05 (Capacitors) and AG D1.06 (Emerging Technologies). In 2008 CIGRE Paris meeting, SC D1 has started 4 new Working Groups (WG): WG D1.23 (Diagnostics and Accelerated Life Endurance

Testing of Polymeric Materials for HVDC Application), WG D1.24 (Potential of Polymer Nanocomposites as Electrical Insulation for Highly Stressed Insulation Material in AC and DC Application), WG D1.25 (Application Guide for PD Detection in GIS using UHF or Acoustic Methods), WG D1.26 (Basic Principles to Determinate Methane Content of Cross-linked Solid Insulation of MV and HV Cables). SC D1 now consists of 7 AG's and 13 WG's: the above new WG's as well as the previous 9 WG's: WG D1.01 (Liquid Impregnated Systems for Transformers), WG D1.07 (Solid Insulating Materials for Rotating Machines), WG D1.14 (Material Properties for Nonceramic Outdoor Insulation), WG D1.15 (HTSC-Material Applications & Cooling), WG D1.17 (HV Asset Condition Assessment Tools, Data Quality and Expert Systems), WG D1.18 (Emerging Technologies in Power Systems), SCTF D1.19 (Solid Insulation Endurance under Repetitive Transient Voltages), SCTF D1.20 (Water Tree Detection in XLPE insulation), WG D1.33 (High Voltage Test and Measuring Techniques).

2008 CIGRE SC D1 Paris Group meeting was held with the following preferential subject, PS1: Status of emerging technologies for power systems, PS2: Diagnostic of material properties in power equipment (Development and practical experiences), PS3: Challenges for materials in future power systems. There presented 24 papers from all over the world, among which following 3 papers were presented from Japan: "Advanced On-site Monitoring and Diagnostics Techniques for Gas Insulated Switchgears" by H.Hama, et al., "Material Challenge of MgO/ LDPE Nano-composite for High Field Electrical Insulation" by M.Nagao, et al., "Development of a High-voltage Large-capacity Electric Double-layer Capacitor and Its Application to the Voltage Sag Compensator" by S.Sugimoto, et al. At the meeting 60 contributions were also presented and 10 from Japan.

The preferential subjects for the 2010 SC D1 Paris group meeting will be PS1.New materials for improved efficiency and sustainability of AC & DC power equipment (Nanomaterials, biodegradable materials, New gas compositions, Recyclable materials, Innovative polymers, HTSC), PS2.Challenges for testing and diagnostics (New requirements for ultra high voltage, Interpretation of diagnostic results for condition assessment, New test and monitoring methods), PS3.Endurance of materials especially in harsh electrical and physical environments (Off-shore applications, Repetitive transients, load cycling, thermal overload, nuclear environment).

The next 2009 International SC D1 meeting is scheduled to be held in Budapest, Hungary on September 20-25, 2009. The 2011 SC D1 meeting was decided to be held in Japan in conjunction with SC A2 (Transformer)

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

RESEARCH ACTIVITIES AND TECHNICAL EXCHANGES IN ASIAN COUNTRIES

Conference Records

International Conference on Electrical Engineering (ICEE2008 Okinawa)

Eiji Kaneko
University of the Ryukyus, Japan

1. Introduction

International Conference on Electrical Engineering 2008 (ICEE2008 Okinawa) was held from the 6th to 10th of July 2008 at the Okinawa Convention Center in Ginowan City, Okinawa, Japan. ICEE is held annually in Japan, Korea, China and Hong Kong through collaborative work with the related academic institutions from these countries. ICEE2008 Okinawa was the fourteenth annual conference, and the fourth one in Japan, followed by those in Matsue City (1997), Kita-kyushu City (2000), and Sapporo City (2004).

Institute of Electrical Engineers of Japan (IEEJ), being the main organizer, strongly supported this conference as one of its major international activities.

2. Opening ceremony

The conference started in the midst of summer, just after the rainy season, on a sunny day in subtropical Okinawa with 607 participants. Details of these participants are shown in Table 1 and 2 below.

Table 1 Participants

Regulars	Students	Accompanies	Total
354	224	26	604

Table 2 Participants by Country/Region

Country/Region	Number
Japan	345
Korea	158
China	31
Hong Kong	15
Others (19countries)	55

At the opening ceremony, Professor Tetsuo Yamakawa of University of the Ryukyus, chairperson of the local organizing committee, opened the ceremony, and Dr. Ichiro Tai, President of IEEJ, addressed a welcome speech, followed by addresses by Professor Jianchao Zheng, Vice President of Chinese Society for Electrical Engineering (CSEE); Professor Hai-Won Yang, President of Korean Institute of Electrical Engineers (KIEE); and Professor Peter Y Wong, President of Hong Kong Institute of Engineers (HKIE).

Fig. 1 Okinawa Convention Center

Fig. 2 Prof. T. Yamakawa at the opening ceremony

Fig. 3 Dr. I.Tai at the welcome speech

The following four keynote speeches were presented:

- "Electric Power Circumstances in Okinawa - The Way of Subtropical Island of Japan" by Professor Eiji Kaneko of University of the Ryukyus
- "Challenges and Technological Opportunities for Sustainable Electric Power Supply" by Professor J. Zheng, Vice President of CSEE
- "Philosophy of Engineering and Challenges of Engineering Education" by Professor Chan Ching Chuen, Past-president of HKIE
- "New Energy Efficiency Standards for Three Phase Induction Motors in Korea" by Soo-Hyun Baek, President-Elect of KIEE

Fig. 4 Prof. E. Kaneko at the key note speech

3. Conference Sessions

The total of 442 papers were presented in 27 oral sessions (232 papers) and 4 poster sessions (210 papers). Details of these papers are shown in Table 3.

Table 3 Registered Papers by Country and Number

Country (Region)	Number
Japan	238
Korea	124
Iran	25
China	21
Hong Kong	11
Taiwan	5
Thailand	4
Vietnam	3
India	2
Others (9 countries)	9
Total	442

Followings are the topics of these sessions.

- Information, control and sensing systems
- Communication systems and semiconductor technology
- Electrical machines, power electronics and industry
- Electrical traction system and control
- Sensor and micro-machine
- Electro magnetic transient programs

Fig. 5 Poster session

- Power generation and sustainable environment
- High voltage, insulation and sensing technology
- Transmission and distribution system, and apparatus
- HVDC and FACTS
- Power system planning and scheduling
- Power system modeling, simulation and analysis
- Power system protection, operation and control
- Power system stability
- Power market and power system economics
- Renewable energy

Two panel sessions - one on "network security technology for infrastructure and industrial systems" and the other on "power system transient simulation" - were conducted for more than 3 hours. Dr Yoshizumi Serizawa of Central Research Institute of Electric Power Industry and Dr. Toshihisa Funabashi of Meidensha Corporation were the conveners of these panel sessions, respectively.

Fig. 6 Panel session

4. Social programs

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

The Welcome Reception was held at DFS Galleria Okinawa's "Food Colosseum" in Naha City, where all participants enjoyed Okinawan cuisine and beverages as well as Okinawan classical rural music and dances, specially arranged by Dr. Funabashi who was one of the conveners of the panel sessions.

At the Banquet held at Laguna Garden Hotel, full-course French dinners were served, along with the performance of Okinawan classical palace dances. Before the closing of the Banquet, Professor J. Zheng,

Vice President of CSEE, made an announcement about the next ICEE, which is scheduled to be held in China next year. He announced that ICEE2009 will be held in Shěnyáng and displayed a video showing information about the city.

Fig. 7 Welcome Reception

Fig. 8 Banquet

The following three technical tours were conducted:

A) Okinawa pumped-storage plant --- Okinawa Churaumi Aquarium
B) Counter measure equipment for frequency variation control --- Nuchi-mahsu factory --- Katsuren Castle
C) Okinawa Subtropical Environment Remote Sensing Center --- Cape Manza --- Okinawa Tracking and Communication Station --- Okinawa Churaumi Aquarium

Fig. 9 Technical tour at the pumped-storage plant

5. Closing ceremony

Professor Kunihiko Hidaka, chairperson of ICEE2008 International Program Committee, presented a summary and statistical data of the conference. Dr. Tokio Yamagiwa, Vice President of IEEJ, gave a closing address, and the ICEE flag was handed to Professor J. Zheng of CSEE.

Fig. 10 Prof. Hidaka at the closing ceremony

Fig. 11 ICEE flag (Dr. Ymagiwa & Prof. Zheng)

6. Remarks

ICEE2008 was supported by Grant-in-Aid for Publication of Scientific Research Result (No.2062003) provided by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), as well as by many companies and universities, especially of those in Okinawa. Great appreciation should be given to them. I would like to personally and sincerely thank the staff and students for their effort for the conference.

We hope that the next ICEE annual conference, which will be held in Shěnyáng, China, will be a success with your participation.

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International Conference on Condition Monitoring and Diagnosis (CMD 2008)

Chairman of CMD 2008
Chengrong Li (North China Electric Power University, China)

The second biennial International Conference on Condition Monitoring and Diagnosis (CMD 2008) organized by North China Electric Power University (NCEPU) was held in Beijing, China, from 21st to 24th of April, 2008. CMD 2008 provides a perfect opportunity and platform for colleagues and experts in the field of CMD to meet each other, to share experience and to discuss the new progress and challenges facing us in the near future.

Short Report on CMD 2008

CMD 2008 was first held in Changwon, Korea (2006) after a joined conference ACEID 2003–ICMEP 2003 in Chongqing, China (2003). It was one of important conferences in the field of high voltage engineering. CMD 2008 has given you a challenging platform to see the latest advances in Condition Monitoring and Diagnosis for industrial application systems.

With the fast progress of society and electric power industry, the concern about the application and development of condition monitoring and diagnosis is increasing more and more. 243 people (not including about 60 exhibitors and 40 accompanying person) have registered for CMD 2008, they are from industry, government, research and academic institution of 26 different countries and areas around the world. The total figure is about 350. The number of persons from China is about 61, and Japan 35, Korea 23, the forth is UK 18, and next is Indonesia 15, India 11 and the Netherland and Austria both are 9. Also, others are from Romania, Germany, Canada, USA, etc.

CMD 2008 had very various scopes from Partial Discharge Detection to Condition Monitoring for GIS, Switchgear, Power Transformer, etc. At this international conference, Over 400 abstracts submitted by prospective authors have been received, at the same time, 320 full papers related to various fields of condition monitoring and diagnosis have been published in the proceeding. In the plenary session, we were so lucky to invite those famous experts and professors to give us some wonderful presentations about their respective fields. All of these proceeded successfully. The content of plenary session is shown in Table 1.

Table 1 Invited Lecture Program of Plenary Session

Speaker	Affiliation	Title
Mr. Liu Zehong	State Grid Corporation of China	Recent R&D and Future Perspectives on Ultra High Voltage Transmission in China
Prof. Johan J. Smit	Delft University of Technology, Netherlands	Integration of Condition Monitoring Intelligence in Electrical Infrastructures
Prof. G. C. Montanari	University of Bologna, Italy	Insulation Condition Assessment of Power Equipments in Electrical Assets Based on On-line Monitoring of Partial Discharges
Prof. Chengrong Li	North China Electric Power University, China	Recent Progress and Future Perspective on Condition Monitoring and Diagnostic Techniques for Power Equipment in China
Prof. Hitoshi Okubo	Nagoya University, Japan	Recent Progress and Future Per-spective on Condition Monitoring and Diagnostic Techniques for Power Equipment in Japan
Prof. Hyun-Hoo Kim	Doowon Institute of Technology, Korea	Recent Progress and Future Perspective on Condition Monitoring and Diagnostics for Power Equipment in Korea

Figure 1 All Participants (continued to the right page)

In the next two day's discussion and communion, conferees fully exchanged their ideas and productions in the form of oral and poster. According to the papers that have been received, the main topics of CMD 2008 were as follows:

1. Fundamentals of Partial Discharge Detection
2. Condition Monitoring for Generator
3. Phenomena and Mechanism of Aging, Degradation and Failure
4. Condition Monitoring and Evaluation for GIS, Switchgear, MOA and Insulator
5. Condition Monitoring for Power Transformer
6. Strategic Planning and Management for Condition Monitoring and Assess Management
7. Evaluation and Condition Monitoring for Electric Systems and other Industrial Fields
8. New Measurement Equipments
9. Advanced PD Detection: UHF Techniques and Noise Suppression Techniques
10. Condition Monitoring for Cable and other Capacitive Apparatus
11. Applications of Artificial Intelligence and Information Technique for Condition Monitoring

The statistics of the contribution for the hot topics on CMD 2008 are: (1) Condition Monitoring for Power Transformer, 49 (2) Phenomena and Mechanism of Aging, Degradation, and Failure, 39 (3) Evaluation and Condition Monitoring for Electric Systems and other Industrial Fields, 35 (4) Condition Monitoring for Cable and other Capacitive Apparatus, 31 (5) Condition Monitoring and Evaluation for GIS, Switchgear, MOA and Insulator 28, etc.

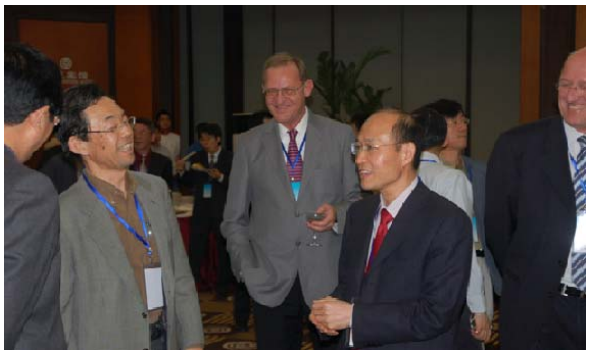


Figure 2 Prof. Hitoshi Okubo, Prof. Michael Muhr and Prof. Chengrong Li (From left to right) in Welcome Reception

Figure 3 Prof. Hitoshi Okubo, Prof. Toshikatsu Tanaka and Prof. Chengrong Li (From left to right) in Welcome Reception

Figure 4 Plenary Session

Figure 5 Prof. Chengrong Li and Prof. Johan J. Smit in Plenary Session

Figure 1 All Participants (continued from the left page)

Furthermore, to have more attention to the key fields, eight invited lectures about hot topics were presented in parallel sessions as shown in Table 2. Most prominent professionals like Prof. Johan J. Smit, Dr. Chen George, Prof. Toshikatsu Tanaka and Dr. Martin D. Judd gave all participants the informative and distinguished lectures as the highlights of the related whole occasions.

CMD 2008 was sponsored by Chinese Society for Electrical Engineering, National Natural Science Foundation of China, State Grid Corporation of China, China Electric Power Research Institute, Wuhan High Voltage Research Institute of SGCC and North China Electric Power Research Institute Co., Ltd.. The conference gained essential sponsor from many manufacturers and exhibitors (the total number is 31). These days, they showed us quantities of advanced productions and new ideas in condition monitoring and diagnosis for industry application systems. The exhibition attracted attentions of all participants as shown in Fig. 9.

Figure 6 Raising Questions (Prof. Harry E. Orton)

Figure 7 Oral Session

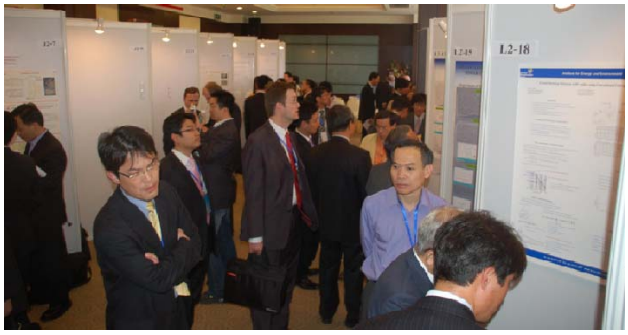


Figure 8 Poster Session

Table 2 Invited Lectures in Parallel Sessions

Speaker	Affiliation	Title
Johan J. Smit	Delft University of Technology, Netherlands	Investigation of Water Treeing – Electrical Treeing Transition in Power Cables
Guanjun Zhang	Xi'an Jiaotong University, China	Lifetime Monitoring and Estimation Strategy for Large Power Transformer
Chen George	University of Southampton, UK	Apparent Mobility and its Relationship with Ageing in Polymeric Insulation Materials
Hung T. Dang	Luxtron/Lumasense Technologies Inc., USA	Finally Fiber Optic Sensing of Power Transformer "Hotspots" Is Paying Off
Zhongdong Wang	University of Manchester, UK	FRA Low Frequency Characteristic Study using Duality Transformer Core Modeling
Chengke Zhou	Glasgow Caledonian University, UK	Partial Discharge Monitoring in Medium Voltage Cables
Martin D. Judd	University of Strathclyde, UK	Radiometric Partial Discharge Detection
Su Q	Petroleum Institute, Abu Dhabi, UAE	Insulation Condition Assessment of HV Cables

Figure 9 Exhibition

What is more, to share experiences in UHF PD monitoring, FRA Measurement and Diagnosis for Power Transformers, two panel discussions about the area were arranged specially. Some questions to prompt contributions to these sessions were given. The organizers particularly welcome the contributions and experts from related fields.

Figure 10 Panel Discussion

During the conference, we had an International Board Meeting with the representatives of CMD 2008 International Steering Committee to summarize the status of this conference, preparations of CMD 2010 and decide the hosting country of CMD 2012, After a successful conversation and discussion we decided eventually that CMD 2012 will be held in Indonesia.

In addition, a technical tour to the UHV DC Test Base of State Grid Corporation of China, the Beijing Key Laboratory of High Voltage & EMC (NCEPU) and the Key Laboratory of Power System Protection and Dynamic Security Monitoring under the Ministry of Education (NCEPU) is arranged specially.

Figure 11 International Board Meeting

Figure 12 The UHV DC Test Base

Figure 13 In the Beijing Key Laboratory of High Voltage & EMC (NCEPU)

Figure 14 In the Key Laboratory of Power System Protection and Dynamic Security Monitoring under the Ministry of Education (NCEPU)

As the chairman of CMD 2008, I really hope that conference was a beneficial and enjoyable experience for all participants and you have had a nice stay in Beijing. Further, I would like to give my most heartfelt thanks to all delegates from all over the world and the member societies for the efforts they have given to assist in this scientifically successful conference.

Prof. Chengrong Li
Chairman of CMD 2008
lcr@ncepu.edu.cn

2007 Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering

Toshiki Nakano
National Defense Academy

The 2007 Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering (JK2007) was held at the Toyosu Campus, Shibaura Institute of Technology, in Tokyo on November 15-17. This symposium was organized by the Fundamentals and Materials Society of The Institute of Electrical Engineers of Japan (IEEJ) and the Technical Committee on Electrical Discharge of IEEJ and co-organized by Study Committee on Electrical Discharge and High Voltage of The Korean Institute of Electrical Engineers (KIEE), Shibaura Institute of Technology, The Institute of Electrical Installation of Engineers in Japan, and The Institute of Engineers on Electrical Discharges of Japan. The JK symposium was originally organized to deepen the friendship between Japanese and Korean researchers in electrical discharges and high voltage engineering, particularly by encouraging the presentation of young students and researchers. This principle has continued to date, throughout the past JK symposiums. The JK symposium had been held alternatively in Japan and in Korea. The JK2007 is the very first symposium that was held outside Kyusyu in the history of the JK symposium organized in Japan as the past JK symposiums were held only inside Kyusyu area.

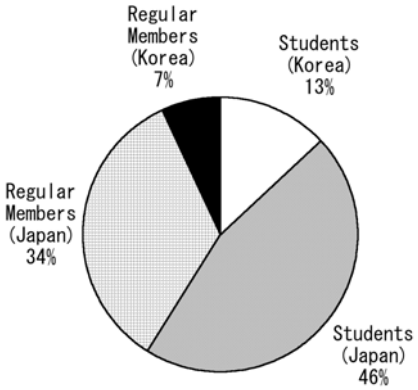
The JK2007 started with the opening remarks where three speeches were given by Dr. T. Okamoto, JK2007 Chairperson, Prof. Ja-Yoon Koo, JK2007 Co-chairperson and Prof. M. Hirata, President of Shibaura Institute of Technology as shown in the photo. Following the opening remarks, two oral sessions were held in parallel. In the first half of the afternoon program, the poster session was opened. In this session, we had very active discussion between poster presenters and symposium participants. This atmosphere continued to the second half of the afternoon program that was scheduled for oral sessions. At the end of the first day of JK2007, the symposium banquet was held to deepen the friendship between Japanese and Korean participants. Oral sessions were held throughout the second day of JK2007. The themes of the oral sessions are indicated below.

Opening Remarks of JK2007

Partial Discharge and Its Diagnostics (I)-(III)
Electrical Breakdown in Vacuum, Gases and Liquids
Lightning and Surge Protection
EMF, EMC and others
Plasma Application
Environmental and Biological Applications
Electrical Insulation and Dielectric Materials (I)-(III)
Fundamental Processes of Electrical Discharges
Testing and Measuring Techniques (I)-(II)

Many papers were submitted to the themes to which roman figures are attached, indicating that many participants were interested very much in partial discharges and insulation materials that increasingly become important in the applications of high voltage engineering.

There were 136 participants in JK2007. This figure was more than expected by the international steering committee. A main reason for the large number of participants to JK2007 is that the symposium was held in Tokyo. In particular, this makes it easy for Japanese participants to attend JK2007. The constituent analysis of JK 2007 participants is shown in the circle chart. As mentioned earlier, the JK symposium has laid much emphasis on the encouragement of the presentation by young students and researchers. This point is found to be evident from the chart.



Constituents of JK2007 participants

In the board meeting during JK2007, the board members of the JK symposium agreed to hold the next JK symposium in Korea, in the November of 2009. JK2009 might be held in conjunction with the KIEE annual meeting. Please contact the Technical Committee on Electrical Discharge of IEEJ

Prof. Toshiki Nakano
Dept. of Electrical and Electronics Engineering
National Defense Academy
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2008 International Symposium on Electrical Insulating Materials (ISEIM2008)

General Chair of ISEIM2008
Naohiro Hozumi (Aichi Institute of Technology, Japan)

The Dielectric and Electrical Insulation (DEI) Committee of IEEJ is holding a domestic symposium every year. The ISEIM (International Symposium on Electrical Insulation Materials) is positioned as to be the international version of the domestic symposium. Researchers outside Japan can participate and make discussions in international circumstances. The ISEIM was established in 1995, and this year's ISEIM was the fifth.

The ISEIM2008 was held on September 7 - 11 in Yokkaichi, Japan, which is located in the suburb of Nagoya. We had a successful symposium with 193 participants from 20 countries and areas. The executive committee of the ISEIM2008 has started its activity about two years ago. Due to liberalization of the electricity market in Japan, investment into development of high voltage power equipment has been decreased. The mission of researchers in the field of electrical insulating materials was forced to change according to the trend of circumstance. Such movement has affected to the academic side as well. As we recognize that our field is facing such a turning point, the executive committee had a long time discussion to renovate the symposium.

The ISEIM2008 covers the nanotechnology, the asset management, and the phenomena under the inverter surge to catch up with the above trend. As for the special lectures, we invited two excellent speakers. The first speaker was Prof. M. Hara, who has awarded the Inuishi Memorial Lecture Award and gave us a lecture on the cryogenic insulating systems. The second speaker was Dr. M. Jeroense, who gave us a plenary lecture on the insulation technology for the HVDC system. These two speakers gave us deep and advanced research meanings.

Dr. Marc J.P. Jeroense (ABB, Sweden) in his invited talk: ”HVDC, the Next Generation of Transmission Highlights with Focus on Extruded Cable Systems.”

Emeritus Prof. Masanori Hara (Kyushu Univ. & Kyushu Electric Power Co., Inc., Japan) in the awarding ceremony. Emeritus Prof. Hara gave the Inuishi memorial talk: ”Bubble-Triggered Breakdown of Cryogenic Liquids in Pool-Cooled Superconducting Apparatus.”

In the sessions, 164 presentations, including 57 oral and 107 poster presentations, were done. These were categorized as aging (23), space charge and interfacial phenomena (29), dielectric phenomena and applications (19), nano-dielectrics (21), insulation for apparatus and outdoor use (27), test and measurement (22), insulation subjected to inverter surges (4), and conduction and breakdown (19).

One of our important missions was to encourage young researchers who will succeed and expand our activities. From this point of view, we planned a session of "Mutual Visiting type Poster session", named as an “MVP session”. This session aims to encourage and improve the presentation and discussion abilities of young researchers. Including MVP sessions, we had sufficient time and space for poster sessions. This is aiming that all participants can make deep and fruitful discussion by overcoming language barriers.

The other important mission was to provide chances for encounter with various researchers to open up a path to the future. Especially in recent days, linkages among researchers in industry and academia (including students) are becoming more and more important. From this point of view, we planned another special session, named as the “Sun-Shine session”, to introduce R&D topics in industry to the academic people. The first trial was successfully held in a domestic symposium last year. It is believed that the Sun-Shine session was helpful for mutual understanding among researchers in industry and academia in the field of electrical insulation materials.

Number of papers by country.

Country	attendees	Country	attendees
Algiers	1	Japan	67
Australia	2	Korea	5
Austria	3	Malaysia	2
Brazil	1	Mexico	2
Canada	2	Norway	3
China	47	Poland	3
Czech Republic	2	Sweden	3
France	3	Taiwan	1
Germany	4	Thailand	1
India	6	UK	1
Indonesia	1	USA	1
Italy	2	Vietnam	2
		Total	74

In addition, it was quite impressive that young students were attracted by enthusiasm of presenters from the industry side.

We also planned some technical and social events including tours and parties. As for technical tours, we visited the Toshiba Mie operations and the site of Superconducting Magnetic Energy Storage System. As for social events, we invited all participants the banquet with the Ninja show.

We hope that all the participants and accompanying families enjoyed delightful time flooded with friendship and kindness. The executive and local committees are proud of providing these events and entertainments.

Finally, we would like to deeply thank all of the participants from all over the world, and members of the organizing committee and the sub-committees for their effort to realize this symposium. We also express sincere appreciation to all the supporting members of this symposium for their tremendous contributions.

The next ISEIM will be held again in Japan in 2011. We wish all participants would come back Japan with the harvest of coming three years.

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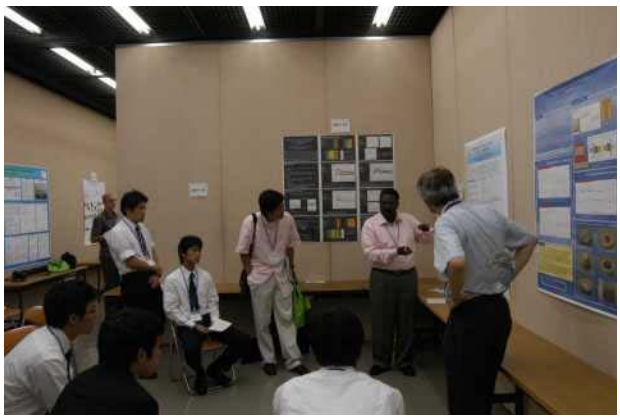

The great idea of "Mutual Visiting type Poster session" for young researchers was proposed by Dr. K. Uchida of Chubu Electric Power Co. It was held in a wide room, taking a long time enough for deep discussion.

Banquet with the Ninja show made all participants happy and friendly.

INTERNATIONAL TECHNICAL EXCHANGE SESSION IN ISEIM 2008

2008 International Symposium on Electrical Insulating Materials

2008 International Symposium on Electrical Insulating Materials (ISEIM 2008) was held at the Yokkaichi Cultural Hall in Yokkaichi City, Mie, Japan, from September 7 to 11, 2008. The International Technical Exchange Session was held for information exchange and human contact among researchers of Pan-pacific regions in the field of electrical insulation at Sept. 10th, 2008, 19:00-21:00 at Hall #2.

Digest Report on International Technical Exchange in or near Asia

Opening Address:

Prof. Toshikatsu Tanaka

(Chair of EINA Committee, Waseda Univ.)

Introduction of EINA activities:

Prof. Masayuki Nagao

(Toyohashi Univ. of Technology)

"Introduction of EINA (Electrical Insulation News in Asia) Activities"

It was aimed at ***"The exchange of information among Asian countries in the field of the electrical insulation research for developing together"****, which was proposed by Prof. Ieda, the EINA Magazine Committee was founded in 1994 and started to publish EINA magazine.*

At the beginning, first chairman of the EINA magazine committee, Prof. Y. Yamashita and present chairman, Prof. T. Tanaka were introduced. Also it was introduced the past issues of EINA magazine with the cover pages. Furthermore, the present activities, such as EINA website, International EINA Meeting, EINA session in ISEIM, Financial Support, and Postal Distribution of EINA magazine to Abroad in 2008, were mentioned.

Introduction of Research and Development in laboratories and in Asian countries:

Dr. Yi Yin

Shanghai Jiao Tong University (China)

"Research and Development of High Voltage Engineering and Electrical Insulation Technology in Shanghai Jiao Tong University"

"The Dept. of HV Eng. and EI consist of two Laboratories. These two laboratories are leading research and teaching laboratories in the field of Insulation, Monitoring on-line, Nanodielectrics, Pulse Power Applications, Power Electronics and High Voltage Measurement in East of China."

Dr. June-Ho Lee

Hoseo University (Korea)

"Launching a New Research Center for Electric Power Technology in Korea"

EFT (Electro-Fusion Technology) Center has been built in March 2007. It was talked from the background of EFT Center to the future vision around the electric power technology. Photos of the inside of HV Test Hall, High Performance Shield Room, PD Diagnostic System, Power Plant, Synthetic Test Circuit, and so on were introduced.

Dr. Pham Hong Thinh

Hanoi University of Technology (Vietnam)

"Overview of the development in diagnostic tools in Vietnam"

Present projects in HUT have been introduced, such as "Dielectric behavior of auto-cooling transformer oil using magnetic nano-particles", "Conception and realization of electromagnetic shielding material with multilayered structure", and so on.

Dr. Sarathi Ramanujam

Indian Institute of Technology (India)

"Research Activities at Indian Institute of Technology Madras"

In major facilities in high voltage laboratory, 800 kV test transformer, 1.5 MV LI voltage generator and 780 kV ns pulse generator were introduced with photos. Also main works in IIT Madras were introduced, such as "Treeing in underground cables", and so on.

Prof. Suwarno

Bandung Institute of Technology (Indonesia)

"High Voltage Engineering in Indonesia"

First of all, he showed the world map and explained the location of Indonesia, the number of islands (~6,000 islands), 13 local languages, and so on. Then it has started to report about the outlines of electric power system, primary energy for electric power generation, industrial pollutions in Indonesia, research activities in HV, and so on.

Prof. Guan-Jun Zhang

Xi'anJiaotong University (China)

"Research Progress in State Key Laboratory of Electrical Insulation & Power Equipment"

It happened that this presentation has been started from world map. In the presentation, quite many kinds of studies and topics around the electrical insulation materials, such as polymer, inorganic ceramics, and composite dielectrics were introduced with some examples and proposed "Environment friendly insulation".

Prof. Naohiro Hozumi

Aichi Institute of Technology (Japan)
(Chairman of DEI Society in IEEJ)

"Dielectric & Electrical Insulation Technology in Japan"

He has suggested the "Fundamental research for understanding phenomena expand our territory". His main topics with full of his humor were "Space charge in the space", "Eco-friendly insulating materials", "Long term test for HTSC cable", "Self healing insulation", "Go with nano-composite", and so on.

Chair:

Mr. Yoshiyuki Inoue

(Task Force, Toshiba Corporation)

Closing:

"Fruitful Talk"

Thank you for all presenters and participants in "EINA Session".

Interview for EINA Magazine

1. **Do you have any requests for EINA magazine activity?**
   - *If possible mention about equipment of different working group and details of working groups.*
   - *Instead of one magazine a year two magazines be better mentioning all DEIS/Pawn Engineering Congresses.*
   - *Introducing more outstanding young researchers, introducing there research activity.*
   - *No.*
   - *Had better to supply in free, if anyone is interesting on it.*
   - *Open EINA editorial committee to expert in Asian countries.*
   - *It's very necessary to increase the awareness of EINA to colleagues in Asian countries effectively.*
   - *EINA project is doing very well.*
   - *The activity is highly appreciated.*
   - *It is of course helpful to understand what is going on in Asian countries, however, we may need more information from other countries than Japan.*
2. **EINA magazine introduces activity of Japan committee, research activity in Asia, new technologies of Japan and so on. What kind of news do you hope (need) for EINA magazine?**
   - *Near feature technology mentioning the need.*
   - *New technologies for future using.*
   - *Research of resent researcher in Asia and the International researcher activity.*
   - *UHV in China should be introduced in this magazine.*
   - *So far, so good!!*
   - *R & D reports in each country. What is going on relevant to domestic activities in each country?*
   - *If possible, some import news even from all over the world.*
3. **Now EINA committee has two kinds of activities, EINA magazine in a year and EINA website. Are these contents of magazine and website good for you?**
   - *Yes. It is very much useful to know about other lab and developments.*
   - *Both of these contents are good for me.*
   - *No, I don't know EINA before.*
   - *Of course. Go on please.*
   - *Yes.*
   - *Only one issue in a year is too limited. May be more information on-time can be posted on the web. Anyway, more issues in a year are expected.*
4. **How method of publication of EINA magazine is good for readers in Asia?**
   - *Present System is very good.*
   - *Published in English, and informing readers with news monthly.*
   - *Free.*
   - *Publication in print is better than internet.*
   - *In the form of hard copy delivered by postal service.*
   - *Web and magazine are pretty enough. In addition, having the EINA session is a very good idea.*
   - *Electronic version is more suitable, and also with a suitable quantities of hardcopy version.*
5. **We hope that EINA news is from many Asian countries, but many sources have been from Japan so far. How do you think many Asian countries can participate in EINA?**

- *Invited other researchers to introduce their research activity.*
- *Yes, Japanese Electrical Insulation research is front in Asia.*
- *I think it depends on the strategy of EINA.*
- *It may take sometime to synchronize the movement of many countries. I believe that advanced countries like Korea will follow.*
- *Topics in eq. Japan- Korea. Symposium will be helpful to find out some articles.*
- *Organizing editorial group in Asian countries will promote significantly.*
- *Yes, of course.*

6. **Have you ever sent any news in your country to other countries as EINA magazine?**
   - *Yes. I have sent information to other researchers in India and collaborations in around.*
   - *No.*
   - *Not yet.*
   - *Not yet. I will try. Actually I early hope to submit a manuscript to EINA from China.*
7. **Do you have any news on research activity in your country?**
   - *Yes.*
   - *Sorry.*
8. **Please contribute news source, activity in your country to EINA magazine**
   - *I will contribute work for it.*
   - *Ok.*
   - *Sorry.*
   - *I will.*
   - *Yes, as much as possible.*

Thank you for sending us the kindly comments, messages and suggestions. These comments are very helpful and strongly encouraging for EINA committee members. Thank you again and we are looking forward to seeing you again in next EINA session.

By **Prof. Kazuyuki Tohyama** (Numazu National College of Technology)

International Conferences to be held in Asia

ICEE 2009 (International Conference on Electrical Engineering) Towards A Safe, Reliable, Sustainable, Intelligent Power System

Dates: July 5-9, 2009
Place: Shenyang, China
Organizer: The Chinese Society for Electrical Engineering (CSEE)
Co-organizers:
Institute of Electrical Engineers of Japan (IEEJ)
The Korean Institute of Electrical Engineers (KIEE)
The Hong Kong Institution of Engineers (HKIE)

The ICEE is a major event that will annually provide an exceptional venue for networking an international group of practicing electrical engineers and experts to highlight key issues and developments essential to the multifaceted field of electrical engineering systems.

The conference adds some prevailing topics like UHV technology, disaster prevention and control technology for power grid safety, DG, smart grid etc. for discussion.

Important dates:

Abstract Submission	December 31, 2008
Full Paper Submission	April 1, 2009
Notification of Full Paper Acceptance	May 1, 2009

Secretariat:
Ms. YE Jin and Ms. Chong Shan
China Electric Power Research Institute
Qinghe, Beijing 100192, China
Tel: +86 10 82812560 & +86 10 62916913
Fax: +86 10 62916913
E-mail: info@icee2009.com

Website: http://www.icee2009.com

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

Dates: July 19-23, 2009
Place: Harbin, China
Chairman: Prof. Lei Qingquan, (Harbin University of Science and Technology)

The 9th International conference on Properties and Applications of Dielectric Materials (ICPADM2009) will be held in Harbin, China on July 19-23, 2009. The conference will be sponsored by the IEEE Dielectrics and Electrical Insulation Society (DEIS), and technically supported by China Electrotechnical Society and Chinese Society od Electrical Engineering (CSEE).
The purpose of this conference is to provide a forum for researchers, scientists and engineers from all over the world to exchange ideas and discuss recent progress in electrical insulation, dielectric and practical applications. The organizing committee cordially incites you to participate in the conference.

Important dates:

Abstract Submission:	March 9, 2009
Manuscript Submission:	May 18, 2009

Secretariat:
Dr. Zhang Xiaohong, College of Electrical and Electronic Engineering, Harbin University of Science and Technology (HUST), Sandadongli Road #23, Xiangfang District, Harbin, 150040, China
Phone: +86 451 8639 6200
Fax: +86 451 8639 6637
E-mail: x_hzhang2002@sina.com

Website: http://www.icpadm2009.com

CMD 2010 (International Conference on Condition Monitoring and Diagnostics)

Dates: September 11-14, 2010
Venue: Shibaura Institute of Technology, Tokyo, Japan

Chairman: Prof. Hitoshi Okubo (Nagoya University, Nagoya, Japan)

The conference will be sponsored by the Institute of Electrical Engineers of Japan (IEEJ) and technically co-sponsored by IEEE DEIS and CIGRE. Conference slogan is “Modern Asset Management Technology for Green Operation”.

Important dates:

Abstract Submission:	January 31, 2010
Manuscript Submission:	May 30, 2010

Secretariat:
Dr. Tatsuki Okamoto, Central Research Institute of Electric Power Industry (CRIEPI), 2-6-1 Nagasaka, Yokosuka, Kanagawa 240-0196, Japan.
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E-mail: secretary@cmd2010.org

Website: http://www.cmd2010.org

Laboratory of High Voltage Engineering and Department of Power Systems at Hanoi University of Technology

Pham Hong Thinh
Hanoi University of Technology, Vietnam

1. Introduction

The department of power systems at Hanoi University of Technology (HUT) was established in 1957, one year after the foundation of HUT. 29 faculty members of the department engage in research in wide range of areas, in order to provide superior graduate education and research in the interdisciplinary fields of power system engineering at the HUT. Being organized by five research groups including "Power Plants and Station" group; "Power System and Networks" group; "Power Distribution" group; "Relaying and Automation" group and "High Voltage Engineering" group, the activities of our department focus on:

- Power system planning and optimization
- Power system management and power quality
- Application of artificial intelligence in power systems
- Strategic directions for development of Vietnam power system networks
- Electromagnetic transients in power systems
- Insulating performance in power systems

About 200 undergraduate students, 30 Master students and 10 PhD students are enrolled in the Department every year. The department is managed by Dr. Tran Van Top, who is currently Vice-President of HUT.

2. Research activities of the Laboratory of High Voltage Engineering

High voltage engineering field is an integral part of the work of the department. The laboratory of High voltage engineering is a graduate research and undergraduate teaching laboratory. The staff involved in the laboratory comprises 5 professors and assistant professors. At present, 7 Master students and 3 PhD students are working toward their Master and Doctor degrees in high voltage engineering discipline. The main research fields in the laboratory include:

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

3. Facilities

3.1. Overvoltages in Power System

As the laboratory of High voltage engineering play as a sub-discipline for Power system engineering, the main activities of the laboratory cover most of aspects relating to overvoltages in power systems and insulation coordination. Various studies in modeling switching and lightning overvoltages by using EMTP and MATLAB in power system of Vietnam have been done in the laboratory, the influence of network structure such as the length of transmission lines, grounding system and surge arresters on the magnitude

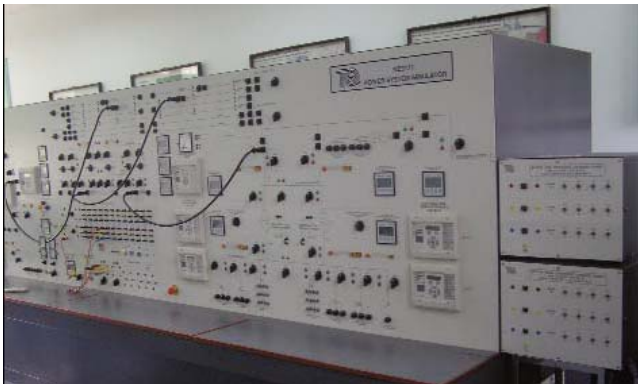

Figure 1: Power System Simulator NE 9171

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

3.2. Dielectric behavior of insulation under high stress

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

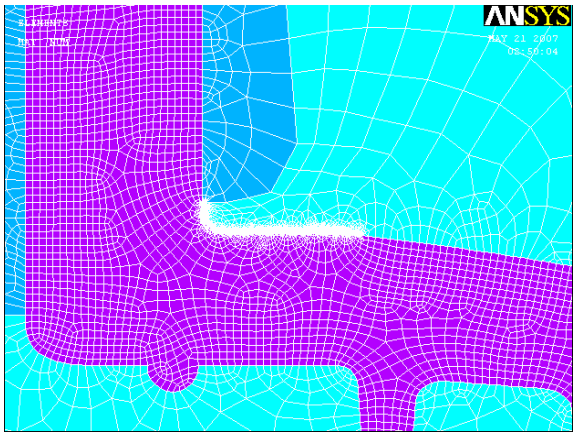

Figure 2: Simulation of polluted surface of insulator by FEM

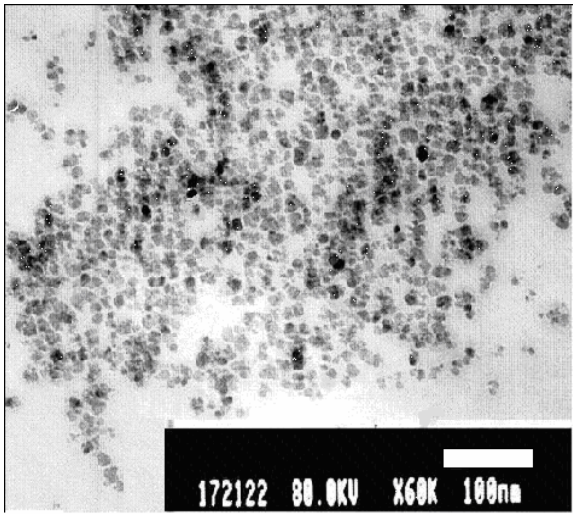

Figure 3: TEM image of magnetic nano-particle using for mixture with transformer oil

4. Current research project

4.1. New generation of transformer oil using magnetic nano-particle

In order to improve the cooling capability of transformer oil in electrical equipment, a collaborative research has been carried out with the cooperation of researchers from International Training Institute for Material Science (ITIMS) at HUT. Mineral oil has been mixed with appropriate ratio of magnetic nano-particles, which are displaced in induced magnetic field inside the equipment. Oil particle surrounding the magnetic particle moves with the magnetic particle, and results in auto-cooling effect.

4.2. Conception and realization of optimal multi-layered electromagnetic shielding of conducting composite in the microwave band

The project is funded by VLIR-HUT institutional Program with the grant of 15 000 E and lasts for 2 years (from 2007-2009). Objective of the project is to make a Polyaniline based conducting composite for electromagnetic shielding application in microwave band (8-18GHz). The project is a collaborative research between the staffs of the Laboratory, the staffs of the department of instrumentation and industrial informatics at HUT, researcher of electric power university (EPU) and professors from Ecole de Mines at Douai (France).

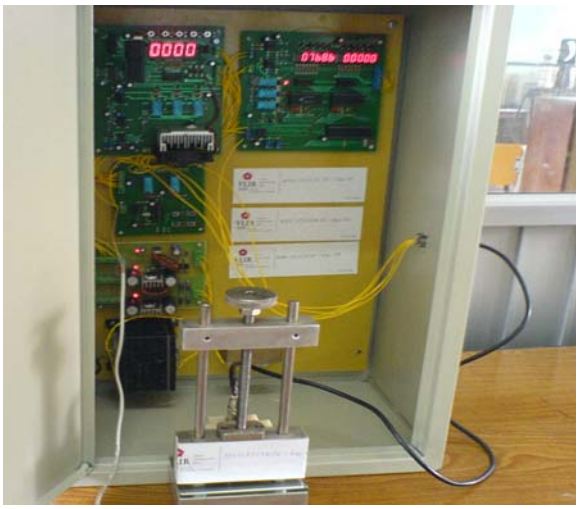

Figure 4: Conductivity measuring device for conducting composite

4.3. Development of insulation diagnostic tools

Insulating failure diagnostic tools are currently developed in the laboratory include partial discharge measurement and leakage current measurement (polarization and depolarization current). With the neuron network simulation, we are trying to sketch out criteria for predicting life expectancy of the insulation in transformer, cable and generator.

5. International cooperation

Besides the relation of the department of power system with traditional partners such as Department of Power System at Moscow Institute of Energy (MEI), Grenoble Electrical Engineering Laboratory (G2E Lab), AUF (Organization for French-speaking universities), the Laboratory have very close cooperation with other foreign institutions in preparing and realizing various common research projects such as Systems and Applications of Information Technologies and Energy Laboratory (SATIE, France), Centre for Plasmas-Material- Nanostructure Research (CRPMN, France), Korea Electrotechnology Research Institute at Changwon (KERI, Korea).

6. Conclusion

As a home of nationwide renowned of researcher and graduate student in Vietnam, the Department of Power System and Laboratory of High Voltage Engineering at HUT is pleased to share the experience and facilities with the researchers and people in the community of power system engineering and high voltage engineering. Therefore, we welcome enquiries and interest of professors from over the world, and warmly invite them to visit our department and laboratory in order to enhance our scientific collaboration.

7. Acknowledgment

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

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Activities of High Voltage Research Laboratory at Hoseo University

June-Ho Lee
Hoseo University, Korea

The High Voltage Research Laboratory is a part of Department of Electrical Engineering, Hoseo University, which is located about 60km south-east of Seoul. Its activities started from 1994. The activities can be categorized as follows;
The optical fiber sensor application for power equipment monitoring, high voltage impulse application for water treatment used in power plant, partial discharge measurement, research on water treeing in polymeric cable, development of educational program of business administration for undergraduate student of engineering college.

1. Optical fiber sensor application

A precise information on spatial distributions of temperature are important for diagnosing power transformers and evaluating its life because a power system failure will result in an enormous loss in tangible as well as social. The optical fiber Bragg grating (FBG) sensors, which have been studied intensively for last decade, can be very efficient tools for applications to above mentioned purpose because these are immune to EMI and can be highly multiplexed, which enables efficient quasi-distributed temperature sensing along tens of km range.

Since the first observation of photosensitivity in fiber, the use of FBGs in both communications and sensing applications has been intensively studied in the last two decades, because it has many important advantages. First, a FBG only reflects Bragg wavelength and transforms the sensed physical quantities to shifts in reflected Bragg wavelengths. Because of this wavelength-encoding characteristic, the sensed information is independent of source power fluctuations, total light level, losses in the connecting fibers and couplers and the other environmental noise sources. Secondly, FBGs can be easily multiplexed in a serial fashion, allowing many of them to be used on a single fiber, which enables efficient quasi-distributed sensing. In addition, the reflected Bragg wavelength shifts show linear response to the change of fiber grating's properties, which means any external physical quantities applied to the gratings such as strain, pressure, temperature or vibration can be recovered from the measured Bragg wavelength shifts. By this features, the FBGs have been intensively studied as an optical sensor for various sensing applications used in the health monitoring of civil structures, nondestructive testing of composite materials, smart structures, and traditional strain, pressure and temperature sensing.

Fig. 1 The 3000kVA mold transformer with the 10 FBG sensors to monitor temperature distributions for 2 months in operation.

The developed FBG sensor system has been applied to 3000kVA mold transformer which was in operation on the real distribution network for 2 months. The performance of FBG sensor has been proven to be stable enough for real scale application.

2. High voltage impulse application for water treatment used in power plant

Water used in power plants must always be kept in high purity. Recently, the trend of producing water for power generation is likely to be changed from the conventional water treatment process to the process utilizing the membrane technology, such as reverse osmosis, nanofiltration and ultrafiltration. This is because the membrane technology has the advantage of not only providing superior process efficiency but also stably producing water. In the membrane process, however, the contamination phenomenon of membrane is always noted as a problem, requiring to imminently make it sure for the technology to control membrane contamination.

The membrane contamination may lower performance of membrane and thereby cause the reduction of water production as well as power generation efficiency, imposing the burden of facility costs because of frequent replacement cycle. Hence, the necessity to procure technologies for the control of membrane contamination is being raised. While several methods including chemical cleaning are currently being implemented to solve the membrane contamination phenomenon, those have not provided fundamental solution measures, like a second

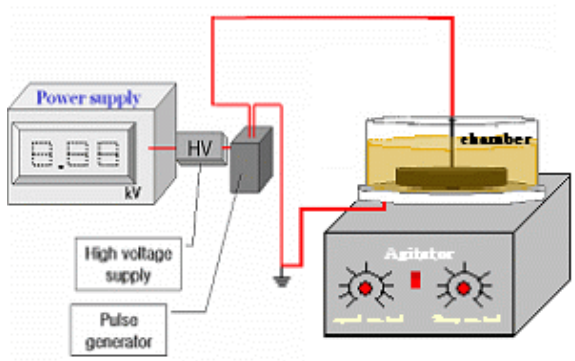

Fig. 2 Schematic diagram of the High voltage impulse system for water treatment used in power plant.

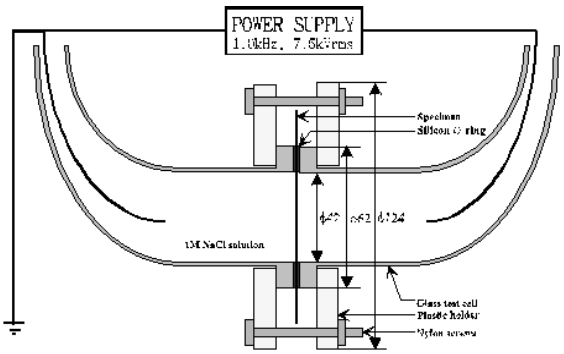

Fig. 3 Water tree accelerated aging cell for double sided water trees

contamination matter, yet.

Accordingly, the purpose of this research is to control the fundamental problem of membrane contamination by utilizing high-voltage pulsed electric fields, not chemicals or physical cleaning that cause a second environmental contamination problem by the use of chemical substances, and this research activities also have analyzed the death rate of microbes processed by electric fields as well as changes in ingredients before and after inducing electric fields.

The actual experimental results demonstrated that the death of microbes is proportional to the magnitude of electric fields. However, since sterilization in microbes means 99.99% complete death, it is expected that better results could be obtained, if experimented with higher magnitude of electric fields and the adjustment of processing time, frequency and pulse duty ratio, based on the above results. We are going to continue these experiments to demonstrate that the experimental system of this high-voltage pulsed electric fields can be effective not only in water treatment facilities but also in various fields requiring high sterilization systems, including food sterilization field.

3. Research on water treeing in polymeric cable

We have investigated the change of AC breakdown(ACBD) strength of water tree degraded XLPE specimens. The spacecharge distributions in the specimens were also measured by pulsed electroacoustic(PEA) method in order to study the correlation between the ACBD strengths and space charge distributions in the water tree degraded XLPE.

The specimens of 700 μm thickness and 85 mm diameter were prepared by hot press molding of XLPE pellet, which is commercially used for 22.9 kV underground cable insulator. For the specimens with one side water trees, opposite surface was painted by silver paste for electrode contact. Figure 3 shows the water tree accelerated aging cell for two sided water tree. In the cell 1 M NaCl solution was applied to the scratched side of the specimens. The water trees were grown at 7.5 kVrms, 1.0 kHz frequency and at room temperature. In order to make a good contact between the NaCl solution and surfaces, the cells were degassed in a vacuum chamber at 10-20 Torr before the test voltage was applied.

Figure 4 shows the spacecharge distributions in double sided water tree degraded XLPE specimens. We increased DC voltage of 0, 6, 9 and 12 kV, and finally removed applied voltage again. The homocharges are concentrated at the water tree tip regions. The correlation between the ACBD strength and spacecharge distribution of water tree aged XLPE was investigated using PEA method. It was found that the ACDB strength was reduced as the water tree grew, and the space charge with same polarity of electrode was distributed along water treed region, especially concentrated near the tree tip. Through the electric field calculation, the local field enhancement at the tip of water tree path was also verified. Based on these results, it could be said that the water tree reduced the breakdown strength of XLPE because of the homo-charge concentration at the tip of water tree path, which resulted in the reduction of effective insulating thickness.

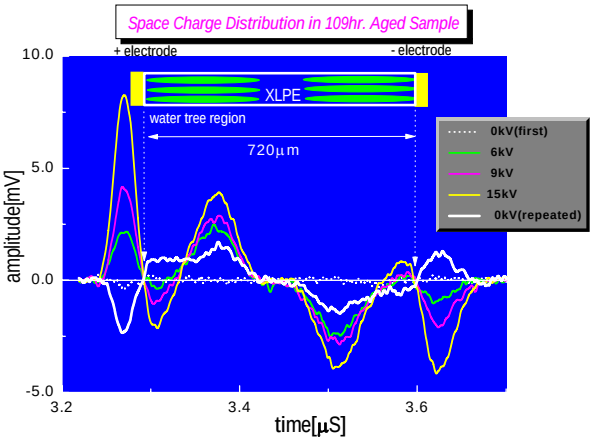

Fig. 4 Spacecharge distributions in double sided water tree sample as a function of applied voltages.

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China Corner

The Development of Ultrahigh Voltage Transmission System in China

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

1 Overall

Developing the ultrahigh voltage (UHV) transmission system with long transmission distance, large trans- mission capacity and low loss is a necessity for China in order to develop a coordinated society between energy consumption and economic development, which is beneficial to intensively develop the bases of large hydroelectric power, large coal-fired power and large nuclear power, to optimize the situation between energy production and consumption; is beneficial to convert the natural resource advantages in western region of China into economic advantages and to balance the economic development among different regions; is beneficial to improve the power grid structure, to enhance the security and reliability of power system, to reduce the construction costs of electrical grid, save land resources, alleviate the pressures from transmission and environment, to raise the efficiency of operation, to promote the construction of an energy conversation and environment friendly society. On the other hand, it is also an important opportunity to totally improve the manufacture level of related electrical equipment manufacture enterprises in China, to make more progresses in the manufacture techniques of equipments operated in UHV, to promote the manufacture techniques of AC/DC equipments and enhance the international competitiveness.

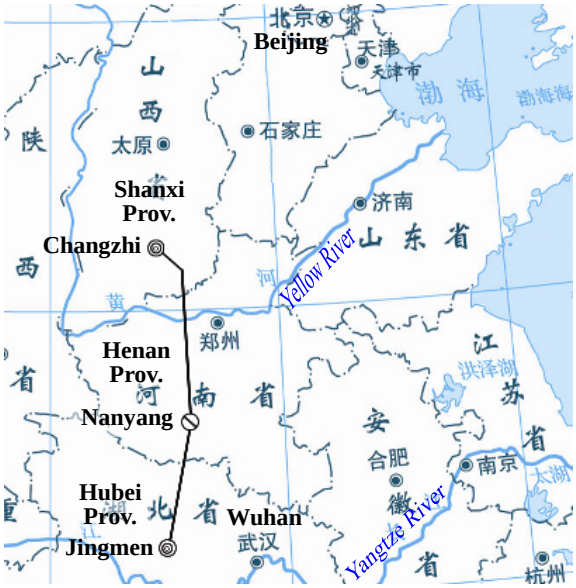

Fig. 1 The 1000kV AC UHV demonstration test project from Southeastern Shanxi province via Nanyang (Henan province) to Jingmen (Hubei province).

Now, the 1000kV AC UHV demonstration test project from Southeastern Shanxi province via Nanyang (Henan province) to Jingmen (Hubei province) (as shown in Fig.1), ±800kV DC UHV demonstration test projects from Yunnan province to Guangdong province, from Xiangjiaba Dam (Sichuan province) to Shanghai (as shown in Fig.2) have been approved by National Development and Reform Commission.

Fig.2 The construction ceremony of ±800kV DC UHV demonstration test project from Sichuan province to Shanghai, on 21 May, 2007.

"The Development and Demonstration Project of Ultrahigh Voltage Transmission and Transformation System" is in the charge of both State Grid Corporation of China and China Southern Power Grid Co., Ltd. On the basis of the demonstration test projects of AC UHV test line from Southeastern Shanxi province via Nanyang to Jingmen, DC UHV test lines in Golden Sand River (phase I) and DC UHV test lines from Yunnan to Guangdong province, the key techniques for electric transmission & transformation have been thoroughly studied and the related main equipments have been developed.

In order to make a thorough research on the various key techniques encountered in UHV projects, to construct the synchronized UHV power grid, to realize the planned program of long-distance and high capacity power transmission through UHV system, the State Grid have done a lot of preliminary works. The AC and DC UHV test bases were completed and put into operation on Feb. 2007 and Nov. 2007, respectively. In addition, the construction of Simulation Center of State Grid is also carried on according to plan. The establishment of all the bases and centers serves as a strong support for the development of UHV project. According to the overall plan of UHV project, the demonstration test project of AC UHV test line from Southeastern Shanxi province via Nanyang to

Jingmen will be completed in 2008 (as shown in Fig.3); ±800kV DC UHV demonstration test project from Xiangjiaba Dam to Shanghai will be put into production with one pole in 2011, and fully completed in 2012.

Fig.3 Under construction of the demonstration test project of AC UHV test line from Southeastern Shanxi province via Nanyang to Jingmen.

AC/DC UHV transmission and transformation engineering is a complex project, which needs full supports from many aspects, for example, project design, equipment manufacture and test, system operation, etc. China is featured by its large country area, which implies complicated operation conditions for power system and more difficulties for the construction of UHV projects. Especially, the specific conditions like high altitude, heavy contamination, ice coating, and high-intensity zones make more demands on materials and structure of the equipments; the increasing concerns on large equipment transportation, land conservation and environment protection require more creativity on the design. Different from Russia and Japan whose UHV transmission project is just limited to lines, the State Grid will establish an UHV framework, in which the reactive power, voltage control, security control of large scale AC/DC power grid and other problems affecting the operation of UHV transmission system should be carefully considered and solved.

The key technique problems encountered in AC 1000kV UHV transmission project include: analysis of UHV AC/DC mixed giant power system, overvoltage analysis and insulation coordination, high altitude and heavy ice coating outdoor insulation, electromagnetic environment, designs and regulations on the main equipments, etc. The main equipments need to be developed in AC 1000kV UHV transmission project include: UHV AC gas insulation switch (GIS), transformer, reactor, arrester, capacitor voltage transformers (CVT), large bushing, etc.

On the other hand, the key technique problems encountered in DC ±800kV UHV transmission project include: the research and simulation of DC ±800kV transmission and its effects on power system, overvoltage analysis and insulation coordination, outdoor insulation (including high altitude) and electric corona, electromagnetic environment,, software for system design, design regulations of the system, test regulations, handover and acceptance standards, common earthing pole, optimal design of controller parameters in main loops, etc. The main equipments need to be developed in DC ±800kV UHV transmission project include: 5 and 6 inch thyristor and valve set, converter transformer, dry type smoothing reactor, protection equipments for control system, outdoor insulation equipments, large brushing, etc.

2 The construction of test bases

2.1 UHV AC Test Base

On Feb.13th, 2007, the 1000kV AC UHV single circuit test lines was charged in Wuhan, Hubei province, which indicated that the AC UHV test base was formally put into operation, as shown in Fig.4.

The AC UHV test base includes UHV test lines, electromagnetic environment lab, UHV climate-control chamber, full scale voltage and large current test lab for equipments used in UHV, etc. In addition, the supports from over 50 domestic electrical equipment manufacture enterprises with their reliable products, like transformers, reactors and arresters, etc, greatly improve the UHV project and realize the localization of main equipments in UHV project.

Nowadays, the test base is featured by the following achievements: adjustable geometric size and optimal design of experimental lines; the comprehensive online monitoring of parameters under the condition such as lightening, contamination, ice coating or vibration, etc; comprehensive training of operation, overhaul, hot-line works in UHV project; the simultaneous measuring of electromagnetic environment in single-tower and double-tower test circuit; all-weather monitoring of electro- magnetic environment; highest level of voltage rating and capacity for power frequency resonant experiment, all of which indicate that the State Grid ranks the leading position in the UHV techniques worldwide.

With the aid of the test bases, a series of researches have been performed, for example, optimal design of UHV transmission and transformation lines, electro-magnetic environment, operation conditions and status monitoring, outdoor insulation and training system, etc.

Fig.4 Outdoor test field of UHV AC Test Base, in Wuhan, Hubei province.

2.2 UHV DC Test Base

The UHV DC test base with an area of 80,000 m^2 was located in Changpingyuan of Zhongguancun Science and Technology Zone in Beijing and established by China Institute of Electric Power Research.

The DC UHV test base includes, outdoor lab for DC UHV surge test, DC UHV test lines, UHV test hall, DC UHV contamination and environment lab, DC UHV electromagnetic environment test lab, DC UHV corona cage and DC UHV equipment test lab, etc. The base is also the research and development base, test base, service base and training base of the State Grid for UHV project.

3 The function of UHV power grid

China will establish a power grid framework with a mixture of ultrahigh AC and DC voltage until 2010, whose main functions are listed below:

i. The UHV main frameworks can be of help to realize the "West-East Electricity Transmission Project" and "Exchange Program of North Coal- Fired Power with South Hydropower" with a larger transmission capacity, longer transmission distance, higher efficiency but lower loss. In addition, it will also optimize the allocation of resources in China;

ii. AC UHV main frameworks are inherited with some benefits, like power grid function and flexible extensibility; are adaptable to the energy flows in the future, and are able to meet the changeable demands in power market, which will in turn definitely improve the development of power market;

iii. UHV main frameworks can deal with the root of problems, like larger opening current due to higher energy density caused by the structure problems existed in 500kV power grid;

According to the power consumption prediction and installation program from 2010~2020 in China, China would form an AC UHV synchronized power grid, which will connect North China, Central China and East China regions. The coal-fired power bases located in west region of Inner Mongolia, Shaanxi province, southeast region of Shanxi province, west region of Inner Mongoli, and Ningxia province are transmitted to North/ South region through some main passages by UHV. On the other hand, part of the hydropower in Sichuan province will also be transmitted to east and central China through some east-oriented passages. In addition, certain support power supplies will be established in receive-side of east region, which is mainly designed to connect the nuclear power into UHV power system. In view of huge energy need, dissatisfactory coal transportation, limited environment capacity and rapid power grid development, it is most promising to develop the UHV technology in China.

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

Korea Corner

Global Leader KERI in Testing and Certification - About KERI

Mr. Sung-Kyun Park
Executive Director
KERI

Korea Electrotechnology Research Institute (KERI) has established in 1976 for the purpose of creating, developing and disseminating new knowledge and technology in the fields of the electric industry and electric power business, and thus advancing the national economy and welfare. And KERI's Testing & Certification Services has begun its role as an independent third-party organization in 1982.

Uiwang branch of Testing & Certification Services was renamed as Power Apparatus Testing & Evaluation Division in 2005. Power Apparatus Testing & Evaluation Division was moved to Ansan city in 2007 except for the High Power Testing Department from Uiwang city.

In 2007, the numbers of testing services were 20,000 and testing revenues were approximately 400 million dollars. The numbers of testing services are 18,000 as of October, 2008.

Power Apparatus Testing & Evaluation Division in Ansan branch is newly built and equipped with state-of-the-art testing facilities. Test site is divided into two buildings.

Test building at a height of 5 meters consists of Safety and Operational performance test room for low voltage electrical equipment, Protective relay test room, Material properties test room, Chemical analysis test room, Calibration room and others.

Test building at a height of 15 meters consists of HV(High Voltage) test cell, Power-frequency short-circuit test cell, PD(Partial Discharge) test cell, EMC test cell including anechoic chamber and others. Especially, Power Electronic test laboratory are newly established in order to support IT technology of the electric industry effectively.

Test building

Test building

The automatic temperature & humidity control system is installed in all test rooms including tempera-

Safety performance test room

Chemical analysis test room

EMC anechoic chamber

Impulse generator

ture-rise test room and control rooms of test cells to meet testing requirements. These testing environmental conditions comply with all ISO/IEC guidelines as an accredited international testing laboratory.

Accredited status

KERI was designated as a certified testing laboratory in 1994 for 840 test items by KOLAS (KOrea Laboratory Accreditation Scheme), a current member of ILAC(International Laboratory Accreditation Corporation). Test reports and certificates issued by KERI are accepted in 35 countries that have signed multilateral agreements with ILAC.

Also KERI is certified as a product certification body in 2005 by KAS(Korea Accreditation System), a member of International Accreditation Forum, IAF.

KERI is now recognized as the new global leader in the field of testing and certification being internationally accepted as a CBTL(Certification Body Testing Laboratory) in 2004 and a NCB(National Certification Body) in 2008 for 25 IEC standards of 4 product categories(POW, PROT, CONT, EMC) by IECEE CB-Scheme.

Testing & Certification Services is carried out by several departments and their work are briefly introduced as follows.

◎ Quality Certification Department
- Inspection services for development and acceptance tests for electrical apparatus
- Factory inspection for KS and high efficient electrical apparatus
- Management of quality system for internationally accredited body
- Activities related to standardization for national and international standards

◎ Electric Apparatus Testing Department
- Type tests and acceptance tests for electrical equipment and power apparatus
- EMC tests for electrical equipment and power apparatus
- Tests and evaluation for IT equipment and protocol in IT equipment
- Materials and chemical analysis tests for electric apparatus

◎ Safety Performance Testing Department
- Tests for KS certification and Safety certification of low voltage electrical equipment
- IECEE CBTL activities for low voltage protective equipment
- Calibration services for measuring equipment
- Low voltage and high power testing using short-circuit transformers

◎ High Power Testing Department Ⅱ
- Direct short-circuit tests on LV and MV electrical equipment
- Short-time withstand current and peak withstand current tests
- Capacitive and inductive current switching tests
- Short-circuit withstand tests on power transformers

Epilogue

KERI has provided its customers worldwide with the testing, certification, inspection, and calibration for electrical apparatus ranging from low voltage to high voltage. KERI is also an internationally certified testing and certification body with well recognized technical capabilities, strict testing and certification procedures and fully experienced experts.

In order to comply with the latest standards such as IEC, IEEE, ANSI, JIS, UL, KS and the various technical requirements from out customers in the world, KERI has been continuously expanding its infrastructure through the enhancement project of its testing facility on a regular and occasional basis.

KERI is now a world-class testing and certification institute whose growth goes beyond Korea and Asia. KERI will carry out its responsibility and role as a globally reputable testing laboratory and certification body on the basis of an outstanding infrastructure, technical professionalism, and transparent and systematic operations.

KERI www.keri.re.kr/test/

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TECHNOLOGIES FOR TOMORROW

NGK High Voltage Laboratory

1. Introduction

NGK High Voltage Laboratory is equipped with world class testing facilities such as AC 1,650kV high voltage test facilities, 4,200kV lightning impulse generator and AC 1,000kV/DC 750kV insulator contamination test facilities. Electrical and mechanical tests in actual scale have been carried out in this laboratory. These activities include research and developments for AC 1,000kV/DC 800kV class insulator string assembly and 1,000kV class gas bushings. The insulator design suitable for contaminated environments has also been studied in this laboratory. We are proud of our contribution to power industry in the world by supplying these high-quality insulators yielded through our research and developments activities.

These achievements are widely presented at the international conferences such as IEEE and CIGRE, and are partly published as “NGK Review”.

2. Main Test Facilities

2.1 High Voltage Tests for AC and DC

High voltage tests of insulator assemblies up to the 1,000kV class can be carried out. Withstand and flashover voltage performance of the various insulator assemblies can be evaluated under dry and wet conditions. Also, visible corona and RIV tests are possible to conduct.

- UHV AC Test Hall
  Dimension of hall: 40m x 40m x 30m h.
  Double-shielding system by expanded iron netting (Electromagnetic shielding effect: 75dB).
- AC 1,650kV Voltage Source
  Transformer: 550kV, 500kVA, 3 units in cascade connection, corona free up to 1,000kV.
- DC 500kV High Voltage Source
  Type: Delon-Greinacher circuit by using silicone rectifiers.
  Rated voltage: 500kV, Rated current: 30mA.
- Corona Noise Measurement Equipment
  Coupling capacitors: 2,000pF(500kV), 1,000pF (1,000kV).
  Radio noise meters: NEMA type meter. CISPR type meter.

2.2 Contamination Tests

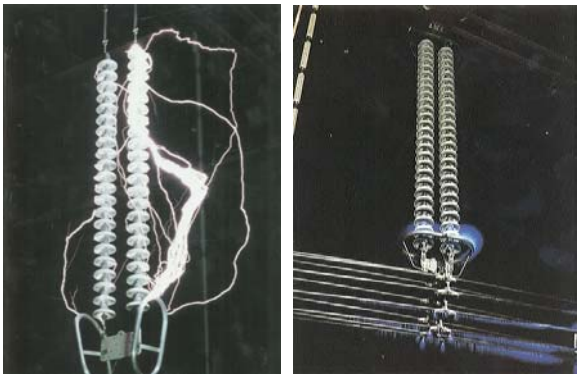
Contamination withstand and flashover voltage tests of the insulator assemblies can be carried out. After specimen insulators are artificially contaminated, a constant test voltage applied. Then, the contaminated insulators are moistened by artificial fog in order to simulate normal environmental conditions.

- UHV Contamination Test Hall
  Dimension of hall: 30m x 25m x 30m h.
  Electromagnetic shielding effect: 65dB.
  Fog generating equipment(steam fog): 3.6 ton/h.
- AC 1000kV Voltage Source
  Testing transformer: 1,000kV, 5,000kVA/1 min., 4,000kVA/continuous.
  Voltage drop of the total system: Less than 5% at 3A, 600 - 1,000kV.
- DC 750kV Voltage Source
  Type: Cascaded three phase full-wave rectification with feed-back system.
  Rated voltage: 750kV.
  Voltage drop of the total system: Less than 5% at 2.2A, 200 - 750kV.

2.3 Impulse Voltage Tests

Lightning and switching impulse voltage tests can be carried out on an actual scale, for the transmission and substation insulator equipment, the transmission line arrester and others.

AC withstand voltage test on 1,100kV gas bushing



(a) **(b)**

(a): Flashover test of 500kV insulator assembly
(b): Corona test under wet conditions of 1,000kV insulator assembly

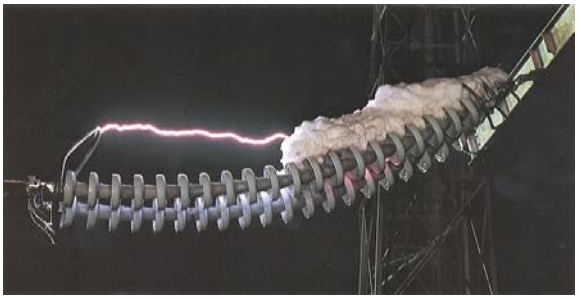
- 4,200kV Lightning Impulse Voltage Generator
  Type: Marx Circuit. Max. Storage energy: 315kJ.
  Main capacitor: 0.0375μF(1.5μF/42).
  Max. charging voltage: 4,200kV.
  Max. voltage available: 3,300kV.
- 2,500kV Switching Impulse Voltage Test Facilities
  Type: Marx circuit.
  Generator: The above 4,200kV generator.
  Max. voltage available: 2,500kV.
  Wave form controlling capacitor:
  0.0132μF(0.5μF/38).
  Wave form: (50 - 500) x (2,500 - 3,000)μs.

3. Mechanical Tests

Mechanical performance tests on various kinds of insulator equipment and artificial galloping test, etc. can be carried out.

DC contamination test of DC500kV insulator assembly

Impulse voltage test facilities



Switching impulse flashover voltage test of 500kV insulator assembly with snow accumulation

4. Accredited Laboratory

NGK High Voltage Laboratory was accredited conforming to ISO/IEC 17025 in February 1999 for the first accredited high voltage laboratory by JAB(Japan Accreditation Board) which covers AC, DC and Impulse high voltage tests. High voltage tests are carried out on insulator assemblies and power equipment for transmission and distribution lines and substations. The report and certificates are issued with accreditation symbol of internationally recognized.

Artificial galloping test of tension insulator assembly

CERTIFICATE OF ACCREDITATION

COPY

Certificate No. RTL00590

JAB

ilac-MRA

The Japan Accreditation Board for Conformity Assessment (JAB) hereby declares that the testing laboratory

NGK INSULATORS, LTD.
NGK High Voltage Laboratory

Representative : Yoshihiro Suzuki

2-56, Suda-cho, Mizuho-ku, Nagoya-shi, Aichi, Japan
1155, Tagami, Futaebori, Komaki-shi, Aichi, 485-8566 Japan (Laboratory)

complies with the requirements of JIS Q 17025:2005 (ISO/IEC 17025:2005). On the ground of this, JAB grants accreditation to the said laboratory.

The accredited scope : **Electrical testing**
(As described in the appendix.)
Effective for the period : From February 16, 2006 till February 15, 2010

Revised (8)	March 22, 2007
Renewed (2)	February 16, 2006
Original Certificate	February 16, 1999

E. Masada, Chair
Laboratory Accreditation Committee

T. Kanai, President
The Japan Accreditation Board for Conformity Assessment

Certificate of accreditation

By **Osamu Fujii**

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TECHNOLOGIES ALERT

Commercial Application of Y-Branch Prefabricated Transition Joint for 275kV Cable System

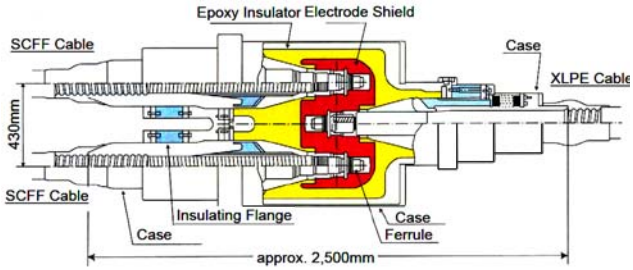
Tokyo Electric Power Co., Ltd and J-Power Systems Corp. have developed Y-branch prefabricated transition Joint (hereafter called as YJB) for 275kV Cable System in order to utilized existing underground power cable line effectively. This YJB can be applied to both XLPE cable and SCFF cable.

By using the YJB, new 275kV cable system has been put into commercial use since 2007. In this project, nine sets of YJB for three circuits were installed. XLPE 2500mm^2 cable was installed to the single-mouth side and two SCFF cables were installed to the double-mouth side.

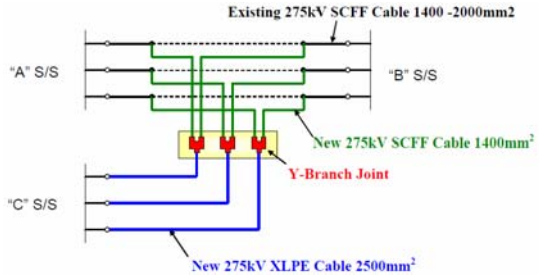
In the future, the increase of YJB applications for a replacement of aged existing equipment and other usage is expected.

Tokyo Electric Power Company
1-1-3 Uchisaiwai-cho, Chiyoda-ku, Tokyo, JAPAN
http://www.tepco.co.jp/en/

J-Power Systems Corporation
URL:http://www.jpowers.co.jp/



Installed 275kV YJB



Scheme of YJB applicable project

Development toward practical use of HTS cables for the earth in future

Superconductivity is an advanced technology for energy-saving and compact in electrical devices due to its properties of zero resistance and high current density. A high-Tc superconducting (HTS) wire is a electric wire that has superconductivity in liquid nitrogen temperature (-197℃). Particularly, we expect that coated conductors as typified by a YBCO wire will be applied for electrical power devices, because these will be achieved lowest cost and lowest loss in HTS wires in near future. The Furukawa electric have been developing the HTS cables that is one of the most promising applications and we have obtained brilliant successes such as the lowest AC loss cable, cable intermediate joint and so on.

However, it is difficult to put the HTS cables into a real power network because an infrastructure in an electrical utility needs very high reliability. Therefore, it is necessary to go clear problems of long term reliability and accident one by one. For example, we have successfully carried out a short circuit current test of 31.5kA 2second using a ten meter long HTS cable that was made from YBCO wires.

We develop HTS cables toward practical use in 2020 as important technology for the 'cool earth'.

Fig. YBCO HTS cable cut model and photograph of the short circuit current test. The test cable was constructed of a 10m YBCO HTS cable and a cable intermediate joint.

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Development of new cable accident point measuring instrument

The underground power cable is a high reliability supplying system, because equipment disaster cause by the thunder and wind are little. However, when the accident due to the cable damage occurs, the discovery of the accident part is difficult and the restoration time is long. Therefore, the method of measuring the accident point of the bridge method etc. is used. However, in recent years, it increased to construct a lot of lines in the same route. There are cases where the inducement voltage from the adjoining cable reaches up to 200V, and the measurement become difficult. Therefore, to solve this problem , the new underground power cable accident point measuring instrument that had a high measurement performance (The inducement voltage up to 300V is endured, Measurement accuracy ±0.5% or less) was developed.

The feature of this measuring instrument is a thing equipped with a multistep active filter to make the influence of the inducement voltage a minimum. As a result, it is expected that an early grasp of the accident part can be done.

Fig. New cable accident point measuring instrument

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http://www.kepco.co.jp/english/rd/index.htm

Araldite® HCEP & S-HCEP systems

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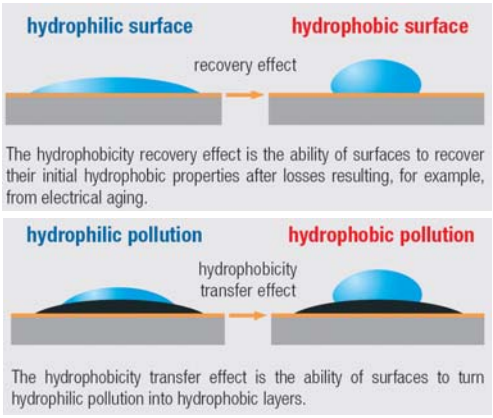
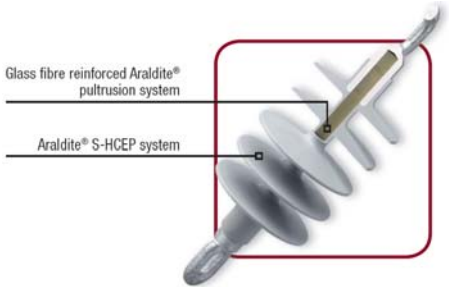
- Intrinsic hydrophobicity
- Hydrophobicity transfer effect
- Hydrophobicity recovery effect
- Long-term stability of hydrophobicity



(2) S-HCEP, Cost-efficiency in composite insulators

S-HCEP systems are new hydrophobic epoxy based semi-flexible shed materials for medium to high voltage outdoor insulation applications such as sheds of composite insulators and surge arrestors. They deliver intrinsic hydrophobicity, hydrophobicity transfer and recovery effects similar to the well-known HCEP systems and also provide excellent tracking and erosion resistance and good water diffusion break down strength. Insulators made from S-HCEP systems have passed the 1000 hours salt fog test according to IEC 61109 (FGH Mannheim, Germany).

- Mixing ratio of 1:1 by volume which makes it suitable for the same meter mix equipment as used for LSR
- No vacuum preparation, no pre-mixing and no heating necessary
- Lower material cost than that of silicone (LSR)
- Better adhesion of sheds to the composite rod
  = No primer treatment needed to composite rod
- Lower viscosities = lower filling times
- Moderate reactivity = no mold cooling
- No post-cure necessary



Reference : AdMat_Araldite HCEP/S-HCEP_03/08_en

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http://www.huntsman.com/power

The World Most Outstanding and Advanced Technology Adopted In CHINA UHV FIELD

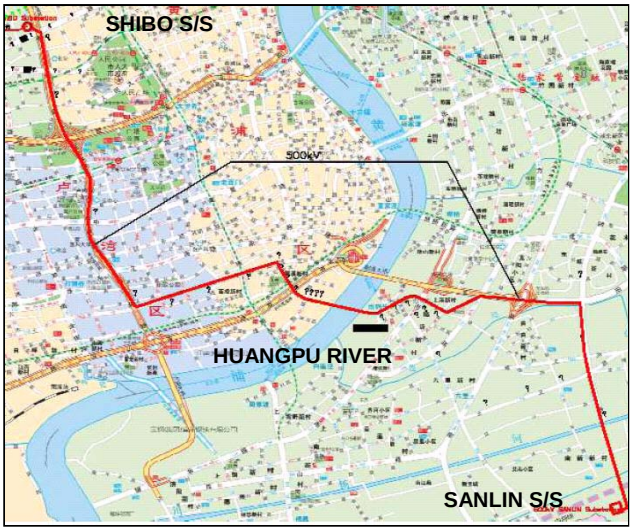
(1) SHANGHAI EXPOPOSITION 500kV XLPE CABLE TRANSMISSION LINE

As the completion of XLPE cable technology, the world first and longest 500kV XLPE cable transmission line (TEPCO Sin-Toyosu line in Japan) has been realized in 2000.

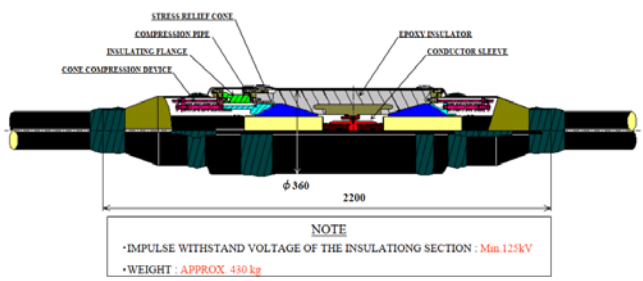
This technology and world first 500kV prefabricated joints (which was also developed in Japan) are now applied to supply major power for the site of SHANGHAI EXPOSITION 2010 and will be energized in late 2009.

We, VISCAS Corporation Japan is honored to supply & erect about 52km of 500kV XLPE/ Al.Corrugated/FRPVC Cable 2500mm^2 and 78 sets of Prefabricated joint which is the world **first** experience to be installed in the Shanghai Huangpu River crossing Tunnel constructed by Shanghai Municipal Power Co.

The Cable system was long-term (IEC62067, prequalification) tested at Wuhan Testing Institute with satisfactory results and also type tested at our own laboratory.



500kV SHIBO CIRCUIT ROUTE LAYOUT

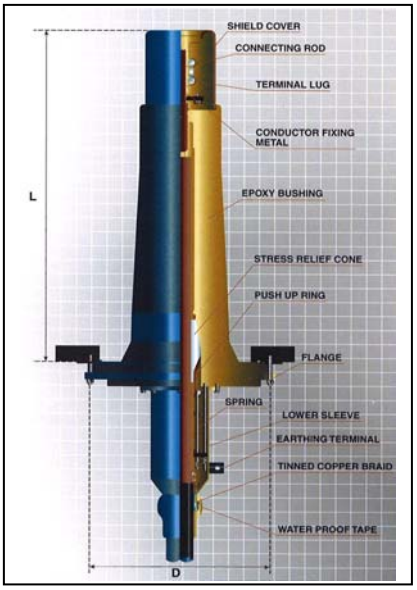


500kV PREFABRICATED JOINT

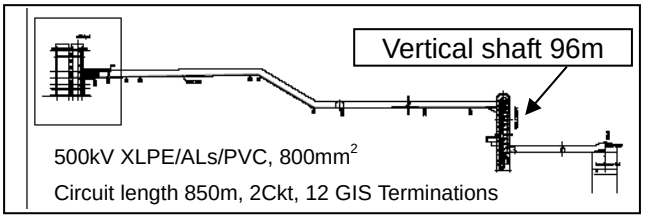
(2) THE WORLD FIRST 500kV DRY TYPE GIS TERMINATION ENERGIZED IN CHINA

After years of continuous effort, research & development, the world **first** perfectly DRY type GIS termination were completed and energized on July 2008 at XILONGCHI Pumped Storage Power Station, SHANXI, CHINA. On successful completion of the above projects, a few new projects with same DRY type of GIS termination are now under construction. The main characteristics of the termination are as follows;

- ✓ Perfectly DRY, does not require Oil or GAS
- ✓ Positioning of DRY GIS termination in reverse, horizontal or tilt
- ✓ Environmental Friendly (no leaking of Gas or oil) & Maintenance Free



World first 500kV DRY-type GIS Termination



XILONGCHI 500kV Pumped Storage S/S Layout

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Improving Epoxy-based Insulating Materials with Nano-fillers toward Practical Application

(1) Motivation for Development of Environmental-conscious Heavy Electric Apparatus

Nanocomposites offer exciting new possibilities for dielectric and insulating materials, and practical application has been a primary concern in recent research. We have focused on nanocomposite insulating materials as a way to realize environment-conscious switchgears without sulfur hexafluroride (SF_6) insulating gas, which was designated as a greenhouse gas in the Kyoto protocol on global warming. SF_6 gas emissions into the atmosphere are strictly controlled at present, although reduction of its gas use is an important issue. Solid insulation systems using nanocomposite materials are an effective approach to reducing the use of SF_6 gas (Figure 1).

(2) Nano- and Micro-filler Combination Enabling Practical Use of Nanocomposites

Our R&D demonstrates that nano-filler dispersion is effective in improving insulation properties of epoxy-based insulating materials. Moreover, nano- and micro-filler combination is adopted as an approach toward practical application of nanocomposite insulating materials (Figure 2). The nano- and micro-filler mixed composite (NMMC) has the same low thermal expansion as metal conductor (aluminum), and insulation breakdown properties superior to those of conventional insulating materials. Consequently, an aluminum conductor and a vacuum interrupter were molded by the nano- and micro-filler mixed composites for the first time in nanocomposite research (Figure 3). Our next work will be to evaluate the NMMC in full-scale trial models.

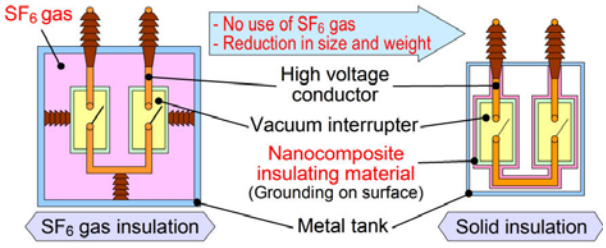

Figure 1. Environment-conscious switchgears by solid insulation system

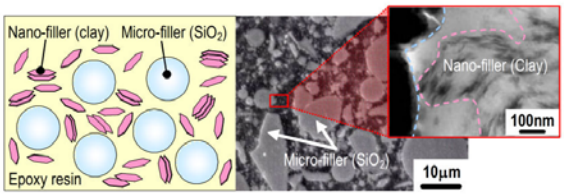

Figure 2. Nano- and micro-filler mixed composite (NMMC)

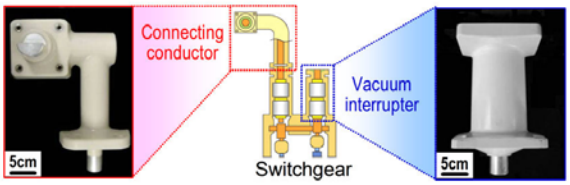

Figure 3. Full-scale trial models molded from NMMC

Toshiba Corporation, Kansai University (Prof. Ochi) and Waseda University (Prof. Ohki and Prof. Tanaka) conduct this collaborated R&D project supported by New Energy and Industrial Technology Development Organization (NEDO).

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MISCELLANEOUS

Photos on Front and Rear Covers

Front Cover

Laboratory of Advanced Technology Of Electrical Engineering and Energy, Graduate School at Shenzhen, Tsinghua University

Advanced Technology of Electrical Engineering & Energy laboratory is part of the Shenzhen Branch of National Key Laboratory for Power System, and it is also supported by high voltage outdoor insulation Laboratory, Electrical Engineering department, Tsinghua University. The Laboratory is located in the Building L, Graduate School at Shenzhen, Tsinghua University. With an area of 320 square meters of laboratory, 150 square meters of offices and a total investment in equipment of 6 million RMB, Laboratory of Advanced Technology of Electrical Engineering & Energy ranks to the top level among universities worldwide, ensuring an academic and educational prestige in China.

Owning all kinds of advanced instruments, facilities, test-bed and power resource, the LAB devotes much research to basic theory and key technology of high voltage. Focusing on the international frontier technology and its application as well as the key problems in national economy, the LAB has taken a few projects from National Natural Science Foundation and projects at provincial or ministerial level. The LAB actively carries out the research on the formation mechanism and industrial application of atmospheric pressure glow discharge, and meanwhile applies for its key projects from National Natural Science Foundation.

The researches of the lab focus mainly on traditional high voltage insulation technology such as the compact transmission line, mechanism of gas discharge and electric power insulation problems at high altitude area, the high voltage discharge along the contaminated surfaces, high voltage experimental test, dielectric property of the high voltage materials and Ultra high voltage and etc. Other researches includes the advanced technology of high voltage engineering for example water and exhaust gas treatment by the pulsed discharge plasma, nonthermal processing of liquid food by Pulsed Electric Field and etc.

There are 5 professors in the lab, including 2 academicians of the China national academy of engineering, 2 post doctor, 19 doctor candidate students and 23 master students.

The lab aims to become the south center and base of high voltage research, academic communion, and novel technology application. With the support of Shenzhen government and Tsinghua University, it will continue its contribution to electrical power development in China.

The photos of the front cover show:

The top photo: The Stable Post- Buckling Behavior of the Composite Insulator

The lower left photo: Composite insulator developed for high altitude areas

The lower right photo: High voltage novel technology which includes 1)water treatment by discharge plasma, 2) Liquid food processing by Pulsed Electric Field, 3)Automobile exhaust treatment by Plasma facilitated Catalysts

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http://www.sz.tsinghua.edu.cn/en/

Rear Cover

Partial Discharge Images of Magnet Wires under Inverter Surge Voltage

Inverter surge voltage is characterized by the rise time as short as nanosecond order and the repetition rate as high as kHz order. The inverter surge voltage may cause partial discharge (PD) and insulation degradation of magnet wires for inverter-fed motors used in environment-friendly vehicles and so on. Thus, PD characteristics and their measurement techniques have been discussed in IEEJ technical committee in conjunction with IEC and CIGRE activities.

The figure shows PD light emission images of a twisted pair composed of enamel wires for different magnitudes Va of inverter surge voltage (rise time: 120 ns, pulse width: 10 μs, single shot). PD is generated in the wedge-shaped air gap of the twisted pair at the lower voltage levels and propagates along the surface of the enamel wire. At the higher voltage levels, PD extends to the lower electric field region on the backside of the enamel wire, where the outline of the twisted pair can be identified. These figures enable us to understand that insulation degradation of enamel wires can progress even in the lower electric field region, leading to fatal breakdown.

Prof. Naoki Hayakawa and
Prof. Hitoshi Okubo
(Nagoya University, Nagoya, Japan)

Transactions of IEEJ

Six kinds of transactions are published. Five kinds of transactions are edited by five societies* in IEEJ. The other one (IEEJ Transactions on Electrical and Electronic Engineering) is bimonthly published in English, which are edited by editorial committees in IEEJ and five societies in turn.

(*) Five societies in IEEJ are as follows: (please visit **http://www.iee.or.jp/index-eng.html**)

A: Fundamentals and Materials Society (This magazine is published from EINA Committee under this society.)
B: Power and Energy Society
C: Electronics, Information and Systems Society
D: Industry Applications Society
E: Sensors and Micromachines Society

IEEJ Transactions on Fundamentals and Materials

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Vol. 127-A No. 9 (Sept. 2007)	Special Issue on Asian Conference on Electrical Discharge (ACED)
Vol. 127-A No. 11 (Nov. 2007)	Special Issue on Industrial Applications of Pulsed Power and Plasma Technologies
Vol. 128-A No. 1 (Jan. 2008)	Special Issue on Technology 2008 : Reviews & Forecasts
Vol. 128-A No. 3 (Mar. 2008)	Special Issue on History of Power Transmission Technology in Japan
Vol. 128-A No. 5 (May 2008)	Special Issue on Electrode Materials and their Technologies for the Fuel Cells
Vol. 128-A No. 8 (Aug. 2008)	Special Issue on Recent Progress in Power Magnetics and Related
Vol. 128-A No. 10 (Oct. 2008)	2007 Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering

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1101	"Properties and Novel Functions of Organic and Composite Films by Nano- structure Control for Device Applications"	(A),	2007/10/25	¥3,780
1102	"A report on the risk management and compatibility for lightning in information, communication and power system"	(A),	2007/10/25	¥4,095
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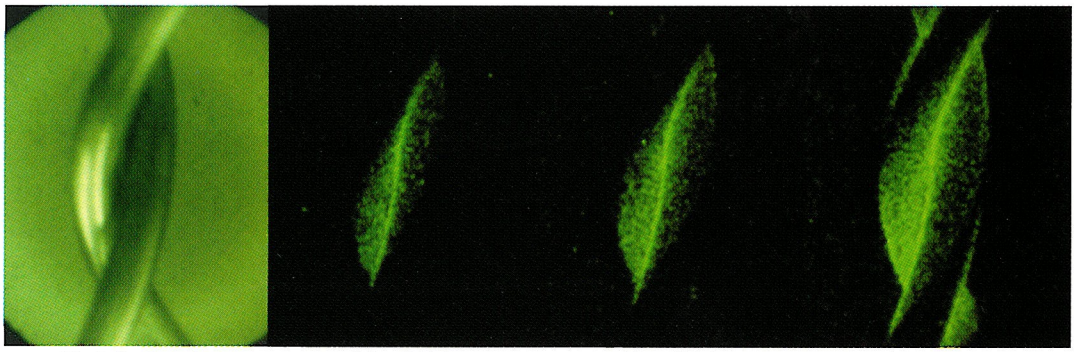

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