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# OUTLINE OF TECHNICAL COMMITTEES IN IEEJ

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## 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) T. Takahashi (CRIEPI)

The committee was set up in 1979 succeeding the Permanent Committee on Electrical Insulating Materials upon the reorganization of IEEJ. The activities of the committee have been covering mainly solid and composite dielectric materials and relating technologies. The name of the committee changed in 1994 from "TC on Electrical Insulating Materials" to "TC on Dielectrics and Electrical Insulation" aiming to expand the field of activity to electronic and dielectric functional systems.

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 Insu-

lating Materials (ISEIM), which is considered as an international version of the SEEMAS. This symposium is normally held every three years. The last ISEIM was held in Kitakyusyu-city with Honorary Chair of Prof. T. Tanaka and General Chair of Dr. T. Okamoto.

The committee is now headed by N. Hozumi of Aichi Institute of Technology, who took over T. Okamoto of CRIEPI. The TC-DEI currently runs nine Investigation Committees (ICs) that organize several technical meetings a year. This year three new ICs have started. T. Tanaka chairs a committee on nano-composite, Y. Tanaka chairs that on irradiated polymeric materials, and H. Homma chairs that on outdoor polymer insulation. The ICs are categorized into four research areas as followings:

### *Macro-view of DEI technology related*

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

### *New materials including nano-materials related*

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

### *Diagnosis of electric and electronic equipment related*

- > Being planned.

### *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))
- > Surface function and long-term performance of outdoor polymer insulation materials (01/06-09/07, 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:	H.Yasui	(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 four 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 ten domestic technical meetings on electrical discharges every year. In these meetings, more than 200 full papers are presented in total from both academic and industrial sides by researchers, engineers, professors and students. Some of these meetings take place jointly with the TC on Dielectrics and Electrical Insulation, the TC on High Voltage Engineering and the TC on Switchgear and Protection, the TC

on Pulses Power Technology. Besides regular presentations of full papers, poster sessions are placed in these meetings to encourage the young researchers working in the field of electrical discharges. The poster session of this year was successfully held last June in the joint technical meeting of the TC-ED and the TC on Pulses Power Technology.

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 next J-K symposium will be held on the November of 2007 in Tokyo. The special issue of this symposium is also scheduled. The selected papers from all the symposium presentations will be published in the IEEJ Transactions on Fundamentals and Materials in 2008.

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

Table Investigation Committees in TE-ED

Chairperson	Research subjects and established time
H. Yamashita (Keio University)	Extreme technologies for the measurements of electrical discharges in liquids (established in April 2004)
O. Yamamoto (Kyoto University)	Control of electrical discharges in vacuum and high technologies of their measurements and simulations (established in April 2004)
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)

## Plasma Science and Technology (PST)

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

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

The major activity of this committee is to succeed to organize several Technical meeting on plasma science and technology every year. For example since January 2006, four technical meeting were held; in January at Ibaraki University, in May at Musashi Institute of Technology in Tokyo, in August at Kauai Island Hawaii, in November at Ehime University in Ehime. At each symposium, about 20 to 30 presentations are made. Presentations by young researchers in bachelor course and master course are strongly encouraged and appreciated.

Every two years, TC-PST sponsored international symposium APSPT (Asia pacific symposium on plasma technology) had been held in Taiwan in collaboration with domestic societies related to plasma science and technology since 1999. Recently, APSPT-4 was held in Yunlin Taiwan in December, 2005. Aiming at more flexible management, APSPT-4 became sponsorship by the international organization committee from this time. While many members of TC-PST participate in the international organization committee, TC-PST is continuing playing a role important as a support organization.

TC-PST currently runs two investigation committees, and a few new will be set up in future. The investigating committees dispersed recently, Plasma ion intensive use process investigation committee and Microwave plasma investigation committee, had published their investigation as hard cover books, and it was useful for these books to systematize the newest technology trends of these field.

Table. Investigation Committee in TC-PST

- Spherical tokamak  
(3 years from August 2004, Chairperson: Y. Nagayama (National Institute of Fusion Science))
- The advancement of metal sputtering plasma  
(3 years from January 2006, Chairperson: K. Nakamura (Chubu University))

## Pulsed Electromagnetic Energy (PEE)

Chair Person:	Kazuhiko Horioka	(Tokyo Institute of Technology)
Vice Chair Person:	Weihua Jiang	(Nagaoka University of Technology)
Secretary:	Koichi Takagi	(Iwate University)
Assistant Secretary:	Hiroyuki Shinkai	(CRIEPI)

Efforts to enhance the activities in pulse power technology and high energy density physics have been continued in the Technical Committee on Pulsed Electromagnetic Energy (TC-PEE). Researches on pulsed electromagnetic energy have

evolved into a well-developed subject in the field of electric power engineering, plasma and discharge engineering, high energy density physics, accelerator engineering and others. By the modification of pulsed electromagnetic energy, we can

make an extremely high energy density (high temperature and/or high density) state that can be utilized for generations of high power lasers, intense radiation sources, high current particle beams, thermo-nuclear fusion and also for formation of new materials. Among others, pulse-power-driven discharge plasmas are expected to be a next generation light source for semiconductor lithography.

As the field of high energy density plasma has a multi-disciplinary nature, extensive discussions of related subjects were difficult in conventional societies. The purpose of this committee is to provide a forum to discuss important technical developments, their applications, increased understandings, new trends, and also future prospects in the field of pulse power technology and the high energy density states. In particular, keeping this field attractive for young scientists and motivating them have been of primary concern for all of committee members.

Regularly, Technical Committee Meetings are held four times a year. To provide international forum and promote international collaborations, the meeting is held once a year, as an international symposium with collaboration among the researchers in Japan, Korea, and China, which is named "International Symposium on Pulsed Power and Plasma Applications (ISPP)". The 6<sup>th</sup>

ISPP-2006 named 1<sup>st</sup> EAPPC will be held in China (Chengdu, China) on Oct.18-22 (2006) as a joint conference of ISPP and 3<sup>rd</sup> EPPS (European Pulse Power Symposium). In addition to this conference, the 3<sup>rd</sup> Japan-US Symposium on Pulse Power and Plasma Applications will be held at Makaiwa, Hawaii, Aug.6-9, (2006). The objective of these conferences is to provide a forum for discussion of the subjects in the field of pulsed electromagnetic energy, mainly in the related countries. However, those research meetings including regular technical meeting, are open for persons whoever interested in the field of pulsed electromagnetic energy.

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

## **Electromagnetic Compatibility (EMC)**

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

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

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

For this purpose the committee pays their attention on

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

1. Investigation Committee on Lightning Risk and Management for Electrical Power System and Communication System
2. Investigation Committee on Evaluation Technologies for Induced Electric Field and Current in a Human Body Caused by Non-uniform and transitional Electromagnetic Fields.
3. Investigation Committee on Earthquake Predic-

tion by Electromagnetic Filed Measurement.

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

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

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

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

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

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

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

#### Communication System

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

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

#### 2. Investigation Committee on 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. 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 performs trend study with focusing on 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;
- (5) Preparation of a committee report on the above items.

The committee is just established for taking over from the previous Investigation Committee on Electric Field and Current Induced in a Human Body Exposed to Electromagnetic Fields.

### 3. Investigation Committee on Earthquake Prediction by Electromagnetic Field Measurement

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

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

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

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

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

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

## Light Application and Visual Science (LAV)

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

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

Miniaturization of semiconductor integrated circuits has been progressed under the law of Moore in these 40 years, and the minimum feature size has been reduced from several microns to several tens nanometers. Such miraculous progress

has not been found in any other technology fields. Half pitches of 65 nm and 45 nm are expected in 2007 and 2010 respectively in International Technology Roadmap for Semiconductors (ITRS). Gate resist pattern widths are narrower, and the targets are 42 nm and 30 nm in 2007 and 2010 respectively. New lithography tools for realizing these small feature sizes are ArF immersion scan exposure systems. Resist films coated on wafers are exposed to ArF excimer laser light with a wavelength of 193 nm in pure water.

Figure 1 shows the values of the numerical aperture of the exposure systems. Systems have been

developed very vigorously, and systems available for device production were announced only for 2-3 years on end. Refraction index of pure water is 1.44 for the 193 nm light, and the resolution is improved corresponding to the index value. Minimum pattern size obtained by projection exposure is often expressed by

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

Here,  $R$  is the minimum pattern width,  $\lambda$  is the wavelength and  $NA$  is the numerical aperture of the projection optics. Patterning easiness can be roughly judged by the  $k_1$  value. Calculated  $k_1$  values for 45-nm patterns are shown in the right column of Fig. 1. It is known that  $k_1=0.3$  for  $NA=1.3$ .

It should be noticed that the value of  $k_1=0.3$  is not so large to print patterns using only conventional lithography techniques. It is presupposed that phase shifting masks and/or oblique illumination systems selectively effective for one directional or orthogonal patterns are accepted. New methods for dividing patterns into 2 groups alternatively or into vertical and horizontal patterns are also discussed.

Since there are no alternative technologies for production are prepared, immersion lithography is going to be applied for fabricating advanced devices with some ideas in patterning processes. (Investigation Committee (TC): Advanced Technology for Lithography)

- 1) K. Nakano and S. Owa: Abstracts, NGL2006, p.8-11, 2006.
- 2) K. Morisaki: Abstracts, NGL2006, p.12-14, 2006.
- 3) <http://journal.mycom.co.jp/news/2006/07/12/300.html>
- 4) K. Kasama: The Papers of Technical Meeting, LAV-06-1~7, IEE Japan, p.1-6, 2006.
- 5) <http://journal.mycom.co.jp/news/2006/06/13/101.html>.

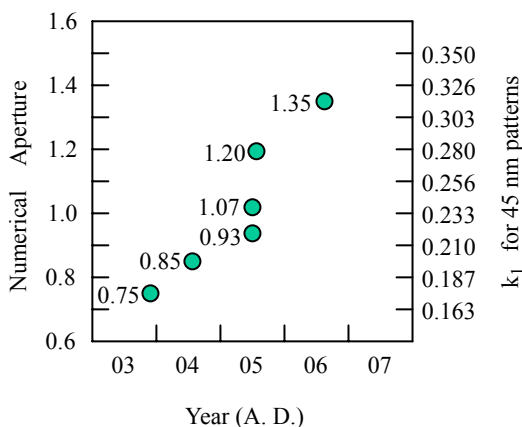


Figure 1 Development of numerical aperture and  $k_1$ .

In the field of discharge light sources, research on Mercury-free light sources has been most important topics as well as development of high efficacy light sources for these 10 years. In Japan fluorescent lamps has been main target of mercury-free movement because fluorescent lamps are most popular lamps for lighting in Japan. Jinno's group at Ehime University has been carrying on the research on mercury-free xenon fluorescent lamps using an auxiliary external electrode, and reported they achieved 100 lm/W of efficacy and 10000 cd/m<sup>2</sup>. This technology is leading the world and is attracting many light source researchers' interests. In the field on PDP Whang's group at Seoul National University reported that they reached 120 lm/W in xenon discharge. Whang's light source's luminous flux is not enough at all, but this result also show the possibility to obtain efficient mercury-free light sources in xenon discharge.

A positive column in xenon discharge is well know to be easily contracted and to form filamentary discharge. Akasi's group recover this phenomena in a 2D numerical model of DBD xenon pulsed discharge.

Another trend of mercury-free light sources is solid state device, that is, LED. In the laboratory chip efficacy of LED has achieved about 80lm/W and as a products in market LED achieved over 25 lm/W. This makes LED possible to be a substitute of incandescent lamps. Recently light sources manufacturer and researchers are strongly interested in LED, especially in Europe and USA. Though LED is the one of the hot topics in the field of light sources, light sources researchers also think that at the moment because of their low efficacy, small luminous flux it is difficult for LED to replace fluorescent lamps. LED manufacturer announced within a few years LED's efficacy will reach over 150 lm/W. At that time LED could be a substitute for mercury fluorescent lamp.

The COST21 program in Europe has been making a effort to establish a standard for metal halide for benchmark. Now the test lamps are available and are delivered to research group in the world. Now many reports about measurements, modeling and observation of this standard lamp are expected.(TC: Diagnostics and Modeling of New Light Sources)

The third topics is non-invasive monitoring of blood glucose by optical method. According to the diabetes survey in 2002 of our country, it is presumed that the total number of persons having diabetes and the possibility of diabetes are 16,200,000 in Japan.

The commonly used potable blood glucose

sensor utilizes the character of the enzyme electrodes. The resistivity of the enzyme electrodes changes in proportion as glucose concentration, when the glucose in blood reacts the oxygen of enzyme electrodes. The method is unsuitable to a child, a newborn infant and a diabetic who needs measurement of blood glucose level several times in a day.

The device using interstitial fluid of the skin without collection of blood has been released in U.S.A. But there are some problems on the application of human body; (a) it cannot response to rapid change of glucose level and (b) it causes inflammation as it attaches firmly to the skin.

Therefore, the optical blood glucose sensor has been expected because it is non-invasive and is capable to yield the continuous data of blood glucose level.

A method which estimate the blood glucose level from the absorption of glucose is the simplest. From the reflection spectrum of skin of the oral cavity or the transmitted light of a finger, the blood glucose level was monitored.

However, light absorption of glucose corresponding to the criterion level of diabetes is extremely weak even at the absorption band of glucose of 1.6  $\mu\text{m}$ . The temperature fluctuation of water absorption masks the change of transmitted light intensity owing to the change of blood glu-

cose level.

In biological tissue, the difference of refractive indices between the floating small particles and the medium, which causes the light scattering, is very small. The scattering coefficient is thought to be very sensitive to the change of refractive index of the medium which is a function of the glucose concentration. Therefore, the change of glucose concentration is estimated from the change of the scattering coefficient.

The change of the scattering coefficient by glucose have been detected as the change of intensity of quasi-ballistic component in transmitted light or the change of OCT (optical coherence tomography) signal. The high rate of change of signal intensity owing to the glucose level is expected in comparison with methods measuring absorption. However, there is a problem that the refractive index by blood glucose cannot be distinguished from that by other ingredients because the spectrum parameter peculiar to glucose is not employed.

In addition, trials such as measurements of optical rotation by glucose, Raman scattering spectrum by glucose, PAS signal of glucose have been performed to estimate the blood glucose level. However, the practical optical glucose sensor for medical diagnosis has not been developed till now. (TC: Infrared Application for Safety and Peace)

## History of Electrical Engineering (HEE)

Chairperson:	Yasuharu Suematsu	(National Institute of Informatics)
Vice-Chairperson:	Satoru Yanabu	(Tokyo Denki University)
Secretaries:	Masami Sukeda	(Hitachi, Ltd.)
	Masao Takahashi	(Toshiba Corporation)
Assistant secretaries:	Akio Toda	(Mitsubishi Electric Corporation)
	Toshiaki Maruoka	(Toshiba Corporation)

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

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

Now, 3 investigation committees are organized in the HEE and are running actively for survey of

the subjects listed in Table 1. The investigation committee for history of technology interaction is an international joint study group. The members are consisting with Japanese, Europeans, Americans and Asians. Field study in overseas is planning in this committee.

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



conference holds a panel discussion emphasizing the importance of electrical engineering history.

Meetings for presenting research papers on electrical engineering history are held regularly under the auspices of the HEE. Starting in 1991, meetings have been held three times a year, so a total of 42 meetings have been held already and more than 300 research papers have been presented.

Public information activities are running by HEE. One of these activities is the publication of a newsletter. Inaugurated in 1994, the newsletter reached its 40th issue this year. The four-page

publication features technological history-related articles, records of visits to museums and book reviews. Another important public information activity is the web site. This web site was opened in 2001 and it announces workshops, publishes the summaries of research papers presented at the meetings, and publicize the committee's activities as I have mentioned in connection with the activities. The newsletters and the web site are in Japanese only but the web site in English will be soon. Please visit

[http://www.iee.or.jp/fms/tech\\_a/ahee/index\\_e.html](http://www.iee.or.jp/fms/tech_a/ahee/index_e.html)

Table 1 Investigation Committees in HEE

Research Subject	Chair Person
• Factors of Innovation in the Postwar Development of Electrical Engineering	Takayuki NAGATA (National Science Museum)
• History of Technology Interaction (JULY 2005 - )	Fumio ARAKAWA (Global Engineering Institutes)
• Award-presenting system study in the Electrical Engineering (June 2006 - )	Masami Watanabe (Mitsubishi Electric)

## High Voltage Engineering (HV)

Chairperson: S.Yokoyama (CRIEPI)  
 Secretaries: I.Aono (Mitsubishi Electric Corp.)  
 K.Hoshina (Toshiba Corporation)  
 Assistant Secretary: Y.Mizutani (CRIEPI)

This technical committee (TC) belongs to Power & Energy (P&E) Society of the IEE of Japan, and supervises activity of investigation on technical subjects related to high voltage engineering. Five investigation committees listed in Table 1 are active in August 2006.

The 4th International Workshop on High Voltage Engineering (IEHV 2004) was held in Sapporo city, following the 1st IWHV at Okinawa in 1999 , 2nd IWHV at Tottori in 2000 and 3rd IWHV at Fukuoka in 2003.

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

There were 8 sessions, where 40-60 papers were presented orally for two days. All speakers pre-

sented their paper in English, following fruitful discussions.

The workshop banquet was held also where many participants changed various information of the world wide technology of electric power industries, and the research on electric discharge phenomena while enjoying the food (and history) .Next IWHV will be held in Hamamatsu city of Shizuokaken on 1<sup>st</sup> and 2<sup>nd</sup> of February of 2007.

We hope the next IWHV 2007 will also be valuable workshop for exchanging the information related to rapidly moving technology of high voltage engineering.

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

TC on High Voltage Engineering meeting meets four times a year. One of the meetings will be as-

sociated with a technical visit to Kobe area.

The members of the committee other than the chairpersons of the investigation committees are

from universities (4), a research institute (2), electric power utilities (4) and manufacturers (9).

Table Investigation Committees in TC-HV

Research Subject	Chairperson
Manner of Lighting Damages to Wind Power Stations	S.Yokoyama (CRIEPI)
Insulator Coordination (Performance measurement technology)	T.Matsumoto (Shizuoka University)
Mechanism of Lightning Outages on Distribution Lines.	Y.Moro-oka (Kyushu Electric Power Company)
Surge Phenomena on Low-voltage and Control Circuits	T.Funabashi (Meidensha Corp.)
Numerical Electromagnetic Analysis Methods for Surge Problems	A.Ametani (Doshisha University)

## Electrical Wire and Cables (EWC)

Chairperson: Takahisa Imajo (Electric Power Engineering System Co., Ltd)  
 Secretaries: Kazushi Nakaya (Exsym Corporation)  
 Assistant Secretary: Shigekazu Yokoyama (Viscas Corporation)

Technical Committee on Electrical Wire and Cables (TC-EWC) is a committee organized to support the IEEJ Power and Energy Society, and includes members from universities, power and communication utilities, the JR railway company, 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. Three technical meetings was held as the joint meeting with TC-DEI, on January 28, 2005, in Nagoya, and focused on the subject of "Deterioration Diagnosis and economical Assessment". In addition to organizing such technical meetings, the technical committee supervises investigation committee dealing with subjects, which are related to electrical

wire and cables.

During the several years of activity, Investigation Committee for DC Cable Systems, the Investigation Committee for Technology of Wires and Associated Accessories for Overhead Transmission Lines, and the Investigation Committee for Computer Software and Its Application for Power Cable Line were organized. This year, two investigation committees are in action. The name and chairpersons of the committees are listed in Table 1.

Occasionally a technical visit by the committee members is made to encourage study on the advanced science and technology. This year, the committee members visited the Central Load Dispatching Center by Tohoku Electric Power Co, Inc.

Table 1 Investigation Committee in TC-EWC

Research Subject	Chairperson
Investigation Committee for Accessories for 66kV and Higher Voltage XLPE Power Cable	A. Toya
Technical Trend and Problem for Underground cable Distribution System	J.Motohashi

## Instrumentation and Measurement (IM)

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

The field of instrumentation and measurement technology is very wide and has a long history. The activity of our committee is always influenced by the technological trend in the era.

The early activities of this committee have mainly focused upon the presentation and discussion of studies and researches in the fields of electrical standards and precise measurement in various electrical fields. It is the reason that our committee is now categorized in the society A (Fundamentals and Materials) of IEEJ. Technological contents in our committee have, however, gradually shifted to various electrical and electronic fields.

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

- i) The general meeting of the committee is held four times every year for discussing the various activities of the committee. 15 members including a chairman, a secretary and an assistant-secretary constitute the committee.
- ii) The meeting by the chairman, the secretary and the assistant-secretary is held four times every year for tentatively planning the activities of the committee.
- iii) The workshops for the presentation and discussion of studies and researches are taken place almost every month in principle as a main activity.
- iv) The professional research committee for special subject is under consideration.
- v) The visit of professional facility is planning to carry out twice per year.

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

- # Ultra-high speed electronic instrumentation
- # Electro-magnetic measurement related with electrical environment
- # Optical measurement applied to electronic instrumentation
- # High precision electronic instrumentation applied to frequencies and time domain
- # Bio-electronic measurement applicable to the welfare field in society shifted to the

aged

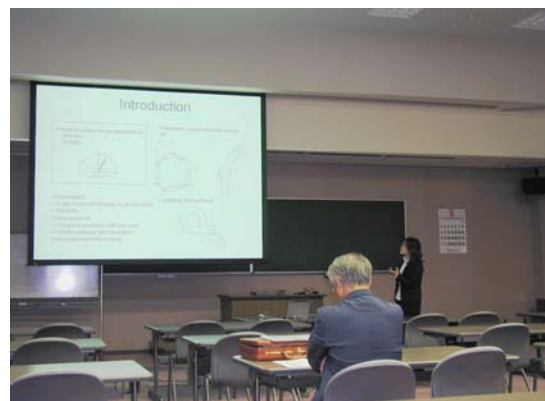
# Magnetic measurement related to magnetic sensors.

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

The number of annual presentation in the workshops is around 80 titles. The workshop is supported by IEEE IM and sometimes by other organization.

A professional research committee for special subject by the name of the application technology of precise measurement for frequency and time has successfully concluded. (the chairman: Prof. Sakuta )

Our committee website (<http://www.im-ieee.com/>) also assists to understand our activity.



One scene of some workshop

Written by Prof. Katsunori Shida, Chairman ( Saga University )

e-mail: [shida@cc.saga-u.ac.jp](mailto:shida@cc.saga-u.ac.jp)

# Metal and Ceramics (MC)

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

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.

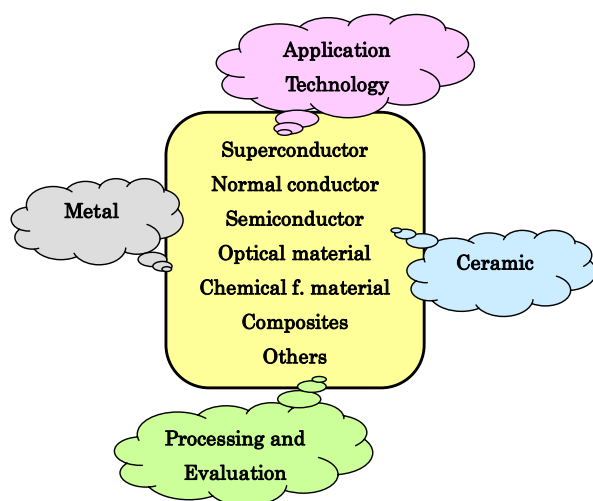


Figure 1 Activity scope of the TC-MC

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 as shown in Table 1, and the second activities will be found in the next section.

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

Last year, much attention has been paid on an investigation on advanced materials for future

batteries and fuel cells to be compatible with clean, green and renewable society.

Table 1 Symposiums in the National Convention of the IEEJ

Theme	Date	Site
Observation on nanotechnologies and super- conductors	2003.03.17	Tohoku-Gakuin University
Attractive carbon nano-tube as a new electric and elec- tronic material	2004.03.17	Aoyama-Gakuin University
Remarkably advanced diamond for electric and elec- tronic materials	2005.03.17	Tokushima University
Electrode materials for fuel cells and the secondary but- teries	2006.03.17	Yokohama National Univer- sity

**Activities of Investigation Committee in TC-MC**

As of 2006, there is one investigation committee under TC-MC as shown in Table 2, the name of which is “Fabrication technologies and characterizations of advanced superconducting materials”. The chairperson and secretary are Dr. Hiroaki Kumakura (National Institute for Materials Science, NIMS) and Dr. Takao Takeuchi (NIMS), respectively. Regularly, there are six meetings a year.

The meetings discuss fabrication technologies and evaluations on electromagnetic, thermal and mechanical properties mainly for Nb<sub>3</sub>Al conduc-

tors, Bi-based oxide superconductors, MgB<sub>2</sub> conductors and Y-based oxide superconductors. Most expecting investigation results are fabrication technologies to produce a long-length wire for MgB<sub>2</sub> and Y-based oxide, and their cost performance as the practical superconductors and their applied technologies to such as persistent current mode-coil, cable, transformer, fault current limiter and so on. As an intermediate result, 3 $\mu$ m-coated conductors of the Y-based oxide superconductor will be available in the near future.

Table 2 Investigation Committees under the TC-MC

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

# **IEC Japanese National Committees Related to Electrical Insulating Materials**

## **IEC TC15 Japanese National Committees**

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

Japanese National Committee for TC15 had four meetings in the last year. TC15 is a very busy committee; during the last year, 32 drafts for standardization concerning to TC15 have been received from IEC Central Office, including CD, CDV and FDIS, all of which were deliberated and discussed in the meetings of the national committee. Furthermore, 24 voting results or compiled comments, and 7 maintenance cycle reports were circulated in the member of the national committee.

For the activities on the working groups in the TC, the experts from Japan participate in WG5 (flexible insulating sleeving), WG7 ((reactive resinous compound and varnish). This year, a new expert joined to WG9 (cellulosic materials).

TC15 plenary meeting has been annually held. This year, the meeting was held during the 3rd

week in May in Vienna Austria. More than 40 persons were attended in the meeting.

In July last year, IEC SC15C was transformed into IEC new TC15 by a decision of IEC SMB, because a new TC112 was constructed merging TC98 into SC15E in April last year. The corresponding Japanese National committees were reconstructed according to the IEC new structure. The title of new TC15 is “Solid Insulating Material”, which was accepted in the Vienna meeting. The tasks of the new TC15 are almost unchanged from that of SC15C, which are focused on, but not limited, to, the development and maintenance of international standards on specifications for solid electrical insulating materials alone or in simple combinations. This includes coatings which are applied in the liquid state but cure to solids, such as varnishes and coatings.

## **IEC TC112 Japanese National Committee**

Chairperson: N. Shimizu (Meijo University)  
Vice Chairperson: T. Okamoto (CRIEPI)  
Secretaries : K. Haga (Fuji Electric System Co., Ltd.)  
K. Kimura (Mitsubishi Electric Corporation)  
N. Nakamura (Japan Electrical Safety & Environment Technology Laboratories )  
H. Uehara (Kanto Gakuin University)

Title of TC112 is “Evaluation and Qualification of Electrical Insulating Materials and Systems”. TC 112 was established in 2005 May by a merger of SC 15 E “Insulating Materials - Methods of Test” and “TC 98 Electrical Insulation Systems”. The chair of TC112 is Dr. P.V. Ronca (Canada), the former Chair of TC 98. The Secretary is Mr. B. Götttert (Germany), the former secretary of SC 15

E.

The Scope is “To prepare International Standards covering methods of evaluation and qualification for electrical and electronic insulating materials and electrical insulation systems”. The participant members and the observer members are 20 countries and 6 countries respectively. Japan is one of the participant members.

The TC112 Japanese National Committee was established in October 2005. The members of TC112 JNC are came from both the former SC15E JNC and TC98 JNC; 40 experts from universities, research institutes and industries serve as the member. The officers are as follows:

Chair: Prof. N. Shimizu (Meijo University)

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

Secretaries : Mr. K.Haga (Fuji Electric System Co.,Ltd.)

Dr. K.Kimura (Mitsubishi Electric Corporation)

Mr. N. Nakamura (Japan Electrical Safety & Environment Technology Laboratories )

Prof. H. Uehara (Kanto Gakuin University)

TC112 has 8 working groups WG1-8. It should be mentioned that the two convenors for WG.7 and WG.8 are from our Japanese National Com-

mittee. Corresponding to these WGs in the international field, JNC has also 8 WGs in the domestic field. WGs are shown below with name of covenor in international field and chief in Japan.

- WG 1 Thermal Endurance (Convenor Prof. Montanari, Italy / Chief in Japan Dr. Kaneko)

- WG 2 Radiation (Mr. Dawson, UK / Prof. Kudo, Tokyo University)

- WG 3 Electrical Strength (Prof. Stimper, Germany / Dr.Kimura, Mitsubishi Electric)

- WG 4 Dielectric / Resistive Properties (Mr. Haupt, Germany / Prof. Watanabe)

- WG 5 Tracking (Dr. Winter, Germany / Dr. Honma, CRIEPI)

- WG 6 Systems (Dr. Densley, Canada / Mr. Sakano)

- WG 7 Statistics (Dr. Okamoto, Japan / Dr. Okamoto, CRIEPI)

- WG 8 Various Material Properties (Prof. Shimizu, Japan / Prof. Shimizu, Meijo University).

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

Chairperson: M. Nagao (Toyohashi University of Technology)  
Secretary: M. Tsuchie (Mitsubishi Electric Corporation)  
Assistant Secretary: T. Takahashi (CRIEPI)

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

SC D1 has now 12 Advisory Groups (AG) and Working Groups (WG); SAG (Strategic AG) • CAG (Customer AG), WG D1.01 (Fluid-Impregnated Insulating Systems), WG D1.03 (Insulating Gases), AG D1.05 (Capacitors), WG D1.07 (Solid Insulating Materials for Rotating Machines), WG D1.12 (Materials for DC Applications), WG D1.14 (Material properties for nonceramic outdoor insulation), WG D1.15 (HTSC-material applications & cooling), WG D1.16 (High Field Phenomena in Solid Insulation and Interface), WG D1.17 (HV Asset condition assessment tools, data quality and expert systems), WG D1.18 (Impact of emerging generation technology) and WG D1.33 (HV test and measuring techniques). In 2006 Paris meeting, 2 new WG's will start, namely, WG D1.19 (Solid insulation endurance under transient voltages) and WG D1.20 (Non-destructive water treeing detection in MV XLPE cables).

The preferential subject of 2006 SC D1 Paris Group meeting reflects recent topics of SC D1 as follows, PS1 (11 papers): Partial Discharge measurement with non-conventional systems (sensors, sensitivity, calibration; related knowledge rules; comparison with conventional systems), PS2 (6 papers): Materials issues in emerging technologies (reusing of materials, refurbishment, life extension), PS3 (6 papers): High performance materials and new materials for severe operating conditions (nano materials, superconducting materials, space charge-less materials, bio dielectric materials, eco-friendly materials, etc.). 23 papers are presented on these PS and following 5 papers are presented by Japanese as first author; D1-106 New Development for Detecting Partial Discharge Using an UHF Method and Its Application to Power Apparatus in Japan by M. Hanai, et al., D1-206 Cross-Equipment Evaluation of Material Techniques Based on Electrical Insulation Performance in Electric Power Equipment by H. Okubo, et al., D1-303 Superiority in Partial Discharge Resistance of Several Polymer Nanocomposites by T. Tanaka, et al., D1-305 Various Dielectric Characteristics of Polymer Nanocomposites by T. Tanaka on behalf of TF D1.16.03 and D1-306 Development and Application Trend of Superconducting Materials and Electrical Insulation Techniques for HTS Power Equipment by H. Okubo, et al. on behalf of WG D1.15.

The next 2007 International SC D1 meeting is scheduled in Korea and the Japanese National SC D1 has usually 3 or 4 meetings a year.