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, Chair-person: 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, Chair-person: 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.

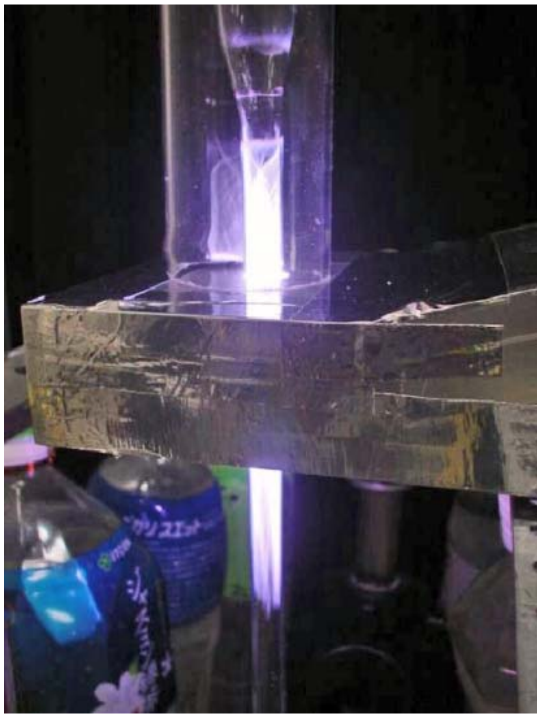
Plasma generation and handling technologies contain mutual interaction of plasmas with electric- and magnetic-field strengths. The interactions bring a high density plasma presenting a high-current beam and a unique crystal structure from dust and powder plasmas. Generation and handling technologies 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.

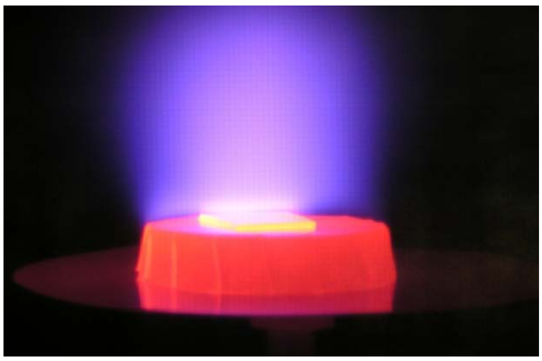
Technical committees of plasma science and technology of IEEJ contributes to the development of fundamental researches and industrial production using plasma technologies. For example, plasma physics to understand the interactions of electric- and magnetic-field strengths, high-current pinch plasma in 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:

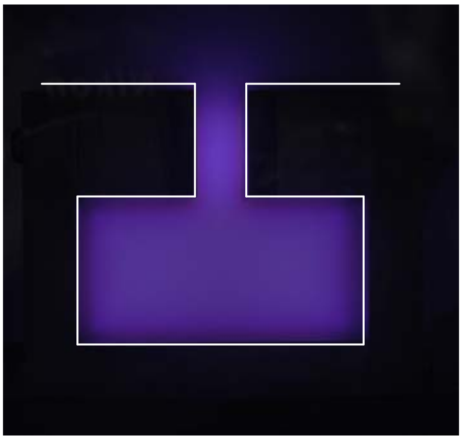
(1) plasma physics, (2) non-linear plasma phenomena, (3) numerical analysis and simulation of plasmas, (4) plasma diagnostics and imaging, (5) corona, glow arc discharge plasmas, (6) electro- and magneto-hydrodynamics, (7) high-density and high-current pinch plasmas, (8) reactive plasmas, (9) astrophysical 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.



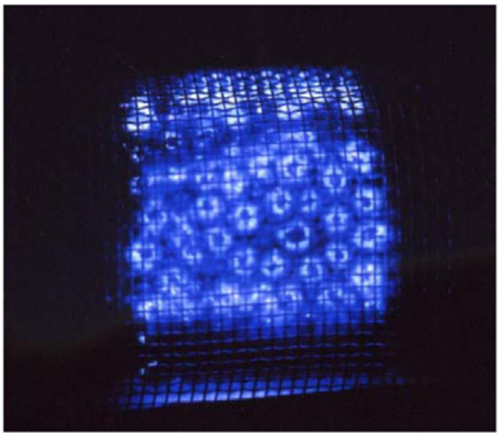
Atmospheric H_2O microwave plasma



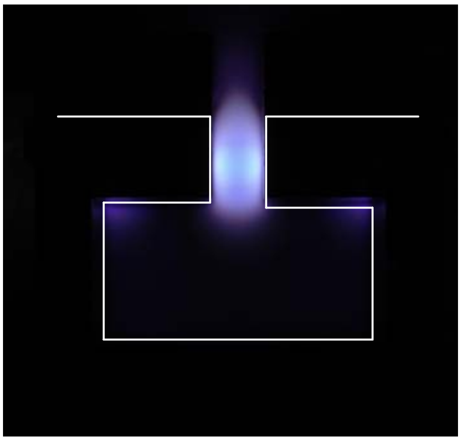
Diamond film preparation



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.

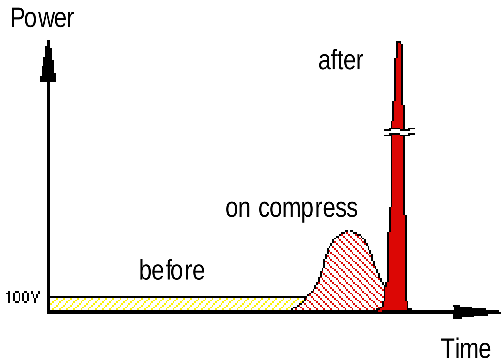


Fig. 1 Pulsed power

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.

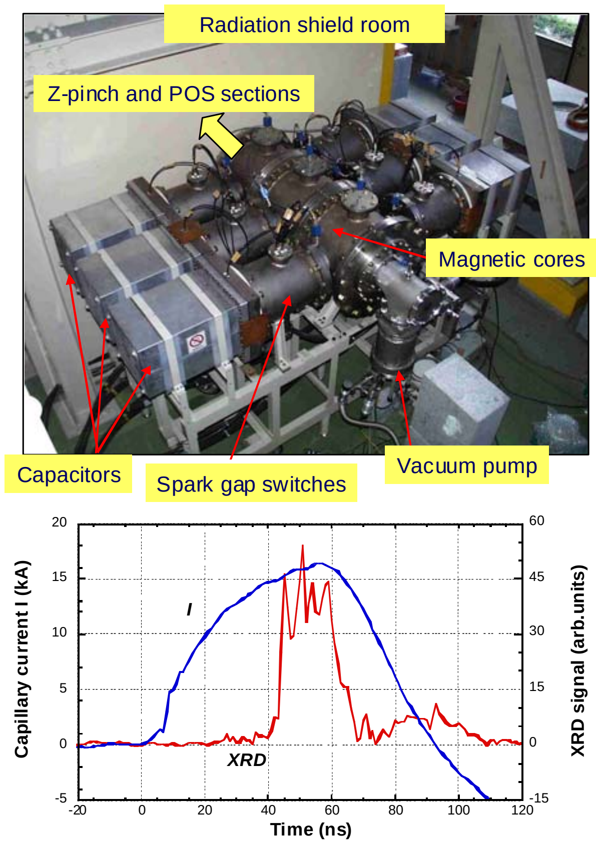


Fig. 2 Pulsed power generator for z-pinch light source and X-ray signal form z-pinch plasma.

(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.

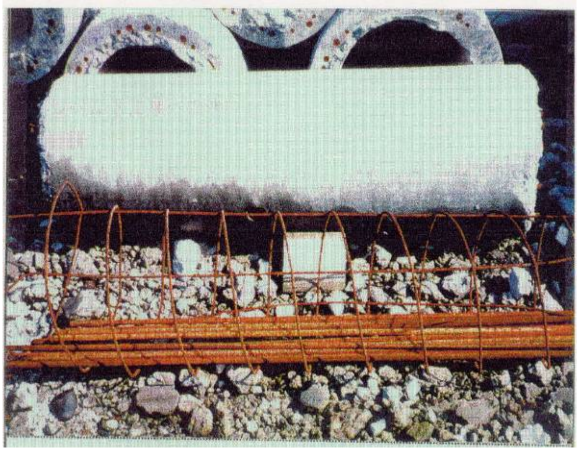


Fig. 3 Recycling of steel framed concrete blocks by the pulsed power discharge.

(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 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 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.

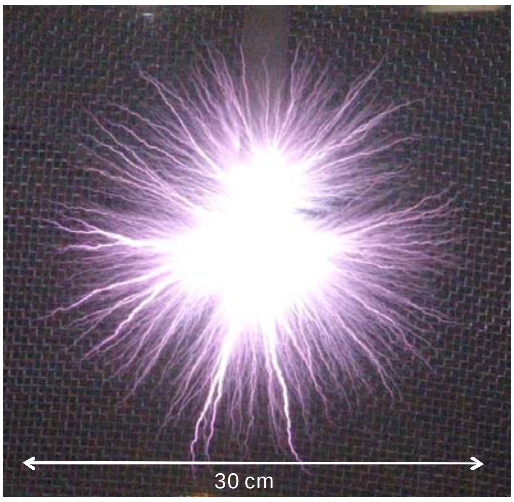


Fig. 4 Large volume plasma in water produced by pulsed power discharge.

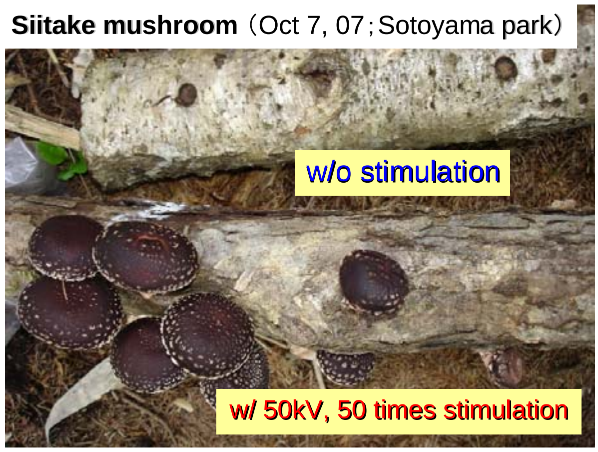


Fig. 5 Typical photographs of cultured *Lentinula edodes* with and without the electric stimulation.

(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.

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.

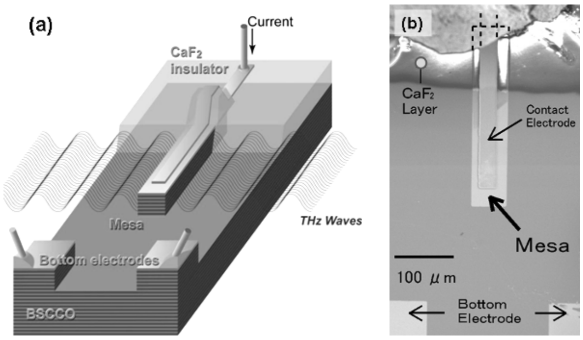


Fig. 1. (a) Device structure of BSCCO mesa for THz emission using current injection, and (b) SEM image of BSCCO mesa(by T.Tachiki, National Defence Academy).

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.

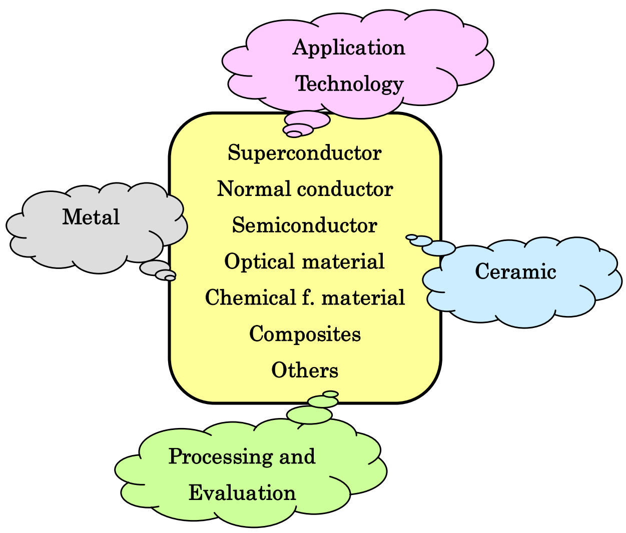


Figure 1 Activity scope of the TC-MC

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.