

News From Japan



Yoshimichi Ohki

Ninth ISEIM Held in Tokyo

Due to the spread of COVID-19 throughout the world, almost all academic conferences have been forced to change their meeting styles. Although some were canceled or postponed, many conferences were held with the help of IT technologies. The ninth International Symposium on Electrical Insulating Materials (ISEIM 2020) was also held online from September 13 to 25, 2020, including an extended discussion period from September 18 to 25.

First, a brief outline of the prior history of the symposium was presented. The story goes back to July 1991. At that time, the third International Conference on the Properties and Applications of Dielectric Materials (ICPADM) was held at a

newly built international conference hall at Waseda University, Tokyo, Japan. That conference was the first international conference in the field of electrical insulation and dielectric phenomena and the first IEEE-DEIS-sponsored one, held in Japan. Namely, the taking place of such an international conference was truly new at that time. Regarding this, an English language newspaper reported this event as shown in Figure 1 and the Deputy Minister of Education of Japan appeared for the observation of the conference. This conference ended as a big success and, as a result, many DEIS executives urged the Japanese conference organizers to inaugurate a similar international conference and hold it regularly in Japan.

With such a background, Japanese people in academia and industry in the field of electrical insulation started this series of symposia. The first ISEIM was held in September 1995 at a hotel within a short walking distance of Waseda University. Then, the ISEIM was held in Toyohashi in 1998 (second), Himeji in 2001 (third), Kitakyushu in 2005 (fourth), Yokkaichi in 2008 (fifth), Kyoto in 2011 (sixth), Niigata in 2014 (seventh), and Toyohashi in 2017 (eighth). Through these symposia, the ISEIM gradually established high recognition as an important international conference held in Japan. From the second symposium held in 1998, internationally recognized researchers listed in Table 1 were invited to give special plenary Inuishi Memorial Award lectures.

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MAINICHI DAILY NEWS

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Special

Int'l Confab On Dielectric And Insulating Materials In Tokyo

300 Scholars From 23 Countries

Although not grand, an international conference on dielectric and insulating materials, which are indispensable for electric power technology and electronics technology, is being held at Waseda University in Tokyo from July 6. This is the third International Conference on Properties and Applications of Dielectric Materials.

This conference is scheduled to take place every other year in the Pan-Pacific region. The past two conferences were held in Xi'an and Beijing, China. This time a large number of researchers from European countries and the United States, countries of the Asia-Pacific region, India and countries of the Middle East and Africa, the Soviet Union and countries of Eastern Europe are attending.

Dr. T. Tsunaka of CHRP, who is Secretary-General of the conference, said that "this is probably the first international science and engineering conference with so many participants assembled from non-West European countries. In that sense, our experiment is important and will be one step in fulfilling the role of a bridge between the East and the West. I am convinced that various countries of the world are placing great expectations in the conference."

Incidentally, probably few people distinctly hear the words "dielectric materials" and "insulating materials." Nevertheless, an electric appliance without insulating material does not exist. Dielectric materials are indispensable as capacitors in an electric power system or electric circuit. It is necessary for electric power apparatus to withstand extra-high voltage of 225 KV or 500 KV. The reason why we are able to use electricity day and night and enjoy a comfortable life is because of the splendid insulating materials used in generators, transformers, overhead transmission lines, power cables, and power distribu-

tion lines. In the electronics field also, represented by the LSI installed in computers and all electronic equipment, the spectacular developments up to now were made possible by the success achieved in integrating insulating materials and capacitors — dielectric materials able to withstand the ultrahigh electric field.

What, then, are dielectric materials? This is a question that many people would probably want to ask. Dielectric materials are actually another way of calling electric insulating materials. That is why, for example, rubber is an insulating material and also a dielectric material. Mica too is an insulating material and a dielectric material.

Why are insulating materials specially called dielectric materials? The reason is that besides possessing the quality of not permitting electricity to pass through, insulating materials additionally have another dielectric quality. This dielectric quality is one that produces, when electrostatic pressure is applied, the polarization phenomenon of a positive electric charge at one end of a material and a negative electric charge at the other. (This can be easily understood by thinking of a magnet that polarizes into NS poles.)

Dielectric materials can be regarded as directly opposite to the superconductive materials which around a great deal of discussion on one line. As is well-known, superconductive materials have absolutely no resistance to electricity which passes through them without any loss. By utilizing this quality, electricity might be "conducted" or it might be possible to produce an ultrahigh electric magnet. They are very useful materials. Nevertheless, in order to use electricity in the best way, become or in a vacuum. The development of sensors such as ultrasonic transducers and in a vacuum. The development of sensors such as ultrasonic transducers and in a vacuum. The development of sensors such as ultrasonic transducers and in a vacuum.



E. O. Foster, overseas chairman of ICPADM-91, addresses during the opening session Monday.

or leak are also necessary. Accordingly, the study of insulating materials (dielectric materials) is being carried out actively.

Electrical insulating materials are used in various places. The most frequently seen are probably the materials covering electric wires and cables. Although they cannot be seen directly, insulating materials or dielectric materials are doing important work inside transformers, capacitors and generators.

In addition to the transmission phase, studies of insulating materials or dielectric materials have recently spread to the development of various types of sensors and diagnostic methods of monitoring the state of dielectric materials inside the electric power apparatus. Research is also being directed toward such phases as how dielectric quality changes under extreme conditions, such as ultrahigh temperature or in a vacuum.

The development of sensors even to the changes (indicating

and Canada, among European countries, and between Eastern Europe and the Soviet Union but this is practically non-existent in the Asian region.

"I would like to see this conference become a step toward the realization of close cooperation in the Asian region in the future," said Prof. Tetsuo Takata of Musashi Institute of Technology.

The Honorary Chairman of this conference is Prof. Emeritus Y. Inuishi of Osaka University. The General Chairman is Prof. M. Ieda (Aichi Institute of Technology), with Prof. Y. Tanura (Waseda University) as General Co-Chairman and Prof. E.O. Foster (Rutgers University) as Overseas Chairman. Under their direction, preparatory activities were carried out over a two-year period.

Cooperation was received from The Institute of Electrical Engineering of Japan (IEEJ) as the main body but, in particular, centering on the committee on dielectric and electrical insulating materials, great support was received from the related technical committees for the preparation.

Waseda University provided the conference venue and is in regard to operational funds.

The Society of Dielectrics and Electrical Insulation (DEIS) of the U.S. established an Overseas Advisory Committee which offered appropriate advice. Its chairman, Dr. H. Orton (BC Hydro of Canada) is now in Japan.

From China, which hosted the two previous conferences, Prof. Tu Deyun (XU in Haining University) and Prof. Zhang Rongyi (Tinghua University) are here. From Australia, which is scheduled to sponsor the fourth conference in 1995, Prof. M. Duenven (University of Queensland) has arrived to participate in the current conference.

By Masayuki Ieda, General Chairman of the Conference (President of IEEJ of Japan)

In succession to the first conference (in Xi'an, China) and the second (in Beijing, China), at which many important scientific and technical results were achieved over a two-year period.

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divided into 11 major topics and will be reported in 22 sessions in the three categories of Plenary, Ordinary and Special sessions.

The importance of this conference is that by providing a venue for the international exchange of information on the scientific and technical fields of dielectric materials and electric insulation, efforts will be made for enhancing the qualitative understanding of these materials, effective combination of the fundamentals and applications, and their development by experts possessing strong interdisciplinary coloring in broad fields of electric insulation engineering, together with the fostering of the next generation of young researchers and technicians. I am certain that these views will be fully attained through the high quality content of the Reports that are presented.

The various knowledge that will be obtained of electrical substances in the scientific and technical phase will not be limited to electric insulation in the fields of extra-high voltage and large capacity electric power equipment, in which great anticipation is placed, but will also be extremely important for the electric insulation of electronic devices in which the high electric field design is demanded.

Finally, it is also my hope that the participants from many countries of the world attending this conference will carry out a friendly exchange of information through free discussions. It would be most fortunate also if attendance at this conference provided the participants with an opportunity to come into contact with and enjoy Japan's traditions and nature, thereby promoting mutual understanding.

I express my heartfelt gratitude to all the members of the International Advisory Committee, Conference Board, and Executive Committee who have devoted their enthusiastic efforts to make this conference successful.

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Figure 1. An English-language newspaper, *Mainichi Daily News*, reporting about the third ICPADM held in July 1991 (photocopied with courtesy of the *Mainichi*).

Table 1. Inuishi Memorial Award lecturers in the past ISEIM meetings

Number ¹	Year	Lecturer	Affiliation
2	1998	Prof. R. Hackam	University of Windsor, Canada
3	2001	Prof. T. Tanaka	Waseda University, Japan
4	2005	Prof. T. Mizutani	Nagoya University, Japan
5	2008	Prof. M. Hara	Kyushu University, Kyushu Electric Power, Japan
6	2011	Prof. M. Zahn	Massachusetts Institute of Technology, USA
7	2014	Prof. J. K. Nelson	Rensselaer Polytechnic Institute, USA
8	2017	Dr. C. Laurent	Centre National de la Recherche Scientifique, France
9	2020	Prof. L. A. Dissado	University of Leicester, UK

¹The number indicates the turn of the symposium.

The ninth conference, namely, ISEIM 2020 was initially scheduled to be held on September 13 to 17, 2020, at Waseda University after the initial period of the Olympic and Paralympic Games Tokyo 2020. However, as mentioned above, owing to the COVID-19 pandemic, the Organizing Committee of ISEIM 2020 decided to refrain from having a face-to-face conference and to hold it as a web conference. All the committee members and volunteers tried to make the remote conference fruitful and valuable for all the participants and to make the discussion and information exchanges on electrical insulating materials useful.

The countries with at least one registered participant and the number of participants from each country are listed in Table 2. Although general presentations were performed as on-demand ones through the web, several lectures such as invited, plenary, and topical ones were given in real time online. The special invited talk, Inuishi Memorial Award Lecture, was given from 20:00 to 21:00 Japanese Standard Time (JST) on September 14 by Dr. Leonard A. Dissado (Figure 2), Professor Emeritus of the University of Leicester, UK, with a title of “The Role of Theory in Understanding Space Charge Distributions.” In this special talk, Prof. Dissado explained his thoughts about the way that basic theory could be used to develop patterns of space charge behavior and thereby enable the governing features to be identified in such a way that the effect of variations in conditions and materials could be estimated. Figure 3 shows one of

the snapshots of images or photos of audiences, taken right after the session of the Inuishi Memorial Award Lecture held online.

Another invited plenary talk was given from 20:00 to 21:00 (JST) on September 17 by Prof. Suwarno (Figure 4) of Bandung Institute of Technology, Indonesia, titled “Effects of Thermal Aging on the Characteristics of Kraft Paper in Various Liquid Insulating Materials.” In this special talk, Prof. Suwarno explained his experimental results about the effects of thermal aging on the characteristics of Kraft paper in mineral oil, natural ester derived from palm oil, and gas-to-liquid oil. For elucidating the effects of thermal aging on the characteristics of Kraft paper, SEM (scanning electron microscope), EDS (energy dispersive x-ray spectroscopy), and XRD (x-ray diffraction) analyses were used. The changes in the degree of polymerization, tensile strength, and crystallinity with aging were also presented. The reduction in the percentage of oxygen element and the appearance of K in the paper in ester derived from palm oil and that of S in mineral oils were discussed. From the FTIR analysis, he clarified the occurrence and the increase of C-O at around $1,159\text{ cm}^{-1}$ and that of C=O at around $1,743\text{ cm}^{-1}$ with the increase in aging time and temperature.

Table 2. Countries with registered participants to the ninth ISEIM and the number of participants from each country

Country	Number of attendees	Country	Number of attendees
Japan	120	Egypt	2
China	35	Spain	2
India	12	UK	2
Indonesia	6	Algeria	1
Korea, Republic of	6	Belgium	1
Thailand	5	France	1
Italy	4	Greece	1
Sweden	4	Switzerland	1
Germany	3	The Netherlands	1
Malaysia	2		

**Figure 2.** Dr. Leonard A. Dissado, Professor Emeritus of the University of Leicester, UK, who gave the Inuishi Memorial Award Lecture, relaxing at lunch after giving the award lecture, together with his wife, Enid, and Professor John Fothergill.

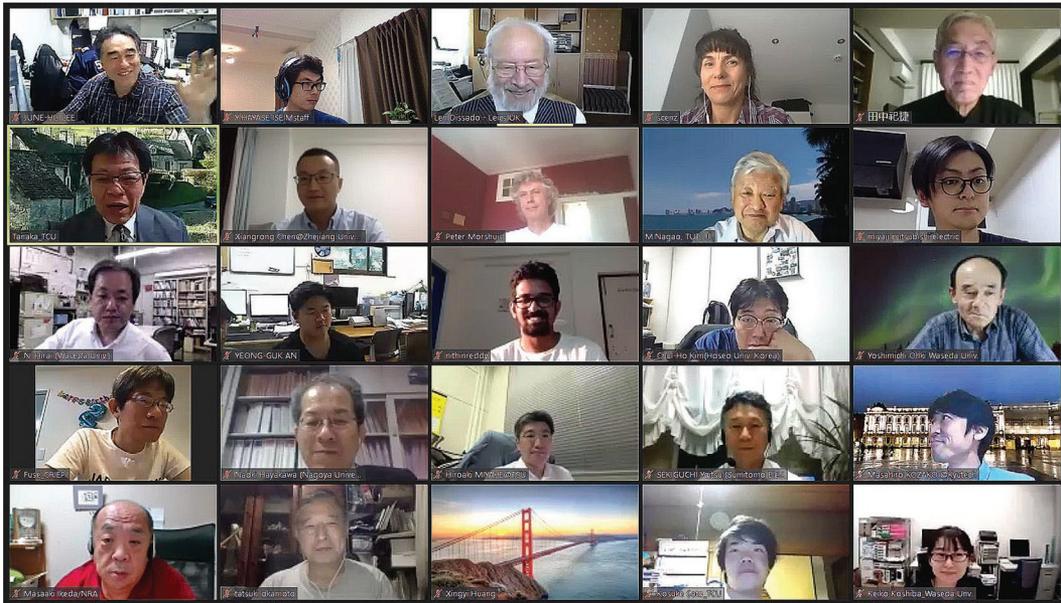


Figure 3. One of the snapshots of audiences, taken right after the Inuishi Memorial Award Lecture.

As a tradition of recent ISEIM symposia, a workshop was actively held by six lecturers. The topic of this workshop held from 19:00 to 21:30 (JST) on September 15 was “Space Charge Measurement Using the PEA Method—Advanced Measurement Techniques and Typical Applications.” A technical report #1491 issued in August 2020 by the Institute of Electrical Engineers of Japan, titled “Standardization of Calibration and Advanced Measurements of Space Charge Distribution at High Temperature Using the Pulsed Electro-Acoustic Method,” was used as a textbook of the workshop.

In the workshop, not only the pulsed electro-acoustic (PEA) method but also the $Q(t)$ method was vigorously discussed. In the $Q(t)$ method, the electric current flowing through a sample insulator is not measured by an electrometer but it is integrated into the form of an electrostatic charge stored in a capacitor put in series with the sample. The charge stored is then measured

in the form of a voltage difference between the two electrodes of the capacitor. The principle of this measurement method itself is well known. In this sense, the $Q(t)$ method is not new if we judge the meaning of the word strictly. However, the $Q(t)$ method, revisited by Dr. Tatsuo Takada (Figure 5), Professor Emeritus of Tokyo City University, who is also famous as an inventor of the PEA method, is very innovative and truly useful to study the insulating behavior of dielectric materials.

A clear example of the versatility of the $Q(t)$ method in comparing the insulating properties between polyethylene terephthalate (PET) and low-density polyethylene (LDPE) is shown in Figure 6. Here, Prof. Takada used a device AD-9832-A (A and D Corp.) developed for measuring $Q(t)$ according to his theory. As mentioned above, $Q(t)$ in Figure 6 corresponds to the charge stored in the capacitor of the device. It is clearly shown



Figure 4. Prof. Suwarno of Bandung Institute of Technology, Indonesia, who gave the invited plenary talk.



Figure 5. Dr. Tatsuo Takada, Professor Emeritus of Tokyo City University, who provided an innovative insight into the $Q(t)$ method with profound depth.

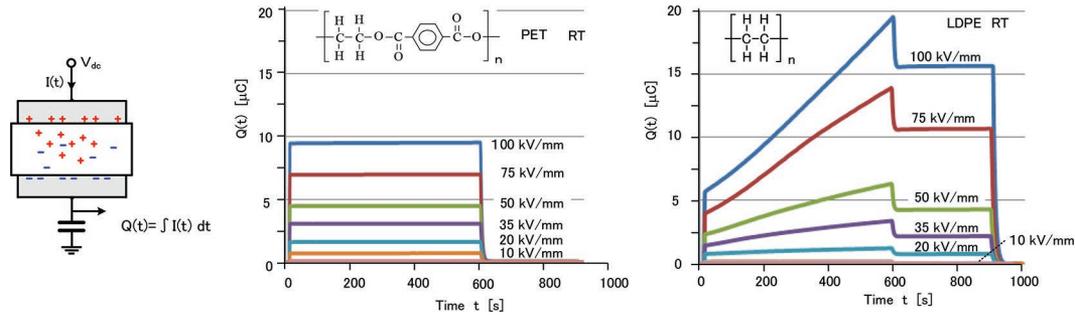


Figure 6. Comparison of the insulating properties between low-density polyethylene and poly(ethylene terephthalate), an example to show the versatility of the $Q(t)$ method.

that $Q(t)$ is unchanged from its initial value $Q(0)$ in the case of PET. This indicates no accumulation of space charge inside the sample. On the other hand, in the case of LDPE, the increase in $Q(t)$ with the increase in time is quite obvious. This means that electric current can easily flow through the LDPE sample under

the experimental conditions. In such a way, the $Q(t)$ method is a good tool to evaluate the insulating property of a material.

This article was completed in cooperation with Prof. Naoki Hayakawa of Nagoya University and other members of the ISEIM 2020 Organizing Committee.



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