Electrical Insulation News in Asia

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PREFACE

Prof. Naoki HAYAKAWA

COVID-19

COVID-19 is widespread all over the world. People are obliged to change their life and work style drastically. Also in my case, as a university professor, the lecture and research activities are greatly affected, some of which will be introduced here.

I have 4-6 lectures every year for undergraduate and graduate students on e.g. electric power transmission, high voltage, electromagnetics, applied superconductivity. We were required to prepare only ICT-based remote classes in the 2020 spring semester, which was relieved in the 2020 fall semester so that we could give some face-to-face classes. I prepared the pptx files with voice recording for the ICT-based remote classes and found that the 90-minutes face-to-face classes were shortened to 30-40 minutes in the pptx classes even for the same contents. This means how much the live lectures had been flexibly modified and added during the lecture with checking the students' response. The merit of ICT-based remote classes would lie in the repeatability on the students' demand. According to the lecture evaluation by students, it was interesting to find that the ratio of students who liked the ICT-based remote classes and those who liked the face-to-face classes was almost the same.

Since most of the research subjects in my laboratory were based on the experiments, the research activities were basically stopped during the period when the students were prohibited to come to university. However, the discussions and communications with individual students or all members in my laboratory were continued using the Web system.

Most of the meetings inside and outside the university, including the domestic and international conferences and business trips, were held on-line using Zoom, Teams, Webex, Skype, and so on. The on-line meetings were often useful to save the time and money, but not enough to give and catch the delicate nuance and feelings in the detailed discussions and communications. In October 2020, I participated in 3 international conferences. Each conference arranged its time schedule in consideration of the international time difference, e.g. in the early morning, in the daytime, in the late evening, sometimes in the midnight, in Japan. For 3 days in the end of October 2020, the 3 conferences happened to be held in the same day and I participated them all day long. Each conference seems to have successfully finished owing to the effort of the organizing committees. As for ISEIM2020 held in September 2020, I would appreciate it if you could read the article in this EINA No.27, where the challenges based on the greatest efforts of the organizing committee are described. The experience in organizing ISEIM2020 under COVID-19 will be reflected to the future conferences such as CMD2022 and ISEIM2023.

I just wish that COVID-19 will come to an end asap and the healthy life will come back to all people in the world.

Prof. Naoki HAYAKAWA
Nagoya University

OUTLINE OF TECHNICAL COMMITTEES IN IEEJ

Dielectrics and Electrical Insulation (DEI)

Chairperson: Naoki Hayakawa (Nagoya Univ.)
Secretaries: Yoitsu Sekiguchi (Sumitomo Electric Industries)
Toshihiro Takahashi (CRIEPI*)
Assistant Secretaries: Yuuji Hayase (Fuji Electric)
Yoshinobu Murakami (Toyohashi Univ. of Tech.)
*CRIEPI: Central Research Institute of Electric Power Industry

The Technical Committee on Dielectrics and Electrical Insulation (TC-DEI) has a long history from 1970. The activity of the TC-DEI has been covering mainly solid and composite dielectric materials and their technologies.

The important activity of TC-DEI is the annual domestic Symposium on Electrical and Electronic Insulating Materials and Application in Systems (SEEIMAS), which is held as the International Symposium on Electrical Insulating Materials (ISEIM) every 3 years. The symposium topics include diagnostic techniques, inverter surge and partial discharge phenomena, functional and new materials and so on. In 2020, owing to COVID-19 coronavirus pandemic, the 51st SEEIMAS was held as the 9th ISEIM in the virtual web symposium (real-time events on Zoom and on-demand events on MS Teams), as shown in Fig. 1, from September 13th to 25th, 2020. Total 210 persons from 19 countries participated in the symposium with 168 presentations (incl. workshop and digest reports) to share their experiences and discuss the latest developments and future challenges in this field. The 9th ISEIM started with the Inuishi Memorial Lecture by Prof. L. A. Dissado at University of Leicester, UK, with the title "The Role of Theory in Understanding Space Charge Distributions". Plenary Lecture entitled "Effects of Thermal Aging on Characteristics of Kraft Paper in Various Liquid Insulating Materials" was given by Prof. Suwarno at the Institut Teknologi Bandung, Indonesia.

Fig. 1. Group photo at the Inuishi Memorial

The next 52nd SEEIMAS is expected to be held as face-to-face symposium at Tohoku University, Sendai, in the middle of September, 2021, after the 32nd Olympic and Paralympic Games in Tokyo.

Fig. 2. Technical report No. 1491 in English.

As one of the fascinating topics of TC-DEI in 2020, a technical report No. 1491 has been published in English with the title "Standardization of Calibration and Advanced Measurements of Space Charge Distribution at High Temperature Using the Pulsed Electro-acoustic Method" (Fig. 2). This technical report was used as the textbook of the workshop as one of the real-time events in the 9th ISEIM.

Adding to some technical, academic and educational events, the TC-DEI runs Investigating R&D Committees (IC's) that organize several technical meetings in a year. The following five IC's are on-going in their investigation research activities:

(1) Application of Quantum Chemical Calculations in the Field of Electrical and Electronic Insulating Materials (Dec. 2018 – Nov. 2021, Chairperson: Satoshi Matsumoto, Shibaura Inst. of Tech.)
(2) Electrical Insulation Reliability of Power Module (Dec. 2018 – Nov. 2021, Chairperson: Masahiro Kozako, Kyushu Inst. of Tech.)
(3) Information for Asset Management of Power Apparatus Based on Insulation Degradation (Aopr. 2019 – Mar. 2021, Chairperson: Katsumi Uchida, Chubu Electric Power)
(4) Advancing Tailor-made Composite Insulation Materials and Their Applications (Jan. 2020 – Dec. 2022, Chairperson: Takahiro Imai, Toshiba ISS)

(5) Advanced Nanomaterials, Organic Device Development and Life Science Application for Supporting Sustainable Growth (Oct. 2020 – Sept. 2023, Chairperson: Keizo Kato, Niigata Univ.)

Electrical Discharges, Plasma and Pulsed Power (EPP)

Chairperson: Akiko Kumada (The University of Tokyo)
Vice-Chairperson: Hiroaki Ito (University of Toyama)
Secretaries: Hiroki Kojima (Nagoya University)
Katsuyuki Takahashi (Iwate University)
Assistant Secretaries: Yusuke Nakagawa (Tokyo Metropolitan University)
Yuki Inada (Saitama University)

The Technical Committee on Electrical Discharges, Plasma and Pulsed Power (TC-EPP) in the Fundamentals and Materials Society of the Institute of Electrical Engineers of Japan (IEEJ) was newly founded by integrating former Technical Committee on Electrical Discharge and Technical Committee on Plasma and Pulsed Power in January 1, 2019. This committee covers the research fields related to the science and technologies of electrical discharges, plasma and pulsed power.

The main purpose of the TC-EPP is the wide promotion of the research activities concerning to ta variety of electrical discharges, plasma and pulsed power in vacuum, gas, liquid and on surfaces of materials and their applications to advanced technologies, especially for realizing sustainable society for the next generation.

In FY 2020, the COVID-19 epidemic had a significant impact on the technical committee activity. Although the technical meeting was postponed for two months from the originally scheduled in May, we quickly decided to hold the technical meeting online based on the judgment that providing an opportunity for research presentations should be the highest priority in the activities of the technical committee. This was the second trial-based online technical meeting in IEEJ. After that, a joint workshop with switch protection/stationary equipment was held at the end of September, and the International Workshop on High Voltage Engineering (IWHV), a joint workshop with high voltage and switch protection, was held online in mid-November. Since the merits of on-site planning have been reaffirmed, we are planning a joint hybrid-style dielectric/hyper voltage workshop in January, depending on the social situation. Among other activities, the 2020 PDJ symposium was held online on July 31. In late January 2021, the Plasma Processing Research Society/Plasma Materials Science Symposium (SPP-38/SPSM33) will be held online.

As the applications of electrical discharge, plasma and pulsed power technology, we have focused on the fields of energy, environment, materials, medicine and bio-agriculture. Our Technical Committee (TC-EPP) holds three investigation R&D committees: (1) Investigation R&D Committee on the Insulation of Converter-fed Rotating Machines with Expanded Applications (Chair: Kumada, until November 2021): (2) Investigation R&D Committee on the Trend of Surface Treatment Technology for Plasma Materials (Chair: Ryuta Ichiki, Oita University, until December 2021): and (3) Investigation R&D Committee on Food Sterilization and Processing Technology by Pulsed Electric Field (Chair: Yasushi Minamitani, Yamagata University until December 2021). The following is a description of the activities of each technical committee and the status of its scope.

A. Investigation R&D Committee on the Insulation of Converter-fed Rotating Machines with Expanded Applications

For energy saving and high efficiency operation, the use of inverter drives for industrial motors is increasing. In addition, the recent trend toward aircraft electrification is expected to lead to the operation of motors in harsher environments than ever before. In order to ensure insulation reliability of motors against increasing stress, it is necessary to establish an insulation design method based on the discharge phenomenon and degradation mechanism. An overview of the current status of international standards, the latest technology trends in the automotive industry, research trends in measurement and analysis techniques for insulation evaluation, and the latest research trends in the elucidation of partial discharge and degradation characteristics of motor insulation were investigated. The committee met online in response to the corona ravages and completed the draft table of contents of the technical report in the second half of the investigation period.

B. Investigation R&D Committee on the Trend of Surface Treatment Technology for Plasma Materials

The committee is based on the idea that we can invigorate technological progress by identifying common problems in various fields of plasma surface technology. A wide range of technologies are divided into four fields: “film deposition,” “diffusion treatment,” “surface modification,” and “new

concepts," and information on the technological progress and problems in each field is being shared. Until last year, the committee meetings were held in the form of meetings to share information. This year, we are working to share more specialized issues in the form of a study group, at the online-based meetings (Fig. 1).

Fig. 1. Online-based meeting.

C. Investigation R&D Committee on Food Sterilization and Processing Technology by Pulsed Electric Field

Food disinfection is an important and essential task for food companies to prevent food poisoning and extend shelf life. However, heat pasteurization is the mainstream method for sterilization of food products because of its reliability and safety, but because of the severe deterioration of flavor and color, it is not enough to simply sterilize food products, and this is a major issue that food companies should review in order to differentiate their products from those of other companies. Therefore, pulsed electric field and discharge plasma sterilization have attracted the attention of food companies as a non-thermal sterilization technology. In addition, a need has arisen to see if it can be applied to the efficient production of food products in a derived form. This committee is investigating these latest research trends.

With respect to food processing, pulsed electric fields are used to promote the extraction of components from fruits. In addition, the quality of fruits and vegetables has been improved through the use of tissue perforation by pulsed electric fields, dried fruits by accelerated drying, and vegetable chips by color and shape preservation. It is also possible to soften food by piercing the tissue of food through the application of a pulsed electric field, and to soften beef, pork, poultry, hard vegetables, and beans to make them easier to eat for people with weak teeth. With the advent of an aging society, there is a need for a method of softening such foods to make them more palatable without reducing their nutrition and flavor.

Electrical Wire and Cables (EWC)

Chairperson: Naohiro Hozumi (Toyohashi University of Technology)
Secretaries: Yoshihisa Nagoya (Furukawa Electric Co., Ltd.)
Kenichi Furusawa (Sumitomo Electric Industries, Ltd.)
Hiroshi Nishino (Fujikura, Ltd.)
Kouji Miura (SWCC Showa Cable Systems Co., Ltd.)

Technical Committee on Electrical Wire and Cables (TC-EWC) is a committee organized in the IEEJ Power and Energy Society, and is comprised of members from cable manufacturers, power utilities, railway companies, universities and related research institutes such as Japan Electric Cable Technology Center (JECTEC) and Central Research Institute of Electric Power Industry (CRIEPI).

The technical committee organizes technical meetings to provide opportunities to present technical achievements and to promote R&D activities in this field. The technical committee so far held technical meeting as a joint meeting of TC-DEI (Technical Committee on Dielectrics and electrical insulation) and TC-EWC, on "Insulation performance and degradation, characteristics of DEI materials" in November, 2020. Although the meeting was partially held on-line because of the Corona issue, it was flooded with deep discussions.

The technical committee will also hold two more technical meetings, which are jointly organized by TC-DEI and TC-EWC. The topic of the technical meeting was "Insulation performance and aging of cable system, electric properties of insulating and dielectric materials". Until the end of FY2020 we will hold meetings on "Degradation and malfunction of wires/cables and countermeasures" and "Technology trends in cable and wire systems (product technology, aging mechanism clarification, diagnostics, evaluation, judgment methods)" under this scheme.

In FY 2020 TC-EWC participated the symposium on "Power facilities supporting Japanese lifelines", organized by the TC on Static Apparatus, and made a presentation on cable technologies.

In addition to organizing technical meetings, forums and symposia, the technical committee supervises investigation committees dealing with subjects related to electrical wire and cables. Two investigation committees are in active during FY2020 on the following subjects, respectively, i.e. "Technology

transition and issues in distribution insulating wires and cables and their accessories responding to environmental usage" (this committee has been terminated after publishing a technical report), and "Status quo and technology trends in power transmission cables". One more committee is now in preparation.

In FY2020 the technical committee published a special issue on "Recent Technologies on Electric Power Wires & Cables" (2020 Vol. 140 Issue 4) with 8 outstanding full papers.

It is quite regrettable that because of the Corona issue we could not organize a site visit that is recognized a good opportunity to be exposed with new technologies, as no photo is available this year let us again paste one taken last year when we visited "TEPCO Decommissioning Archive Center in Fukushima" so that the readers can recognize most of the members of the committee.

We strongly believe that Electric wire and cables occupy an important part of infra-structure that sustains stable supply of electric power. It is thus an important responsibility of us to clarify the social background and development process lead to the establishment of the technologies, and pass these onto the next generation.

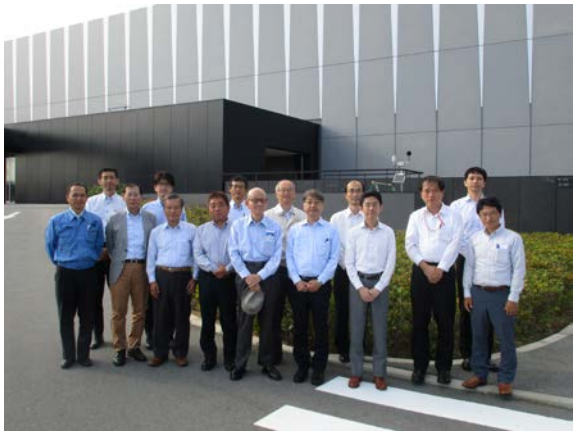

Fig. 1. Visit to TEPCO Decommissioning Archive Center in Fukushima.

High Voltage Engineering (HV)

Chairperson: Hideki Motoyama (CRIEPI*)
Secretaries: Takeshi Iwata (Hitachi Corp.)
Yoshiki Nakazawa (Toshiba Energy Systems & Solutions Co.)
Assistant Secretary: Hirokazu Matsumoto (CRIEPI*)
*CRIEPI: Central Research Institute of Electric Power Industry

Overview

Technical committee (TC) on High Voltage Engineering (HV) is a TC belonging to Power & Energy (P&E) Society of the IEE of Japan (IEEJ). This TC aims to promote exchange of information and knowledge in the field of high voltage engineering from international and domestic viewpoints. The major activities of the TC include establishing Investigating R&D Committees, publishing IEEJ technical reports, and organizing Technical Meetings. This TC has dealt with issues related to high voltage engineering such as generation, measurement and evaluation of high voltages, lightning, insulation coordination, EMC/EMI/EMF and electromagnetic transient (EMT) analysis. As of November 2020, 5 investigation committees are active (Table 1), and three technical reports are slated to be published shortly (Table 2).

Organization

The TC on HV consists of Chairperson (1), Secretaries (2), Assistant Secretary (1), and members belonging to the following institutes: university (4), research institute (1), electric power utility (5), rail way company (1), and manufacturer (7).

Information on IWHV

One of the major missions of the International Workshop on High Voltage Engineering (IWHV) is to provide researchers, engineers, etc. mainly in Asian countries with an opportunity of sharing novel findings in the field of high voltage engineering.

Since IWHV was first held in Okinawa, Japan in 1999, IWHV has been held in various cities in Japan. IWHV is now held once in two years. In every IWHV, participants have active discussions and exchange their knowledge and experience with each other. In addition, contributions with original findings are selected and introduced in a special issue of IEEJ Transactions on Electrical and Electronic Engineering.

IWHV2020 was the 12th IWHV meeting. Unlike ordinary IWHV meetings, IWHV2020 was held online from November 19th to 20th due to the COVID-19 pandemic.

IWHV2020 included six sessions where 18 papers were presented orally during the two-day meeting. In accordance with the rule of IWHV, presentations and discussions were made in English.

We hope that IWHV2020 was a productive meeting for all the participants.

Table 1. Investigation R&D Committees in the TC on HV.

Investigation R&D Committee	Active period	Chairperson
Investigation R & D Committee on Characterization of Electromagnetic Fields around Electric Power Facilities	3 years from 2018	Kenichi Yamazaki (CRIEPI)
Investigation R & D Committee on Analytical Technique Advancement of Insulation & EMC design on General Electric Equipment	3 years from 2018	Toshiaki Ueda (Daido University)
Investigation R & D Committee on Lightning Protection Issues for Traction Power Supply and Signaling System for Railway	3 years from 2019	Hitoshi Hayashiya (East Japan Railway Co.)
Investigation R & D Committee on Clarification of Lightning Damage Mechanism and Lightning Protection Measures on Power Distribution Lines	3 years from 2019	Tomoyuki Sato (Tohoku Electric Power Co.)
Investigation R & D Committee on Lightning Protection Issues for Offshore Wind Power	2 years from 2020	Koichi Yamabuki (National Institute of Technology, Wakayama College)

Table 2. Technical Reports to be published.

Title of Technical Report	Chairperson
Social Infrastructure Insulation and EMC Design based on Lightning Risk Assessment	Toshihisa Funabashi (Nagoya University)
Technological Transition and Future Issues for Rationalization of Lightning Protection Design of a Medium-Voltage Distribution Line	Shinji Yasui (Nagoya Institute of Technology)
Trends in the Latest Technology for Maintaining the Lightning Resistance and Improving the Operating Rate of Wind Power Generation Facilities	Kazuo Yamamoto (Chubu University)

Activities of Investigation Committees in the DEI Technical Committee

Insulation Diagnosis Technologies for Electric Power Apparatus and Equipment Using New and Practicable Insulation Materials

Chairperson: Yoshiyasu Ehara (Tokyo City University)
Secretary: Takashi Kurihara (CRIEPI*)
*CRIEPI: Central Research Institute of Electric Power Industry

Objective

Since cables and electric power apparatus were installed in the high-growth period of the Japanese economy, more than 40 years have passed and a lot of them have reached their design lifetimes and time to replace. On the other hand, it is requested because of the cost reduction in the operation of the power apparatus and equipment to understand their degradation conditions and prevent the loss due to their breakdown beforehand. Moreover, it is strongly requested to use the electric power apparatus for the lifetime limit.

The insulation materials and the structure of the electric power apparatus and equipment are different according to the manufacturing age and voltage class. The insulation materials were transformed to the artificial ones from natural ones, and they have been improved and diversified. Insulation technologies have also progressed, and breakdown and lifetime theories of insulation materials have been established. Also, an electric field calculation and the various new measuring methods have been established, and the technologies relating to the insulation materials have entered a mature phase. With those transitions of electrical insulation materials, insulation materials with various functions are now adopted in the main insulated system, and they are very hard to degrade. However, physical phenomena to determine degradation indexes and diagnostic technologies to detect pre-breakdown phenomena for those apparatus and equipment have not been established. Also, the electric power apparatus and equipment for which it is hard to carry out lifetime prediction is also being manufactured.

On the other hand, in recent years, low price sensor and telecom infrastructures have become available and the studies using IoT technologies are increasing. Now, we can deal with big data such as data about practical operation, operated apparatus and equipment, and diagnosis now all at once. From now on, if the remote insulation degradation diagnostic system applying the new diagnostic technique is established, it will become possible to improve an insulation diagnosis precision using big data analysis etc. For the purpose, it is still significant to understand the characteristic and the degradation mechanism of the newest insulation material.

For this reasons, the investigation committee on insulation diagnosis technologies for electric power apparatus and equipment using new and practicable insulation materials was established in April 2017 with a total of 23 persons' composition from universities, cable and electric power apparatus manufacturers, insulating material manufacturers, electric power companies, a research institute, a diagnostic company, and users. This investigation committee is aiming at investigating and examining the trend and problems on the degradation characteristics of insulation materials, diagnostic technologies, and practical use of IoT and big data in insulation diagnosis.

Activities

The committee performs the further investigation and examination to the above problems and future trends. The main investigations of the committee are as follows;

- Investigation of the newest insulation degradation measurement technologies for dielectric and electrical insulation materials.
- Investigate of material characteristics, degradation mechanisms, and insulation degradation diagnostic technologies relating to the electric power apparatus and equipment using new insulation material.
- Investigation of practical applications of IoT technologies or big data to insulation diagnosis.

In this committee, sixteen meetings were held since 2017. Published papers were surveyed focusing on the insulation degradation diagnostic technologies based on characteristics of the insulating materials. The committee held investigation tours three times on the cable and the insulating material manufacturers and the users. In addition, the committee held the study meeting with degradation phenomena and diagnosis technologies for power cable and electrical insulating materials in 2018, and introduced investigated results on insulation materials and the latest diagnostic technologies for 3 to 77kV electric power equipment in the annual meeting of IEEJ in March 2020. The final technical report will be issued from IEE Japan in February 2021.

Term of Investigation

The term of this committee is three years from April 2017 to March 2020.

Members of Investigation Committee

Chairperson: Yoshiyasu Ehara (Tokyo City Univ.)
Secretary: Takashi Kurihara (CRIEPI)
Members: Seiichi Inoue (Fuji Electric), Tadashi Ikemori. (Wave System), Koji Urano (SE Technology), keisuke.etoh (Idemitsu), Yasumitsu Ebinuma (Shonan Ins. of Tech.), Hiroyuki kamiya (Hitachi), Hiroaki Kamohara (dyden), Masahiro kozako (kyushu Ins. of Tech.), Hiroyuki kon (Fujikura), Naoto Shigemori (Furukawa Electric), Kiyoka Suenaga (JFE Steel), Makoto Takanezawa (Toshiba), Hiroaki Cho (Toshiba), kazunori Hayashi (kitamachi planning), Hitoshi Hayashiya (JR East), Masayuki Hirai (kuwahara denko), Jun Fujiki (Nitto Shinko), Naoya Yamasaki (Sumitomo Electric Ind.), Yasuhiro Yoshioka (Meidensha), Keisuke Yokohata (Tokyo Electric Power), Masanobu Yoshida (Chubu Electric Power).

Advancing Tailor-made Composite Insulation Materials and Their Applications

Chairperson: Takahiro Imai (Toshiba Infrastructure Systems & Solutions Corp.)
Secretaries: Muneaki Kurimoto (Nagoya University)
Hideki Misaka (CRIEPI*)
Assistant Secretary: Ryotaro Shimada (Hitachi, Ltd.)
*CRIEPI: Central Research Institute of Electric Power Industry

Objective

Tailoring of polymer composites enables insulation materials to meet demand in electric power and electronics sectors. Previous investigating R&D committee (Chairperson: Dr. Toshikatsu Tanaka, Waseda University) summarized the cutting-edge research on tailoring of composites and published IEEJ technical report No. 1455 in May 2019.

Advent of Artificial Intelligence (AI) including Materials Informatics (MI) is just about to accelerate the tailoring of composites. Therefore, the subsequent committee started in January 2020. Our investigating R&D committee has two main objectives as shown in Figure 1. We believe that our activities toward the objectives play an initiative role in polymer composite insulation material fields.

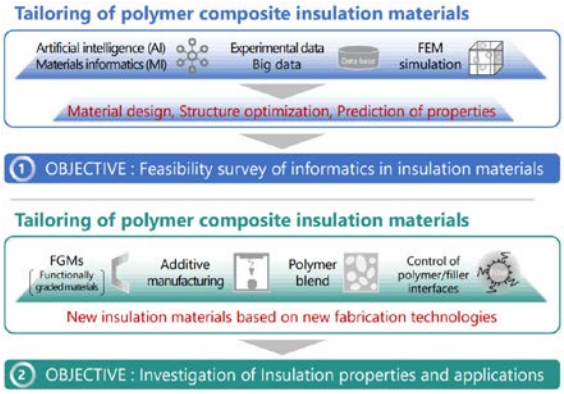

Fig. 1. Two main objectives in investigating R&D committee.

Activities

A. TMC (Tailor-Made Composite) Newsleaf

TMC Newsleafs have been issued monthly to share the latest technology and information as shown in Figure 2. Editor, Dr. Muneaki Kurimoto, gathers the articles concerning topics of interesting papers, self-introductions and upcoming related conferences from the committee members. Members look forward to reading the Newsleafs.

Fig. 2. TMC Newsleaf No. 1 and 2.

B. Special Lecture for Understanding of Materials Infomatics

COVID-19 (coronavirus) pandemic has an impact on the committee but cannot stop our activities. We keep the investigative activities and continue to hold the trimonthly meeting. In particular, the 2nd meeting held on web in May 2020 invited the specialist, Dr. Yasutaka Nishida (Toshiba Corporation), of Materials Informatics (MI). His special lecture enhanced our understanding of the MI and stimulated our efforts for the feasibility survey of the MI in the insulation material fields.

Moreover, we plan a special lecture of new insulation materials based on new fabrication technologies and their applications in web or

face-to-face meeting.

Term of Investigation

January 2020 to December 2022 (three years)

Members of Investigation Committee

Committee members are shown in Table 1. Our committee consists of 28 persons. Ratio of academia including research institute and industry is almost half and half. We believe that it is particularly good balance. Industry members consist of many specialists belonging to manufactures in electric power, electronics, cable, and material sectors.

Table 1. Investigation R&D Committees in the TC on HV.

Name	Affiliation
Araoka, N.	Fukuoka University
Ebina, T.	National Institute of Advanced Industrial Science and Technology
Fujimoto, N.	Sumitomo Seika Chemicals Co., Ltd.
Fujita, M.	SWCC Showa Cable Systems Co., Ltd.
Hasegawa, T.	Fuji Electric Co., Ltd.
Hayakawa, N.	Nagoya University
Igarashi, T.	Showa Denko K.K.
Iizuka, T.	Waseda University
Inada, T.	Hitachi Chemical Co., Ltd.
Iwata, S.	Osaka Research Institute of Industrial Science and Technology
Kasamatsu, N.	Nagase ChemteX Corporation
Kozako, M.	Kyusyu Institute of Technology
Kumada, A.	The University of Tokyo
Kurokawa, N	Japan Electrical Insulating and Advanced Performance Materials Industrial Association
Mabuchi, T.	Mitsubishi Electric Corporation
Miyata, K.	Denka Company Limited
Murakami, Y.	Toyohashi University of Technology
Nagata, M.	University of Hyogo
Ohki, Y.	Waseda University
Ohta, T.	Panasonic Corporation
Sasaki, K.	Meidensha Corporation
Sato, M.	The University of Tokyo
Shimozato, A.	Takaoka Toko Co., Ltd.
Suzuki, S.	Sumitomo Electric Industries, Ltd.
Tanaka, T.	Waseda University
Tanaka, Y.	Tokyo City University
Tohyama, K.	National Institute of Technology, Numazu College
Yoshimitsu, T.	Toshiba Mitsubishi-Electric Industrial Systems Corporation

(Alphabetical order)

Information for Asset Management of Electric Power Apparatus Based on Insulation Deterioration (IAM)

Chairperson: Katsumi Uchida (Chubu Electric Power Co., Inc.)
Secretary: Kiyoka Suenaga (JFE Advantech Co, Ltd.)
Assistant Secretary: Yuta Makino (CRIEPI*)
*CRIEPI: Central Research Institute of Electric Power Industry

Objective

Many electric power apparatuses in Japan manufactured from the 1960s to the 1980s, and lots of them have been used. Therefore, it has been required to maintain and replace them with minimizing maintenance costs and considering the fault risk. Asset management (AM) is one of the ways to achieve this.

Previous committees have surveyed various bibliographies and have discussed the strategic AM that can reduce and control maintenance costs by considering the deterioration and the fault risk on electric power apparatuses. Besides that, research institutes and organizations have discussed the application of AM to electric power apparatuses. However, AM has not been widely applied to the electric power apparatuses yet. The next step is the widespread use of AM in apparatus users.

This committee was established in 2019 in order to clarify the reason why AM has not been widely applied to the electric power apparatuses and proposes the necessary conditions for the widespread use of AM. To achieve that, we investigate bibliographies and actual examples of the application of AM to electric power apparatuses and discuss what information is necessary for the application of AM to electric power apparatuses.

Activities

The committee is composed of 12 members from domestic and overseas universities, manufacturing and electric power companies, and a research institute. Main investigation topics are as follows.

(1) Understanding of necessary information for the application of AM to electric power apparatuses.
(2) Investigation of accuracy of diagnostic techniques to electric power apparatuses.
(3) Discussion appropriate AM for electric power apparatuses.

It is assumed that there is appropriate information for AM on each electric power apparatus. It is also important to collect information for AM continuously and to use this information in order to understand the trend. Therefore, we will investigate necessary information for the application of AM to apparatuses by surveying bibliographies and actual examples.

In addition, diagnostic techniques are applied to some apparatuses in order to understand their condition. The accuracy of diagnostic techniques is related to AM. Also, it is assumed that the accuracy of diagnostic techniques is improved with comparison of the diagnosis result and the condition of removed apparatus. By investigating the examples of the investigation of removed apparatus and its results of diagnostic techniques, we discuss how they are related

to AM.

Finally, we will discuss appropriate AM for electric power apparatuses and propose the necessary conditions for the application of it.

By these investigation and discussion, information for the application of AM can be collected widely and continuously, and AM will be conducted in earnest. As the result, it is expected that maintenance costs can be reduced and controlled.

This committee has been held four times. We have investigated and discussed the following points.

- Necessary information for the application of AM to electric power apparatuses.
- Diagnostic techniques to electric power apparatuses.
- Improvement of the accuracy of diagnostic techniques with comparison of the diagnosis results and the condition of removed apparatuses.
- Examples of the application of AM on electric power company and other companies that use electric power apparatuses.
- Current status of AM in overseas.
- Appropriate AM for electric power apparatuses.

Through the investigation and discussion on this committee, we have confirmed that it is important to apply AM to apparatuses even if it's not the appropriate AM. Then, the user can turn the PDCA. Also, the comparison of the diagnosis results and the condition of removed apparatuses is important to understand deterioration and improves the diagnostic accuracy. Through the PDCA including that comparison, AM would become appropriate AM.

As the last activity of this committee, we will hold the Symposium about AM on the annual meeting of I.E.E. Japan in 2021. We plan to present the overview of AM, examples of the application of AM, current status of AM in Japan and overseas and the proposal of the necessary conditions for the widespread use of AM. Audience will be able to imagine the specific application of AM to electric power apparatuses in their company.

Term of Investigation

The term of this committee is two years from April 2019 to March 2021.

Electrical Insulation Reliability of Power Modules

Chairperson: Masahiro Kozako (Kyushu Institute of Technology)
Secretaries: Naoya Kishi (Zeon Corporation)
Yuji Hayase (Fuji Electric Co., Ltd.)

Objective

In recent years, while power electronics systems have attracted considerable attention as a key energy-saving medium, improvements in their electrical insulating materials are needed. The development of next-generation power modules must focus on aspects such as miniaturization, high density, high heat resistance, high withstand voltage, high efficiency, and high reliability. Additionally, the reliability of electrical insulation is of particular importance. Currently, established evaluation methods are applied; however, in the future, understanding electrical phenomenon with even more evolved electric fields is inevitable. Therefore, the "Investigation Committee on Electrical Insulation Reliability of Power Modules" (Power module Insulation and Evaluation technologies (PIE)) committee) was established in December 2018 under the ambit of the Technical Committee on Dielectric and Electrical Insulating Materials of the IEEJ. The objective of this committee is to discuss existing and newly developed evaluation methods and insulating materials and subsequently propose evaluation material technologies that are suitable for developing next-generation power modules.

Fig. 1. A group photo of a visit to the Osaka Research Institute of Industrial Science and Technology

Fig. 2. A snapshot of the 6th meeting held on the web in June 2020.

Activities

The main fields of activity related to power modules are as follows. (1) Latest trends in development technology, (2) insulation performance reliability evaluation technology (current and new possibilities), (3) electrical insulating materials (current and new possibilities), and (4) insulation mechanism. The committee also takes an active interest in international activities related to setting standards for evaluating insulation reliability. The committee conducts four meetings at specific intervals during the course of a year.

Term of Investigation

The term of this committee is three years from December 2018 to November 2021. The final technical report will be issued from IEE Japan in 2022.

Members of Investigation Committee

Committee members are shown in Table 1. The investigation committee comprises 28 members from universities (9), laboratories (3), power-module makers (6), material makers (7), power-module users (1), experts (1), and agencies (1).

Table 1. Members of the committee.

Member	Affilication	Member	Affilication
Daiko, Y.	Nagoya Institute of Technology	Murakami, Y.	Toyohashi University of Technology
Haga, M.	Daicel Corporation	Nagata, M.	University of Hyogo
Ichikura, Y.	Toshiba Infrastructure Systems & Solutions Corporation	Ohki, Y.	Waseda University
Imai, Y.	National Institute of Advanced Industrial Science and Technology	Ohta, T.	Panasonic Corporation
Kadowaki, K.	Ehime University	Okabe, S.	Japan Science and Technology Agency
Kamei, N.	RIMTEC Corporation	Oomori, H.	Sumitomo Electric Industries, Ltd.
Kitani, R.	Osaka Research Institute of Industrial Science and Technology	Oowashi, K.	Sekisui Chemical Co., Ltd.
Kumada, A.	The University of Tokyo	Shimizu, T.	Toshiba Mitsubishi-Electric Industrial Systems Corporation
Kurimoto, M.	Nagoya University	Takada, T.	Expert (Tokyo City University)
Kurokawa, N.	Japan Electrical Insulating and Advanced Performance Materials Industrial Association	Taniguchi, K.	Fuji Electric Co., Ltd.
Kusukawa, J.	Hitachi, Ltd.	Yamada, S.	Denka Company Limited
Miyake, H.	Tokyo City University	Yamamoto, K.	Mitsubishi Electric Corporation
Morishima, Y.	Furukawa Electric Co., Ltd.	(Alphabetical order)	

Application of Quantum Chemical Calculations in the Field of Electrical and Electronic Insulation Materials

Chairperson: Satoshi Matsumoto (Shibaura Institute of Technology)
Secretaries: Hiroaki Miyake (Tokyo City University)
Yoitsu Sekiguchi (Sumitomo Electric Ind., Ltd.)
Assistant Secretary: Masamichi Kato (Yuka Industries)

Objective

In recent years, along with the development of quantum chemical calculation techniques, research to understand insulating materials using quantum chemical calculation techniques has expanded, and new knowledge has been obtained regarding the movement of electrons in polymer materials at the molecular level. Unlike the periodic crystal structures of metals or semiconductors, polymer materials used for electrical and electronic insulating materials have a hierarchical higher-order structure based on the arrangement of polymer chains. In addition to this, chemical structure that represents the arrangement of atoms show a very complicated appearance as shown in Fig.1. As a result, it was difficult to express the electronic structure of the insulating material well, which hindered the understanding of the correlation between the movement of electrons in the material and the dielectric phenomenon. This committee investigates the application of quantum chemical calculation in the field of insulating materials, evaluates its usefulness, and looks at future developments to promote the use of quantum chemical calculation and foster young researchers.

Main Survey Items

The committee plans to study application examples of quantum chemical calculations in the field of insulating materials by dividing them into several themes. Main themes are as follows.

A: Arrangement of relationship between calculated parameters and dielectric properties

B: Issues in large-scale calculations and trends in their solutions

C: Research trends overseas

Based on the results of these surveys, we will make presentations at study groups and national convention symposiums, and plan to compile them in technical reports.

Past Activities and Expected Effects

Activities so far regarding the application of quantum chemical calculations in the field of

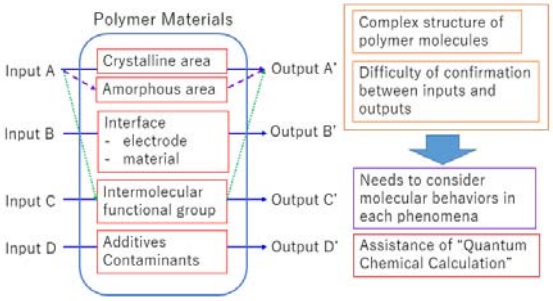

Fig. 1. Needs for quantum chemical calculation in the field of electrical and electronic insulation materials.

insulating materials are based on the APIANS at the ISEIM International Conference organized by the Research Committee on Evolving Tailor-made Composite Insulating Materials, the Technical Committee on Dielectric Insulating Materials and various dielectric and insulating materials have been taken up in a special session, and active discussions have already been made. In response to these activities, this committee had started full-scale activities in 2019. Main topic is a direct lecture on the research results in Japan among the application examples of quantum chemical calculation in the field of dielectric insulating materials in order to share information within the committee.

Expected results and investigating themes: For each of the themes, quantum chemical calculations can be used effectively in the field of electrical and electronic insulating materials by systematically organizing the obtained information. Looking at insulating materials at the molecular level is a new initiative, and we believe that a broad survey of research results and trends in Japan and abroad will provide guidance on the application and future development of quantum chemical calculations in this field. We also hope that such efforts will attract the interest of young researchers and engineers, and create a new trend in research on electrical and electronic insulating materials.

Standardization of Calibration and Advanced Measurements for Space Charge Distribution at High Temperature using Pulsed Electro-acoustic Method

Chairperson: Yasuhiro Tanaka (Tokyo City Univ.)
Secretaries: Hiroaki Uehara (Kanto Gakuin Univ.)
Yoshinobu Murakami (Toyohashi Univ. of Tech.)
Assistant Secretary: Hiroki Mori (Furukawa Electric Co., LTD.)

Objective

The investigation committee has two major purposes. First one is standardization of calibration for measurement of space charge distribution at high temperature using PEA (Pulsed electro acoustic) method. The PEA method has been used to measure space charge distribution in dielectric materials by many researchers, and it has been accepted, in general, as a useful method to understand electrical properties of dielectric materials. A basic measurement procedure at room temperature using PEA system has been already published by the domestic and international organizations for standardization, JEC (Japanese Electrotechnical Committee) and IEC (International Electrotechnical Commission), as JEC-TR-61004-2012 and IEC TS 62758, respectively. However, since many dielectric materials are expected to be used under high temperature and the demand to measure the space charge distribution under such environment has been increasing. Therefore, the investigation committee has been established to discuss and make a draft for the standard procedure to evaluate the PEA measurement equipment for high temperature measurement. Discussion in this committee is supposed to be reflected into the draft of TR in JEC and TS in IEC.

Activities

The committee is composed of 15 members, and investigating the followings.

A. Proposal of the calibration method of PEA measurement at temperature from room temperature to 100 °C.

A recommendation for the calibration method of PEA measurement at temperature from room temperature to 100 °C has been proposed and it has been published on as a technical report (TR) of JEC TR-61010:2020, entitled “The Calibration Method of Space Charge Measurement using Pulsed-electro-acoustic Method at High Temperature”, in March, 2020 (in Japanese).

B. Investigation of the advanced measurement techniques

The advanced measurement techniques, especially

developed by Japanese researchers are investigated, successively taking over the former activities carried out by the former committees. To open the obtained investigation results to the researchers in the world, the committee decided to publish the activities in English. The title of it is “Space Charge Measurement using PEA Method -Advanced Measurement Techniques and Typical Applications-”, and it will be published as a technical report of IEEJ which is normally published in Japanese. The followings are contents of the technical report that will be published in September 2020. Furthermore, a workshop for the published report is supposed to be held in ISEIM 2020.

Contents:
1. Introduction
2. Principle of PEA Measurement
3. Improvement of Measurement
4. Measurement under Specific Environments
5. Under Various Electric Field
6. Various Shape
7. Application to New Materials
8. Q(t) Method

Term of Investigation

April 2017 to March 2020

Advanced Nanomaterials and Nanostructure Control for Innovative Organic Devices and Life Science

Chairperson: Keizo Kato (Niigata University)
Secretaries: Shin-ichro Nakajima (Japan Aviation Electronics Industry, Ltd.)
Yusuke Aoki (Mie University)
Assistant Secretary: Akira Baba (Niigata University)

Recently, research on organic electronics, such as the development of devices and sensors using organic materials, is making great progress. Ubiquitous and wearable devices are also expected as flexible devices. Research on printed electronics and bioelectronics are also active. Research on such organic devices can also be applied to life sciences. For this organic device development and life science application, nano-materials and nanostructure control are considered to be very important, and various trials and research and development are currently underway.

The R&D committee was established in July 2017, with the term of three years. The investigation has focused attention on the nanomaterials and structure control for high performance organic devices and life science related to:
1) Advanced nanomaterials and nanostructure control technology,
2) Surface/interface properties of nanomaterials and devices, and their evaluation technology,
3) Nanostructure control of nanomaterials, organic thin films and composite films, and electronic and optical functions, and
4) Innovative organic devices and life science applications of nanomaterials, organic thin films, and composite films.

As shown in Table 1, 11 meetings were held. Lectures related to the above subjects were given by the committee members and non-member researchers. Recent research topics and trends were also introduced by the committee members, and earnest discussions were done. Advanced technologies such as nanomaterials and nanostructure control will lead to the development of high-performance organic devices. In addition, new functions are expected to be realized by the nanostructure control technologies of nanomaterials and organic/composite thin films. The development of innovative organic devices and life science applications are greatly expected.

Table 1. Meetings of the Investigating R&D Committee.

	Dates	Venue
1st	Jul. 28, 2017	Gofuku Campus, Toyama University
2nd	Sep. 26, 2017	Surugadai Campus, Nihon University
3rd	Dec. 8, 2017	Ookayama Campus, Tokyo Institute of Technology
4th	Apr. 23, 2018	Open Innovation Office, Osaka University
5th	Jul. 19-20, 2018	Head Office, Corona Corporation, Izumiya, and Machinaka Campus Nagaoka
6th	Dec. 6, 2018	Toyosu Campus, Shibaura Institute of Technology
7th	Mar. 14, 2019	Sapporo Campus, Hokkaido University
8th	Jul. 5-6, 2019	Sado Toki Fanclub Hall and Hotel Osado
9th	Sep. 3, 2019	Ueda Campus, Iwate University
10th	Nov. 14, 2019	Head Office, Japan Aviation Electronics Industry, Ltd
11th	Jun, 12, 2020	ONLINE (Zoom)

EINA Magazine Publication

Chairperson: Masayuki Nagao (Toyohashi Univ. of Technology)
Editor: Yoshiyuki Inoue (Toshiba Mitsubishi-Electric Industrial Systems Corporation)
Secretaries: Masahiro Kozako (Kyushu Institute of Technology)
Norikazu Fuse (CRIEPI*)
*CRIEPI: Central Research Institute of Electric Power Industry

Objective

The EINA Committee, which publishes the magazine "Electrical Insulation News in Asia", aims to construct an international interactive channel for information exchange in the field of dielectrics and electrical insulation in the Pan Pacific region. We are currently providing an annual issue of EINA magazine as well as making it available in the EINA Website.

Chronicle of the Committee

The Committee, with official title "the Cooperative Research Committee (CRC) of Asian Interlink of Dielectrics and Electrical Insulation", was established by the late Professor M. Ieda in 1991. It played the leading role in initiation of this kind of work from Jan. 1991 to Dec. 1992. The committee reviewed the present status of scientific and technological cooperation in the field of dielectrics and electrical insulation in Asian countries and sought appropriate ways to promote informative interaction among the countries.

On the basis of the former activities, the CRC of "Electrical Insulation News in Asia" was founded by Professor H. Yamashita, Keio University in April 1994. One of its key activities was publication of the "Electrical Insulation News in Asia (EINA)" from No. 1 (Sept. 1994) up to No. 6 (Sept. 1999). This dedication contributed greatly to mutual understanding of electrical insulation activities in Asia.

Professor T. Tanaka of Waseda University took over this role in 2000, and expanded its role to accommodate information flow among Asian countries and to facilitate more timely flow of information through its Website. Three international technical exchange sessions were held in ICPADM 2000 (Xian Jiatong University, China), ISEIM 2005 (the Kitakyushu Intern'l Conf. Center, Japan) and ISEIM 2008 (Yokkaichi Cultural Hall, Japan) for promotion of information exchange and human contact among researchers of Pan-Pacific region in the field.

Professor M. Nagao of Toyohashi University of Technology) has chaired the committee since 2009. In the past the EINA magazine had been published by both sending by mail as well as through the website. In 2015 we sent out questionnaires on the way of the publication to readers. As the collected answers coincided with our intention, we decided to publish the magazine mainly in electronic PDF form through the website. However, we still continue to send printed booklets for those requesting and authors of articles in the issue. They are also distributed at related international conferences.

Activities

Our present committee consists of 8 key members listed in the right of this page and 20 other members listed in the last page of the magazine. One annual general meeting and also secretariat meetings as needed are held to plan, carry out and review its activities. The EINA Magazine No. 26 was published in electronic form in December 2019 as shown in Fig.1 and was also uploaded to our website http://eina.ws/.

Please visit the website. It may be of interest to you.

The Committee has been financially supported by IEEJ as well as by voluntary contributions from Japanese enterprises.

Term of Investigation

The term of this committee is two years from September 2019 to August 2021. Thereafter a succeeding committee will be set up every two years.

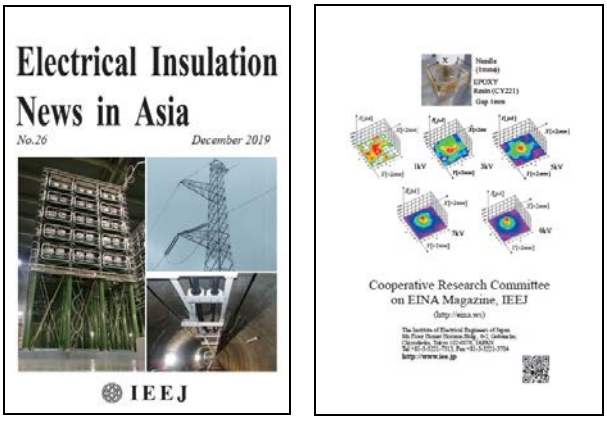

Fig. 1. Front and rear covers of the latest issue of EINA magazine (EINA No. 26, Dec. 2019).

The web site of the committee

http://eina.ws/ where you can browse the EINA magazines.

Activities of Other Committees Related to Electrical Insulating Materials

IEC TC 15 Japanese National Committee

Chairperson: Y. Yamano (Chiba University)
Secretaries: Y. Wakashima (Japan Electrical Safety & Environment Technology Laboratory)
A. Kawaguchi (Japan Electrical Safety & Environment Technology Laboratory)

The scope of IEC TC15 is to prepare international standards including specifications for solid electrical insulating materials alone and in simple combinations1). This includes coatings which are applied in the liquid state but cure to solids, such as varnishes and coatings. The standards include test methods and guidance where these are required for the specifications. Although TC15 Japanese National Committee (TC 15 of JNC) has certainly the same scope as that for IEC TC15, its mission is accomplished by consulting with Japanese industrial situations and market in the world.

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. As shown in Table 1, the current activities of TC15 are carried out by 3 working groups (WGs) and 6 maintenance teams (MTs). IEC TC15 has now more than 160 published standards.

IEC TC 15 meeting of this year has been postponed until September – October 2021 due to the Covid-19. The secretary of TC15 informed us that members of TC15 working groups and maintenance teams are encouraged to utilize online web meeting (such as ZOOM) to address the decisions reached during the 2019 meetings (Frankfurt) in their areas of responsibility and provide necessary documents for appropriate action as referenced in the Meeting Report 15/907A/RM. Following this information, the number of meetings of TC15 of JNC held in this year is reduced from 3 times to 2 times in a year, keeping the activities of revision works as those in last year. The discussions of the revision works were carried out by the online web meeting and e-mail.

As described 2 sentences before, IEC TC15 has 3 WGs and 6 MTs which deals with the individual solid insulating materials for electrical and electronics applications. The kind of insulating materials concerned with TC 15 are classified by fundamental and basic category. Member of TC15 of JNC are encouraged to activate the global market through their technologies of high levels. TC15 of JNC is contributing to the standardization works in WGs and MTs as the convenors and experts of the WGs and MTs, which are WG6 MT3, MT10, MT14, MT15 and MT16. Especially, MT3 and MT16 are managed by Japanese convenor.

The current working projects in TC15 is shown in Table 2. Nine standards are now under revising process. Two JP members are the project leaders for the revisions of PP (Polypropylene) film and PI (Polyimide) film. Last year, a newly revised 3 standards, a series of “vulcanized fibre for electrical purposes” (IEC 60667 -1, -2, -3), has been published with the contribution of the project leader from JP. It is remarkable that JP experts have contributed to the revision of such standards which are old material, but deal with environmentally friendly electrical insulating material.

Table 1. Working Groups and Maintenance Teams in TC 15

Working Groups in active		
WG No	**Title**	**Number of JP expert**
5	Flexible insulating sleeving for electrical purposes	1
6	Rigid fibrous reinforced laminates for electrical purposes	0
7	Resins and varnishes	1
Maintenance Teams in active		
MT No	**Title**	**Number of JP expert**
3	Plastic films	2
10	Combined flexible materials	2
11	Mica products	0
14	Pressboard and related material	1
15	Cellulosic paper products	1
16	Miscellaneous	2

Table 2 .Working Projects Setting up in TC15 (2020.11.01)

Project Reference	Current Stage	Project Leader
IEC 60455-2 ED4 Resin based reactive compounds used for electrical insulation - Part 2: Methods of test	preparation of CC 2020-02	Gunther Baumgarten (DE)
IEC 60455-3-8 ED2 Resin based reactive compounds used for electrical insulation - Part 3 - Sheet 8: Resins for cable accessories	approved for FDIS 2019-08	Gunther Baumgarten (DE)
IEC 60674-3-1 ED2 Plastic films for electrical purposes - Part 3: Sheet 1: Biaxially oriented polypropylene (PP) film for capacitors	Approved for Pub. 2020-07	Yoshitaka Hoseki (JP)
IEC 60674-3-4 ED2 Specification for plastic films for electrical purposes - Part 3: Sheets 4 to 6: Requirements for polyimide films used for electrical insulation	Approved for CDV 2020-09	Yoshiaki Yamano (JP)
IEC 60684-2 ED4 Flexible insulating sleeving - Part 2: Methods of test	Approved for CDV 2020-08	Paul Sheridan (GB)
IEC 60684-3-281 ED2 Flexible insulating sleeving - Part 3: Sheet 281: Heat-shrinkable, polyolefin sleeving, semiconductive	Approved for CDV 2020-06	Paul Sheridan (GB)
IEC 60684-3-282 ED2 Flexible insulating sleeving - Part 3: Sheet 282: Heat-shrinkable, polyolefin sleeving - Stress control	Approved for CDV 2020-06	Paul Sheridan(GB)
IEC 60763-2/AMD1 ED2 Amendment 1: Specification for laminated pressboard - Part 2: Methods of test	Approved for CDV 2018-10	Lars Dreier (CH)
IEC 60893-2 ED3 Insulating materials - Industrial rigid laminated sheets based on thermosetting resins for electrical purposes - Part 2: Methods of test	Approved for CDV 2019-06	Alan Johnson (US)

IEC TC 112 Japanese National Committee

Chairperson: Hiroya Homma (CRIEPI*)
Secretary: Takashi Kurihara (CRIEPI*)
Associate Secretary: Kenichi Yamazaki (Toshiba)
*CRIEPI: Central Research Institute of Electric Power Industry

IEC TC 112 deals with many international standards and specifications on “Evaluation and qualification of electrical insulating materials and systems”. TC 112 was established in 2005 based on the part of TC 15 and TC 98. TC 98 and the related sub-group in TC 15 were disbanded to the establishment of new technical committee. TC 112 Japanese National Committee (JNC) was also established in 2005 to correspond to the activities in TC 112 and to concern with related Japanese standards.

TC 112 involves eight working groups (WG) and dealing with more than 50 standards. TC 112 JNC includes eight corresponding WGs and one more WG that relates with the Japanese Industrial Standards (JIS). The WG structure of TC 112 JNC is shown in Table 1. 24 JNC experts are registered to the eight international WGs and the convener of WG8 is now taken by Prof. Yasuhiro Tanaka. In this reason, Japanese members are very active in this standard region.

Table 1. WG structure of TC 112 JNC.

WG	Subject
1	Thermal endurance
2	Radiation
3	Electrical strength
4	Dielectric/resistive properties
5	Tracking
6	General methods of evaluation of electrical insulation
7	Statistics
8	Various material properties
9	Japanese Industrial Standards (JNC only)

From September 24 to October 2, 2020, IEC TC 112 Meeting was held via Zoom and meetings of WGs were held during the weeks. 12 experts and 1 guest from JNC remotely participated in the TC 112 virtual meetings including the Plenary, Advisory group and WGs meetings.

The next meetings of TC112 will be held in Kista, Sweden from October 25 to 29, 2021.

Recent standards discussed in TC112 are partly listed:

A. WG1

- IEC 60216-3: Electrical insulating materials - Thermal endurance properties - Part 3: Instructions for calculating thermal endurance characteristics.
- IEC 60216-5: Electrical insulating materials - Thermal endurance properties - Part 5: Determination of relative thermal endurance index (RTE) of an insulating material.
- IEC 60216-6: Electrical insulating materials - Thermal endurance properties - Part 6: Determination of thermal endurance indices (TI and RTE) of an insulating material using the fixed time frame method.
- IEC/TR 60216-7-2: Electrical insulating materials - Thermal endurance properties - Part 7-2: Results of the round robin tests to validate procedures of IEC TS 60216-7-1 by non-isothermal kinetic analysis of thermogravimetric data (PL: Jun Haruhara).

B. WG2

- IEC 60544-5: Electrical insulating materials - Determination of the effects of ionizing radiation - Part 5: Procedures for assessment of ageing in service.

C. WG3

- IEC/TS 61934: Electrical insulating materials and systems - Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses.

D. WG4

- IEC 62631-2-2: Dielectric and resistive properties of solid insulating materials - Part 2-2: Relative permittivity and dielectric dissipation factor – High frequencies (1 MHz to 300 MHz) - AC Methods (PL: Yoshiaki Yamano)
- IEC 62631-3-1: Dielectric and resistive properties of solid insulating materials Part 3-1: Determination of resistive properties (DC methods) – Volume resistance and volume resistivity, general method (PL: Jun Haruhara).
- IEC 62631-3-2: Dielectric and resistive properties of solid insulating materials Part 3-2: Determination of resistive properties (DC methods) – Volume resistance and volume resistivity, Surface resistance and surface resistivity (PL: Jun Haruhara).

E. WG5

- IEC 60112: Method for the determination of the proof and the comparative tracking indices of solid insulating materials.
- IEC 60587: Electrical insulating materials used under severe ambient conditions - Test methods for evaluating resistance to tracking and erosion.
- IEC/TR 62039: Selection guide for polymeric materials for outdoor use under HV stress.

Fig. 1. A screen shot of IEC TC 112 Virtual Plenary Meeting.

F. WG6

- IEC 61857-33: Electrical insulation systems - Procedures for thermal evaluation - Multifactor evaluation with increased factors at elevated temperature.
- IEC 61857-41: Electrical insulation systems - Procedures for thermal evaluation - Part 41: Specific requirements for electrical insulation systems for use in dry-type high-voltage transformers with operating voltages of 1kV and above.
- IEC 61857-42: Electrical insulation systems - Procedures for thermal evaluation - Part 42: Specific requirements for evaluation of an electrical insulation system (EIS) used for road transportation applications
- IEC/TR 61858-3: Electrical insulation systems - Thermal evaluation of modifications to an established electrical insulation system (EIS) - Part 3: Clarification of major and minor components.
- IEC 63177: Test method for compatibility of construction materials with electrical insulating liquids.

G. WG7

- IEC/TR 60493-2: Guide for the statistical analysis of aging test data - Part 2: Validation of procedures for statistical analysis of censored normally distributed data.

H. WG8

- IEC/TS 62836: Measurement of internal electric field in insulating materials - Pressure wave propagation method.

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

Chairperson: Tsuguhiro Takahashi (CRIEPI*)
Secretary: Toshiaki Rokunohe (Hitachi, Ltd.)
Secretary: Akiko Kumada (The University of Tokyo)
*CRIEPI: Central Research Institute of Electric Power Industry

CIGRE (International Council on Large Electric Systems) has 16 Study Committees (SC) belonging to each of following four 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. The activity of CIGRE SC's is principally research oriented one.

SC D1 has now following 6 Advisory Groups (AG): Strategic and Customer AG, Tutorial AG, AG D1.01 (Insulating Liquids), AG D1.02 (High Voltage Testing and Diagnostic), AG D1.03 (Insulating Solids) and AG D1.03 (Insulating gases and mixtures SC). D1 consists of these AGs and following 26 WGs.

A. Liquids

WG D1.65 (Mechanical properties of insulating materials and insulated conductors for oil immersed power transformers), JWG A2/D1.51 (Improvement to partial discharge measurements for factory and site acceptance tests of power transformers), WG D1.68 (Natural and synthetic esters-Evaluation of performance under fire and the impact on environment), WG D1.70 (Functional Properties of modern insulating liquids for transformers), JWG D1/A2.77 (Liquid Tests for Electrical Equipment and similar electrical equipment) and JWG B1/D1.75 (Interaction between cable and accessory materials in HVAC and HVDC applications)

B. Testing & Diagnosis

WG D1.50 (Atmospheric and altitude correction factors for air gaps and clean insulators), WG D1.54 (Basic principles and practical methods to measure the AC and DC resistance of conductors of power cables and overhead lines), WG D1.60 (Traceable measurement techniques for very fast transients), WG D1.61 (Optical corona detection and measurement), WG D1.63 (Partial discharge detection under DC voltage stress), WG D1.69 (Guidelines for test techniques of High Temperature Superconducting(HTS) systems), JWG B1/B3/D1.79 (Recommendations for dielectric testing of HVDC gas insulated system cable sealing ends), WG D1.72 (Test of material resistance against surface arcing under DC) and WG D1.74 (PD measurement on insulation systems stressed from HV power electronics)

C. Gases

JWG D1/B3.57 (Dielectric testing of gas-insulated HVDC systems), WG D1.66 (Requirements for partial discharge monitoring systems for gas insulated systems) and WG D1.67 (Dielectric performance of new non-SF6 gases and gas mixtures for gas-insulated systems)

D. Solids

JWG D1/B1.49 (Harmonized test for the measurement of residual inflammable gases), WG D1.56 (Field grading in electrical insulation systems), WG D1.58 (Evaluation of dynamic hydrophobicity of polymer insulating materials under AC and DC voltage stress), WG D1.59 (Methods for dielectric characterization of polymeric insulating materials for outdoor applications), WG D1.62 (Surface degradation of polymeric insulating materials for outdoor applications), WG D1.64 (Electrical insulation systems at cryogenic temperatures), WG D1.73 (Nanostructured dielectrics: Multi-functionality at the service of the electric power industry) and JWG D1/B1.75 (Strategies and tools for corrosion prevention for cable systems).

The draft preferential subjects for the 2022 SC D1 Paris group meeting are,

- PS1: Testing, Monitoring and Diagnostics (Testing and experience with non-standardized, composite and combined voltages / PD measurement under DC, rectifier and impulse stress / Requirements of systems for testing, monitoring and diagnostics)
- PS2: Materials for electrotechnical purposes (Ageing under electrical, mechanical & thermal stress (e.g. power electronics and semiconductors, load cycling, higher temperatures, compact applications, corrosion and radiation ageing, etc.) / Functional properties of insulation materials & testing for validation / Materials for battery and charging devices)
- PS3: Simulation tools partnered with measurement techniques (Application and development of new multiphysical simulation methods / Digital twin for insulation components and insulation systems / Physical models and sensors).

The next regular meeting and group discussion

meeting of SC D1 will be scheduled during 2021 Centennial Session in Paris, France in August. The Japanese National SC D1 will hold 2 or 3 meetings for its preparation.

Developing Networks for Young Researchers in Fundamentals and Materials Society in IEEJ

Chairperson: Yusuke Nakano (Kanazawa University)

Introduction

For the further activation of the field in discharges, electrical insulation and its materials in the Fundamentals and Materials Society (FMS) in IEEJ, it is important to foster young leaders who will lead the next generation and to build a young researcher network. In Oct. 2019, we have newly established the committee consisting of young researchers (one from the university and three from the industry), which provides the opportunity to meet other researchers and discuss common issues and interests. This article introduces the purpose, past activities and future plans of the committee.

Objective

The formation of networks among young researchers would be important for promoting cross-disciplinary research activities and enhancing research collaboration between industry, academia and public institutions in future activity.

Behind the establishment of this committee is the weakening of student exchanges at academic societies. In the previous situation, academic conferences/ symposia are almost the only chance for students to make connections to researchers in industry. Unfortunately, many students see the conference only as a place for research presentations and do not understand that it is a valuable opportunity as mentioned above. To make matters worse, even those opportunities have been lost because of COVID-19, in 2020.

This committee proposes exchange events for young researchers to create a network of young researchers through research activities.

Activities

On September 1st – 3rd 2020, annual conference of FMS was held online. On the first day, the committee had a session of a young exchange event. Fig. 1 shows the number of participants, including committee members. The number was quite small compared to the number of participants in the conference, but this is because the online event could not fully be known in advance. According to the questionnaire, many of the participants expected to increase their acquaintances in the same field, as shown in figure 2, which is largely consistent with our objective. At the online event, participants were divided into four groups (3-5 persons/group) and they talked on several themes prepared. Since the social gathering was not originally planned, it is presumed that the participants could have the opportunity to talk with other affiliations.

For further network construction and expansion of activities in the committee, such online exchange meetings have regularly been held about once a month from after the conference.

Future

From the questionnaire results, students and young researchers also want to form networks. The committee activities have just begun, and in the future, in addition to disseminating activities related to young researchers, we aim to build a network of young researchers that transcends the boundaries of fields and academic societies.

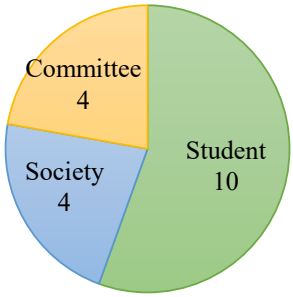

Fig. 1. The number of participants in online event in annual meeting of FMS.

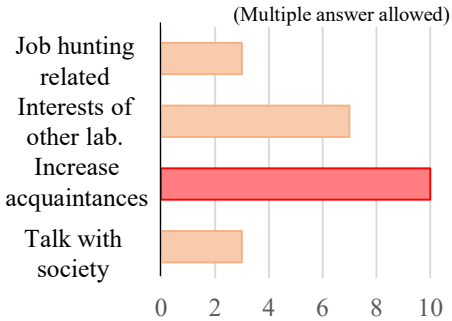

Fig.2. Questionnaire for expectations of participation

RESEARCH ACTIVITIES AND TECHNICAL EXCHANGES IN ASIAN COUNTRIES

Conference Records

2020 IEEE International Conference on High Voltage Engineering and Application (ICHVE 2020)

The 2020 IEEE International Conference on High Voltage Engineering and Application (ICHVE 2020) was held on September 7-10, 2020, organized by Tsinghua University, Beijing China and endorsed by IEEE Dielectrics and Electrical Insulation Society.

Due to the impact of the Covid-19, this conference was held online for the first time. However, it was by far the largest international conference on High Voltage Engineering. The conference received 1132 abstracts. Although due to the impact of the epidemic, some research work was difficult to complete, 730 full texts were received, and 695 papers were finally accepted by the conference. The presentations are form 20 countries. There were 52 oral sessions and 13 open forums. The conference also had 3 keynote speeches and 23 invited speeches. More than 5,000 experts, scholars, and graduate students from all over the world participated in the conference through online platforms Zoom, Weibo and Bilibili.

The topics in ICHVE 2020 include electromagnetic fields; transients, grounding systems, and EMC; sensing, monitoring and diagnostics; high voltage testing and measurement; aging, space charge, and maintenance; advanced materials and insulation systems; high voltage systems and smart technologies; HVDC technologies and applications; industrial applications of high voltage. Figure 1 is the proportion of papers on each topic.

The winners of the 2020 IEEE Sun Caixin-Stan Gezbosky Award were announced at the conference. Professor Xingliang Jiang from Chongqing University, the winner of the Lifetime Achievement Award, and Dr. Chuanyang Li from the University of Connecticut, the winner of Young-Professional Achievement Award, gave lectures respectively. The conference also selected 10 best student papers.

The 8th International Conference on High Voltage Engineering and Application (ICHVE 2022) will be held in Cape Town, South Africa in 2022.

Bo ZHANG, Ph.D., Professor
Dept. Electrical Engineering
Tsinghua University

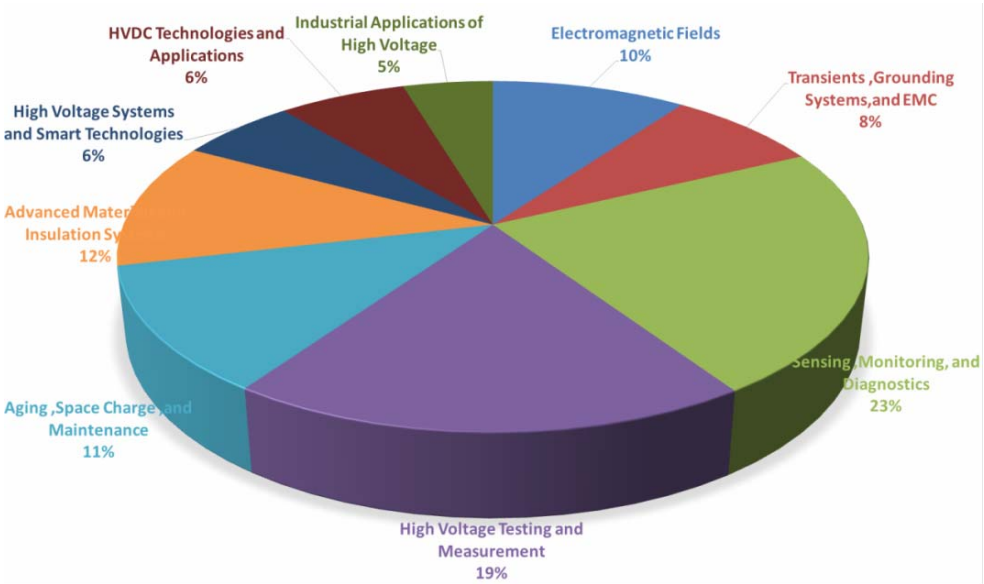

Fig. 1. Proportion of papers on the topics

International Symposium on Electrical Insulating Materials (ISEIM2020)

The 9th International Symposium on Electrical Insulating Materials (ISEIM2020) was held from September 13 to 25, 2020. ISEIM2020 was scheduled to be held in Waseda University, Tokyo, after the Olympic and Paralympic Games Tokyo 2020. However, owing to COVID-19 coronavirus pandemic, the organizing committee of ISEIM2020 decided to refrain from holding the symposium in Waseda University, but to hold ISEIM2020 as a web symposium. Even in the web symposium, ISEIM2020 was quite successful with 210 participants from 19 countries and 168 presentations including Workshop and digest reports, as shown in Table 1. Though the social events such as technical tours and banquet were cancelled, all participants would have fruitful time for presentation, discussion and information exchange on electrical insulating materials, in the similar level as the past ISEIMs (1st: Tokyo in 1995, 2nd: Toyohashi in 1998, 3rd: Himeji in 2001, 4th: Kitakyushu in 2005, 5th: Yokkaichi in 2008, 6th: Kyoto in 2011, 7th: Niigata in 2014 and 8th: Toyohashi in 2017).

ISEIM covers the technical fields of nanotechnology, material aging, inverter surge issues, and several other fundamental material research topics. ISEIM2020 accepted 250 abstracts, as of February 10, 2020, as shown in Table 2, which is the larger number than 201 papers presented at ISEIM2017. However, 154 papers from 16 countries were finally submitted to ISEIM2020, which might be because many researchers could not continue their experiments and/or simulations for their papers due to COVID-19.

ISEIM2020 as the web symposium was organized with the real-time events on Zoom and the on-demand events on Microsoft Teams.

Table 1. Country-wise distribution of participants (210 persons from 19 countries)

Country	Number of attendee	Country	Number of attendee
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	3		

Table 2. Country-wise distribution of papers (154 papers from 16 countries)

Country	Abstract submission	Final paper submission
Japan	87	73
China	71	35
India	17	12
Korea, Republic of	13	4
Indonesia	11	6
Italy	9	5
Germany	8	2
Malaysia	8	3
Egypt	5	3
France	4	1
Thailand	4	4
The Netherlands	3	0
Switzerland	3	1
Spain	2	2
Greece	1	1
Australia	1	0
Sweden	1	0
Algeria	1	1
UK	1	1

A. Real-time Events

The following 4 real-time events were organized (all times are listed in Japan Standard Time (JST)):

(1) Inuishi Memorial Lecture
(September 14, 20:00-21:10)
(2) Workshop on Space Charge Measurement Using the PEA method
(September 15, 19:00-21:40, 6 presentations)
(3) Special Planned Session on Organic Electronics and Bioelectronics for Innovative Devices
(September 16, 20:00-21:30, 5 papers)
(4) Plenary Lecture
(September 17, 20:00-21:10)

Each real-time event was scheduled everyday in the late evening of Asia, which is in the afternoon of Europe and in the morning of USA, in consideration of the international time difference.

The Inuishi Memorial lecture was given by Prof. L. A. Dissado (Fig. 1) at University of Leicester, UK, with the tile "The Role of Theory in Understanding Space Charge Distributions". As shown in Fig. 2, 95 participants attended his lecture on Zoom. After the lecture, Prof. Dissado addressed his poetic message to the participants, as follows:

"Science is a human endeavour to discover testable truth. It knows no boundaries, all can contribute their piece to the beautiful mosaic of human knowledge. Sometimes a piece may not seem to fit. Maybe it can be reconciled to give a deeper understanding, but maybe two pieces are irreconcilable. We must test and reject the wrong piece. Only that way can we progress. There is no shame in being wrong as long as the view is honestly held. Even the greatest human minds have been wrong sometimes. It should always be remembered that the wrong piece stimulates further advance. I am proud to be part of this community and look forward to the new insights that you will bring forth in your future work."

Fig. 1. Prof. L. A. Dissado as the Inuishi Memorial Lecturer

Fig. 2. Group photo after Inuishi Memorial Lecture (95 persons)

Fig. 3. Prof. Suwarno as the Plenary Lecturer

The Plenary Lecture entitled “Effects of Thermal Aging on Characteristics of Kraft Paper in Various Liquid Insulating Materials” was given by Prof. Suwarno (Fig. 3) at the Institut Teknologi Bandung, Indonesia. Figs. 4 and 5 show the lecturers and the textbook at the Workshop. The textbook is an IEEJ technical report No. 1491, which is written in English and has been published in August, 2020, just before ISEIM2020.

Each real-time event was electronically recorded and released on Microsoft Teams until the end of symposium on September 25. Live discussions were accepted after each presentation. Additional questions after the presentation were also accepted by QA sheets linked on Microsoft Teams and answered afterward by the presenters until September 25.

Fig. 4. Lectures at the Workshop

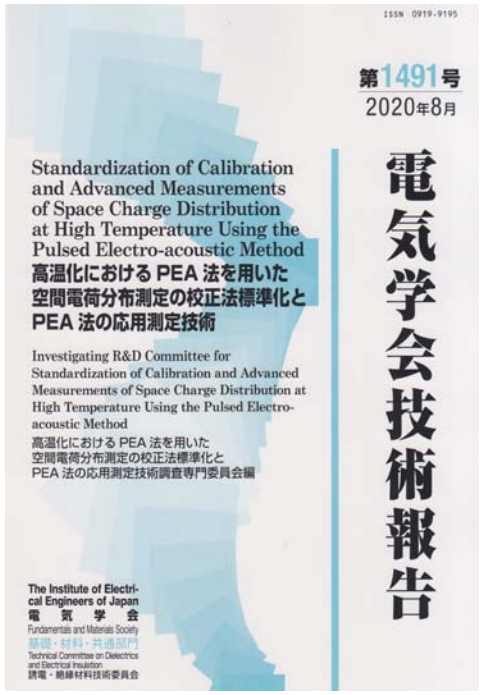

Fig. 5. Technical report in English No. 1491 as the textbook of the Workshop

B. On-demand Events

In the on-demand events, the presenters have uploaded their presentation files with voice and/or movies in pptx or ppsx format to the Microsoft Teams platform prior to the symposium. The participants could enjoy each presentation and give their questions to the presenters by QA sheets on Microsoft Teams. The presenters were required to respond to the questions on the QA sheets. The session chairs coordinated the discussions on the Microsoft Teams. The discussion was made until the end of symposium on September 25.

The following 5 on- demand events were organized:
(1) Special Planned Sessions (3 sessions, 20 papers)

Special Sessions were planned on the recent topics by 4 coordinators, one of which was arranged as the real-time event above and the other 3 sessions were organized as the on-demand sessions as follows:

(a) Emerging Technolo- gies for Next Gene- ration Electrical Insu- lating Material and Its Application (8 papers)
(b) Asset Management and Diagnosis for Electric Power Equ- ipment (6 papers)
(c) Innovative Functional Insulating Materials Development for Advanced Electric Power Apparatus – A Progressive Japanese Project (6 papers)

(2) Normal Sessions (7 sessions: A to G, 35 papers)

In the Normal Sessions, the pptx or ppsx presentations within 20 minutes were organized in the following 7 sessions:

(A) Space Charge Measurement and Simulation (5 papers)
(B) Space Charge on Dielectric Interface and Simulation (5 papers)
(C) Application of Current Integrated Charge Method (5 papers)
(D) Degradation Mechanism and Its Diagnostic Technologies I (3 papers)

Table 3. Young presentation awardees in MVP session (16 persons)

Name	Affiliation	Presentation Title
Mr. Kouta Hashimoto	Tokyo City University	Space charge and conduction current under dc high stress in modified polypropylene
Mr. Kazuki Endo	Tokyo City University	A new method of measuring electron-hole pairs with the PEA method just after electron irradiation
Mr. Chaitawat Chuayin	King Mongkut's Institute of Technology Ladkrabang	Study of asymmetrical leakage currents of metal oxide surge arrester due to multiple current impulses
Mr. Takahiro Mihara	Ehime University	Current reduction caused by strong local field in low-density polyethylene under various temperatures
Mr. Hanwen Ren	North China Electric Power University	Special behaviors of space charge inside insulating materials under different polarization conditions
Mr. A J Amalanathan	Indian Institute of Technology Madras	Investigation of the effect of silver sulfide on the dielectric properties of mixed insulating liquid
Ms. Niharika Baruah	Indian Institute of Technology Guwahati	Statistical analysis of natural ester based insulating liquid using hypothesis testing
Ms. Rachmawati	Nagoya University	Electric field grading by permittivity and conductivity graded materials (ε/σ-FGM) for HVDC gas insulated power apparatus
Mr. Yoshitaka Nojiri	Shibaura Institute of Technology	Micro-structuring of PVDF-TrFE by proton beam writing for tactile sensors
Mr. Johannes Wiener	Technical University Darmstadt	Analysis of the emitted frequency spectra of breakdowns in SF_6 gas as well as in alternative insulating gases for gas insulated systems
Mr. Takuto Matsui	Toyohashi University of Technology	Nondestructive fault localization of semiconductor devices with ultrasound heating
Mr. Kaisei Enoki	Tokyo City University	Surface and internal charge measurement in fluorinated polymer irradiated by electron using non-contact type PEA method measurement apparatus
Mr. Ryuichi Nakane	Nagoya University	Conductivity distribution in air by charging process on solid dielectrics under dc voltage
Mr. Huaiyuan Jiang	Tsinghua University	Microwave detection technology for internal defects of composite post insulators
Mr. Yusaku Miyazaki	Nagoya University	Breakdown characteristics of cone-type ε-FGM spacer for gas insulated switchgears
Mr. Taichi Yamada	Kyusyu Institute of Technology	Examination of impulse PD inception location by electric field analysis in ester oil/pressboard composite insulation system

(E) Degradation Mechanism and Its Diagnostic Technologies II (4 papers)
(F) Electrical Properties and Application of Dielectrics and Bio-dielectrics (7 papers)
(G) Nanotechnology and Power Module Application (6 papers)

The Korea-Japan Young Researcher Exchange Program Award has been established since ISEIM2014 to enhance a friendship between Japanese and Korean Societies in the technical field of electrical insulating materials. In 2020, Mr. Yeong-Guk An of Hoseo University, Korea, was selected as the award winner in Korea and invited to the Normal Session (B) in ISEIM2020.

(3) MVP (Mutual Visiting type Presentation) Sessions (12 sessions: VA to VL, 84 papers)

MVP Sessions for students and young researchers are one of the peculiar sessions to ISEIM and organized also in the web symposium. Presenters are required not only to upload their presentations files and answer the others' questions on the QA sheets, but also to give their questions to the other presenters in their session or group. This encourages the young researchers in the discussion with the others, which is the reason why this session is named as "Mutual Visiting type Presentation" session. The presenters evaluate and vote the good presentation in their session each other. The excellent 16 presenters in the following 12 MVP sessions are awarded as listed in Table 3:

(VA) Space Charge Behavior and Measurement I (7 papers)
(VB) Space Charge Behavior and Measurement II (7 papers)
(VC) Space Charge Behavior and Measurement III (7 papers)
(VD) Liquid Dielectrics and Their Application (8 papers)
(VE) Nanocomposites I (7 papers)
(VF) Nanocomposites II (8 papers)
(VG) Bio and Organic Dielectrics (6 papers)
(VH) Power Module Application (5 papers)
(VI) Dielectric Phenomena on Dielectric Surface and Outdoor Insulation (6 papers)
(VJ) Partial Discharge, Degradation Mechanism and Diagnostic Technologies I (8 papers)
(VK) Partial Discharge, Degradation Mechanism and Diagnostic Technologies II (7 papers)
(VL) Partial Discharge, Degradation Mechanism and Diagnostic Technologies III (8 papers)

Mr. Takahiro Mihara of Ehime University, Japan, in the MVP Session (VC) was selected as the winner of the Korea-Japan Young Researcher Exchange Program Award in Japan. He was also invited to the Korean conference on November 5 to 6, 2020.

(4) SS (Sun-Shine) Session (1 session, 8 papers)

SS Session is another feature of ISEIM to promote the close relation between industries and academia, where industries can exhibit their technologies with the samples, demonstrations and actual products. In ISEIM2020, e.g. mica/epoxy nano-composite, polymer insulators for inverter-fed motors, transformers and their monitoring/diagnosis system of partial discharge and ageing were introduced.

(5) Digest Reports (8 presentations)

The following 8 digest reports were presented to introduce the latest research activities on hot topics in Japanese investigation committees on dielectrics and electrical insulation:

(DR-1) Insulation Diagnosis Technologies for Electric Power Apparatus and Equipment Using New and Practicable Insulation Materials
(DR-2) Advancing Tailor-made Composite Insulation Materials and Their Applications
(DR-3) Information for Asset Management of Electric Power Apparatus Based on Insulation Deterioration
(DR-4) Electrical Insulation Reliability of Power Modules
(DR-5) Application of Quantum Chemical Calculations in the Field of Electrical and Electronic Insulation Materials
(DR-6) Standardization of Calibration an Advanced Measurements for Space Charge Distribution at High Temperature using Pulsed Electro-acoustic Method
(DR-7) Advanced Nanomaterials and Nanostructure Control for Innovative Organic Devices and Life Science
(DR-8) EINA Magazine Publication

C. Administration of Web Symposium

On May 8, 2020, the organizing committee discussed and decided to hold ISEIM2020 as the web symposium. Since then, the hard work in the organizing committee of ISEIM2020 has been accelerated toward the web symposium on its technical and financial issues.

In order to facilitate the international web symposium as much as possible, the organizing committee prepared ISEIM2020 in the hybrid style of both real-time and on-demand events. As for the web system, we contracted 10 licenses of Zoom for 1 month and 5 licenses of Microsoft Teams for 3 months. The web system was constructed, tested and modified many times with the cooperation of domestic and international colleagues.

The paper submission, review process, presentation style and publication requirement were also discussed. The presentation and discussion style was described in the previous sections of the real-time and on-demand

events. The papers which satisfy the following 3 requirements will be published on the IEEE Xplore after ISEIM2020:

(1) Submission of final full paper after review

(2) Submission of presentation electronic file

(3) Payment of registration fee

As for the registration fees, the early bird fees of ISEIM2020 were originally set at 40,000 JPY (Japanese Yen) for members of IEEJ, IEEE, CIGRE, CES, or KIEEME, 50,000 JPY for non-members and 20,000 JPY for students. However, the registration fee of ISEIM2020 as the web symposium was reduced to 8,000 JPY and 5,000 JPY for students. The Workshop ticket was additional 2,500 JPY. The printed proceedings booklet was not published and the participants could download the proceedings data from the web system.

Unfortunately, in the web symposium of ISEIM2020, the face-to-face discussion and information exchange at Waseda University was cancelled. The banquet at RIHGA Royal Hotel Tokyo adjacent to Waseda University was cancelled, too. The technical tour was also cancelled, although it was already prepared to visit the following 4 courses:

(1) TEPCO Electric Power Historical Museum

(2) Takanawa 275 kV underground substation located under Koyasan Tokyo Betsuin Temple

(3) Toshiba Science Museum

(4) Kagami Memorial Laboratory for Materials Science and Technology in Waseda University

ISEIM2020 was hosted by IEEJ Technical Committee on Dielectrics and Electrical Insulation. Also, ISEIM2020 was technically co-sponsored by IEEE Dielectrics and Electrical Insulation Society (DEIS) and IEEE DEIS Japan Chapter, co-sponsored by Kagami Memorial Laboratory for Materials Science and Technology in Waseda University, supported by JSPS KAKENHI (Grant No. JP20HP0303) and SCAT (Support Center for Advanced Telecommunications Technology Research, Foundation). We appreciate their great cooperation and supports.

As the General Chair of ISEIM2020 organizing committee, I express my sincere thanks to all committee members for their great effort to realize this web symposium under the COVID-19 coronavirus pandemic. I believe that all participants and their accompanying families will come to Japan from all over the world and have a pleasant stay in Japan at the next 10th anniversary ISEIM to be held as the ordinary face-to-face symposium in 2023!

Prof. Naoki Hayakawa
Nagoya University, Nagoya Japan
General Chair
ISEIM2020 Organizing Committe

International Conference to be held in Asia

ICPADM 2021 (International Conference on the Properties and Applications of Dielectric Materials)

Dates: July 11-15, 2021
Venue: Johor Bahru, Malaysia
Organized by: Universiti Teknologi Malaysia
Sponsored by: IEEE Dielectrics and Electrical Insulation Society
Theme: Emerging Dielectrics for Energy Sustainability
URL: attend.ieee.org/icpadm-2021/

The International Conference on the Properties and Application of Dielectric Materials (ICPADM) is a conference combining research and application practice in dielectrics covering, but not limited to, the following areas:

- Aging and life expectancy of HV insulation,
- Bio-dielectrics,
- Conduction and breakdown in dielectrics,
- Dielectric materials for electronics and photonics,
- Dielectric phenomena and applications,
- Dielectrics for superconducting applications,
- Eco-friendly dielectric materials,
- Electrical insulation in high voltage power equipment and cables,
- Electrical and water tree development and surface tracking,
- Emerging dielectric materials,
- Gaseous electrical breakdown and discharges,
- High voltage insulation design using computational analysis,
- HVDC Insulation systems,
- Monitoring and diagnostic methods for electrical insulation degradation,
- Nano-technology and nano-dielectrics,
- New diagnostic applications for dielectrics,
- New functional dielectrics for electrical systems,
- Partial discharges,
- Space charge and its effects,
- Surface and interfacial phenomena.

Important Dates:

Submission of abstract:	Sep. 15, 2020
Acceptance notification of abstract:	Nov. 15, 2020
Submission of full paper:	Jan. 15, 2021
Acceptance notification of Paper:	Mar. 15, 2021

ICPADM 2021 Secretariat:
Prof. Dr. Zulkurnain Abdul-Malek
Institute of High Voltage and High Current
School of Electrical Engineering
Faculty of Engineering
Universiti Teknologi Malaysia
81310 Johor Bahru, Malaysia
E-mail: icpadm2021@gmail.com

ISH 2021 (22nd International Symposium on High Voltage Engineering)

Dates: September 19 – 23, 2021
Location: Xi'an,Shaanxi China
Venue: Paradise Resort Hotel, Xi'an
Official Language: English
Official Website: https://www.ish2021.org/

The scope of ISH 2021 includes:

- Electromagnetic fields: computation, measurements, environmental effects.
- Transient voltages: lightning, switching, repetitive impulses, surge arresters, insulation coordination, over-voltage protection, EMC.
- High voltage and high current testing techniques: test procedures, measurements, evaluation, partial discharges, space charges, dielectric characteristics, emerging test techniques.
- Advanced materials and insulation systems: outdoor, indoor, solid, liquid and gas insulated, nanodielectric, eco-friendly and other new materials, novel insulation system.
- Monitoring and diagnostics: intelligent sensing, big data, artificial intelligence, asset management, live-line working, maintenance and repair, safety considerations.
- HVDC technologies and systems: design problems, testing and measuring techniques, advanced HVDC systems.
- High voltage engineering problems in future power grids: distribution generations, smartening of power networks, and integration of renewable energies.
- Industrial applications of high voltage: non-energy applications in different fields.
- Other related issues.

Important Dates:

Submission of abstract:	Feb. 5, 2021
Acceptance notification of abstract:	Mar. 5 2021
Submission of full paper:	May 5, 2021
Acceptance notification of Paper:	June 5, 2021

General Chair: Li, Shengtao, Xi'an Jiaotong University, China
General Secretary: Min, Daomin, Xi'an Jiaotong University, China
Email: ish2021@xjtu.edu.cn

China Corner

China-Developed Insulating Materials Used in ±500 kV XLPE Cable and Accessories: State of the art

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

1. Overall

Recently, the ±500 kV cross-linked polyethylene (XLPE) direct current (DC) cable and accessories developed by China, including ±500 kV XLPE DC submarine cable, ±535 kV XLPE DC underground cable and ±500 kV flexible DC cable accessories, as shown in Fig. 1 [1-3], have successfully passed a series of systematic test. Besides, the ±500 kV extra-high voltage and long-length power transmission XLPE cable system has also passed the type and pre-identification test. All these achievements are due to our technological breakthroughs in basic research and development of insulating materials.

In order to enhance the performance of high-voltage insulating materials used in high-voltage DC (HVDC) cable, a series of research and tests have been carried out on ±500 kV DC submarine cables and underground cables. First of all, in order to meet the requirements of ±500 kV submarine cable insulation and electric conductors, various performance parameters of cable need to be taken into consideration. The insulation eccentricity index of the cable is controlled to about 4%, which is better than the set index of 5%. Therefore, the cable can be used in an environment with an operating water depth of 200 meters, a maximum operating temperature of 70°C and a transmission capacity of 3 GW (bipolar). Moreover, a kind of structure with 127 water-blocking heteromorphic conductors has been designed and its filling coefficient is higher than 0.96. The cross-section area and diameter of electric conductor is 3000 mm^2 and 63.5 mm, respectively[4]. At the same time, the China-developed insulating materials used in ±535 kV DC underground cable has also made breakthrough achievements. During the process, there are strict requirements for the test environment of ±535 kV DC underground cable, for example, the temperature should be controlled at 5°C to 35°C and the humidity should be below 75%. Moreover, when the cable is continuously applied with high voltage, the temperature of the cable conductor is allowed to change within 2°C, and the voltage fluctuates within ±3% to meet the operational standards. Meanwhile, testers need to continuously monitor the heating and voltage stability of the cable during the test, such as monitoring the withstand voltage performance of the cable at a high DC voltage continuously applied to 990 kV, and using infrared and optical fiber temperature measurement methods to monitor the heating of the cable in real time. After 140 days of testing, the ±535 kV DC cable with an inner diameter of 70 mm and a thickness of 25 mm has been produced by using China-developed insulating materials and has passed various type tests [2].

As we all know, the cable accessories are the weak link in cable systems, so the development of advanced accessories is the key to the HVDC cable systems. The operating HVDC cable accessories are subjected to the combined effects of electric field, temperature gradient, mechanical stress. The research of HVDC cable accessories includes almost all the key technical difficulties in DC electric field, such as interface conductance matching of multi-layer dielectric, interface charge suppression and electric field optimization control. In order to meet environmental requirements, the relevant research and protection development of ±500 kV cable accessories which is made from silicon rubber-based materials are carried out. Compared with the ethylene propylene diene monomer-based materials, silicon rubber-based materials are more environmentally friendly materials, while it also increases many difficulties in design process. On the basis of 220 kV AC and 320 kV DC

Fig. 1. ±500kV XLPE DC cable and accessories [2-4]

cable accessories and other technologies, a lot of structural design, simulation analysis and structure optimization works have been carried out for ±500 kV cable accessories. Finally, the first ±500 kV silicon rubber-based DC cable accessories are developed [5].

50 % of the cable system failures occur at the cable joints in regardless of external damage, so, only the development of the silicon rubber-based cable accessories is not enough to ensure the safety of cable system. Extra-long cables do not need to be equipped with intermediate connectors or the number of connectors will be reduced, which greatly improves the safety of the high-voltage cable system. Therefore, it is necessary to develop long-length HVDC cable systems. The core development technology and process control of large cross-section, long-length, and high water-blocking of the high-voltage submarine cable system have been creatively applied to the research and development of onshore power cable systems. Comprehensive technical research has been carried out in terms of ensuring material cleanliness, long-length extrusion and degassing process, and wrinkled aluminum sleeve structure design to meet product requirements. For the first time in the world, the ±500 kV cable with 3000 mm^2 large cross-section has been successfully developed, and passed type and pre-identification test. As shown in Fig. 2, according to customer needs, the cable with a length of up to 1350 meters can be manufactured. The ±500 kV voltage class is the highest one in urban power grid operation, in other words, the level of current cable manufacturing technology represents the highest level of technology in cable industry, which has great significance to promote the development of high-end cable system [6].

2. Development of HVDC cable system

The research and development of HVDC cable products and their reliability tests are crucial to improving the design and manufacturing capabilities of HVDC cables system. The following describes the development test and verification test.

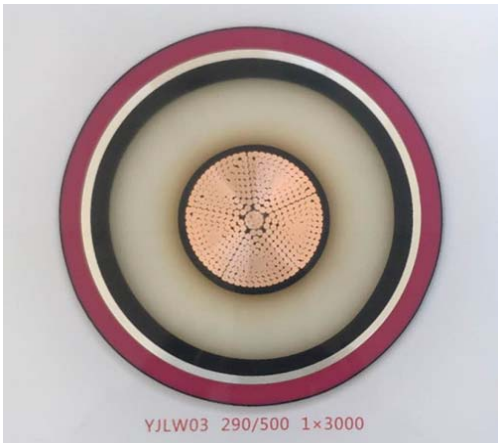

Fig. 2. ±500 kV XLPE cable with 3000 mm^2 section [6]

2.1 Development test

In order to develop a new type of HVDC cable system, the cable design, material selection, performance evaluation and program optimization must be carried out according to all application requirements. Then the physical, chemical, electrical and mechanical properties of samples with different scales should be tested and analyzed. Based on above studies, the final design of the cable system can be determined and accomplished to conduct test verification. In the test, the measurement and evaluation of various properties of the material should try to consider its performance equivalence with the final cable system to ensure that the development process is reasonable and efficient. In the process of materials and cable development, using flat specimens, cable models and cable prototypes to perform equivalent analysis of full-scale cable performance is an effective test method, also known as small-scale test [7].

2.2 Verification test

Type test is a kind of product test, including non-electrical type test and electrical type test, which verifies that the cable system has the expected good performance when the cable materials, manufacturing process or electrical stress level change substantially. The objects of type test contain all components of the cable system, such as cable joints and terminals. The time of 30-day load cycle test set by electrical type test is too short to reflect the long-term working performance of the cable system. Therefore, the pre-identification test method has been proposed on the basis of type test in order to solve this problem. The pre-qualification test is a kind of finished-cable test to verify that the cable system has the expected good long-term performance when the manufacturing process or electrical stress level of cable materials change substantially [7]. Main test requirements on HVDC extruded cable are shown in Table 1.

3. Key scientific issues of HVDC cable development

Currently, in terms of the design of insulating production and reliability of equipment of ±500 kV XLPE DC cable, the main parameters of cable structure have not been established in the DC cable specification, so the design scheme of insulation thickness is one of the key technologies in this project. It is essential to acquire more parameters, such as DC breakdown of thick insulating materials with flake shape. Besides, the electric field in insulating materials is difficult to be determined due to the electric field distortion caused by space charge and the non-linear change of its conductance. Additionally, the aging life index of materials lacks sufficient theoretical and experimental support in insulation design.

The operation of HVDC cable withstands DC voltage and impulse voltage. So, the insulation

Table 1 Main test requirements on HVDC extruded cable [8]

Test type	Test project	Test requirements
Development test	Space charge	Distortion rate of electric field < 20%
	Electric conductivity	
Type test	Mechanical properties	The minimum tensile strength is 12.5 MPa The minimum elongation at break is 200%
	Thermal elongation properties	The maximum elongation at break under stress is 175% The maximum permanent elongation after cooling is 15%
	Load-cycling test	No breakdown under a load-cycle test with positive and negative polarity
	Superimposed pulse test	No breakdown after 10 times of positive and negative polarity of switching combined with pulse voltages, and lightning impulse with pulse voltages
Pre-identification test	Long-term voltage test	No breakdown of 100 meters cable under long-term voltage test and superimposed pulse test with 1.45 times rated voltage for 360 days
	Superimposed pulse test	No breakdown after 10 times of positive and negative polarity of switching combined with pulse voltages and lightning impulse with pulse voltages

thickness of cable must be calculated and designed according to DC voltage and impulse voltage, and the maximum value of them should be taken. The insulation thickness under DC voltage and impulse voltage are calculated by Equation (1) - (2) [9].

$$d_{dc} = \frac{V_0 k_1 k_2 k_3 k_4}{E_{dc,bd}} \quad (1)$$

where, d_{dc} is the insulation thickness under DC voltage, V_0 is the rated voltage of the system, k_1 is the aging coefficient, k_2 is the temperature coefficient, k_3 is the safety coefficient, k_4 is the breakdown strength conversion coefficient, $E_{dc,bd}$ is the minimum breakdown strength under DC voltage.

$$d_{imp} = \frac{\left(V_p M + kV_0\right) k_1 k_2 k_3}{E_{imp,bd}} \quad (2)$$

where, d_{imp} is the insulation thickness under impulse voltage, V_p is the arrester residual voltage, M is the safety level of arrester, k is the Bahder coefficient, $E_{imp,bd}$ is the minimum breakdown strength under impulse voltage.

According to Eqs. (1) - (2), there are many variable parameters related to insulation thickness of HVDC cable. Among these, the coefficient of k, k_1 and k_4 has a wide range of changes, which has a great influence on insulation thickness. The rationality of the design method has been verified, so, the method can provide theoretical guidance for insulation thickness design and verification of HVDC cable.

4. Summary

The main scientific issues and application parameters of ±500 kV XPLE DC cable and accessories are introduced. Importantly, ±500 kV XPLE DC cable and accessories have successfully passed the systematic test, which is a new milestone for HVDC power transmission, marking that the China-developed insulating materials used in ±500kV DC cable are ready for operation in China. In the future, comprehensive and systematic study will be carried out to accelerate the research, development and application of HVDC cables.

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(His photo is on the first page of this article.)

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Korea Corner

A Commercial Implementation of Superconducting Cable System in Korea

Director, Seungki Park
LS Cable & System, Korea

1. Introduction

Superconducting cable is considered as one of the state-of-the-art power transmission tools ascribed to its advantages giving rise to efficiently high transmission capability with lower voltage as well as lower transmission loss. Moreover, other technical advantages have been also remarked such as less external magnetic field emission and eco-friendly materials. For that reason, more differentiated service records have been achieved in comparison with the conventional transmission system.

Korea has put enormous efforts to improve the present power grid by use of superconducting cable system, for which high temperature superconducting cable systems have been developed for diverse operating voltage from medium to high voltage. Afterwards, related pilot projects have been initiated for their implementation into the actual grid in order to attain higher efficiency. One of them is "Tri-ad configuration type" system operating at AC 23 kV for both 50 MVA and 120 MVA. Related demonstrations have been completed for 5 years from 2008 to 2013 at 'Icheon substation'. Furthermore, both the world first DC high voltage superconducting cable system and the world longest AC high voltage systems have been 2016 demonstrated successfully for two years from 2014 to demonstrated successfully for two years from 2014 to at 'Superconducting Power Apparatus Center' in Jeju Island.

Based on these remarkable achievements, Korea made challenging road map for R&D and commercialization as described in Fig. 1, where superconducting cable systems have been employed under both medium and high operating voltage in power grid. In addition, "Munsan Project (AC 23kV, 60MVA)" will be run in actual grid using medium voltage superconducting cable system together with the operation of 'Smart Superconducting Switching Platform (Transforming, Switching & Load supply)'. Moreover, as the world first commercial attempts, two superconducting cable system projects have been firmly planned: "Shing al Project (AC 23kV, 50 MVA)" from July 2019 and "Yeokgok Project (AC 154kV, 400MVA)" to be launched in June 2020.

It is likely that superconducting cable system could be an alternative enabling cost reduction even though its overall system cost is higher than conventional cable system for the following three reasons:

- Compact and eco-friendly facilities could relieve the public reluctance against conventional system.
- Downsizing or minimizing right of way enables to save the civil work cost required for underground cable system.
- Increase in urban grid redundancy by interconnecting radial substations by use of superconducting cables instead of loop networks.

2. Shingal Project:

The first commercial application throughout the world.

2.1 Needs and Economic Feasibility

In order to deliver sufficient electricity to highly populated urban area such as 'Shingal area', two solutions are examined to link between two substations ('Heungdeok' and 'Shingal') located near from each other. One is an additional AC 154 kV unground cable linking between them together with additional step-down transformer. This is our conventional scheme between them together with additional step-down transformer. This is our conventional scheme inevitably requiring to build new substation near existing 'Shingal substation' where the transformer has been already fully-banked. The other one is a superconducting cable system at AC 23kV connecting bus bars between them. This is a new scheme by which the construction of new substation could be possibly

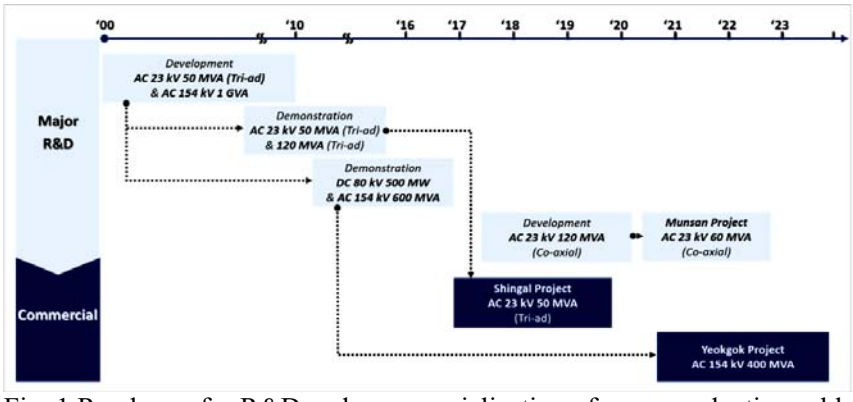


Fig. 1 Road map for R&D and commercialization of superconducting cable system in Korea

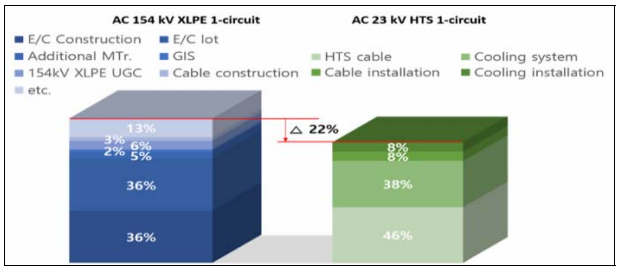


Fig. 2 Comparative analysis on the economic feasibility

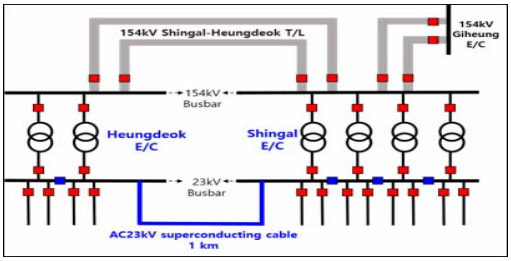


Fig. 3 Bird view of site and schematic grid connection

Table 1. System specification

Item	Unit	Specification
Rated capacity	MVA	50
Rated current/Nominal voltage	kA_{rms}/kV_{rms}	1.26/23
HTS power cable type	-	Tri-ad configuration
Circuit length	m	1,056
Cooling power	kW	7.5 kW@69 K
Operation Condition	K, bar.g	66~77K, under 10 bar.g
Mass flow rate of LN_2	kg/s	0.4~0.6

avoided to deliver required extra electricity.

According to Eqs. (1) - (2), there are many variable parameters related to insulation thickness of HVDC cable. Among these, the coefficient of k, k_1 and k_4 has a wide range of changes, which has a great influence on insulation thickness. The rationality of the design method has been verified, so, the method can provide theoretical guidance for insulation thickness design and verification of HVDC cable.

Considering the benefit of the latter, "Shingal Project" has been launched utilizing superconducting cable system since July in 2019 and then related commercial applicability to power grid has been evaluated. Besides, this project represents significant implication: not only the world first commercial service in grid but also the first economic feasibility study.

From the cost benefit viewpoint, a comparative analysis between above two solutions has been done on the 'Project cost' via NPV (Net Present Value) and the results are described in Fig. 2. Two remarks could be made: Superconducting cable solution has cost benefit as 22%-p and Main cost save is come from avoiding construction work for additional substation.

2.2 Specification and System Configuration

In this project, a superconducting cable system with 1km length has been installed in conjunction with existing cable conduit between 'Heungdeok' and 'Shingal' Substation (named as 'Energy Center' or E/C in Korea) as described in Fig. 3 and Table 1. The

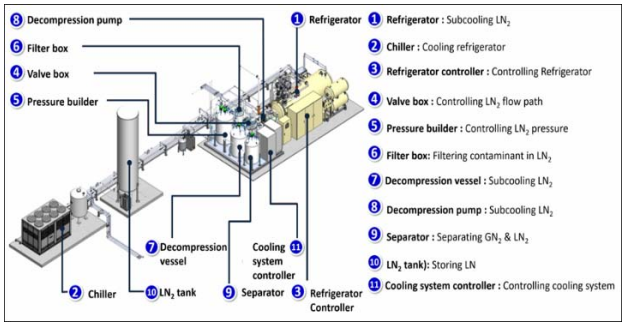
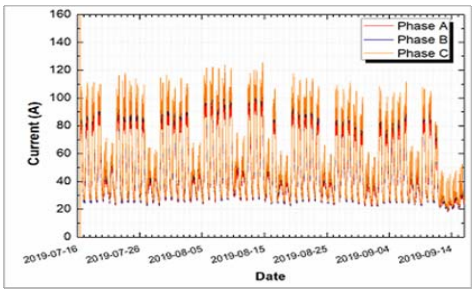
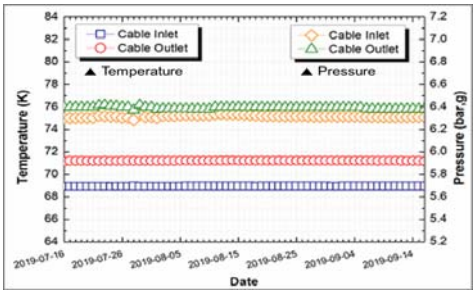


Fig. 4 Design of the installed hybrid type cooling system



(a) Load current



(b) Operating temperature & Pressure

Fig. 5 Operation data

system consists of two main parts: cable system and hybrid type cryogenic cooling system.

Furthermore, the installed hybrid type cooling system is schematically described in Fig.4 of which the special design is composed of two parts: Turbo Brayton refrigeration system requiring 7.5 kW cooling power for primary use and Open-loop decompression unit for backup use. For the former, 1 km cable has employed high temperature superconducting tapes together with 2 sets of normal joint and outdoor termination respectively.

2.3 Operation in grid

After commissioning test, the system has been put into service at operating since the system has put into practically commercial service. Operating data are depicted in Fig. 5.

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Indonesia Corner

Experiences in Using Polymeric Insulators in Indonesia

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1. Introduction

Indonesia is a tropical country located around the equator between 6° northern latitudes and 11° southern latitudes and 95° east longitude and 141° east longitude. This country is an archipelago with the largest number of islands and the longest coastline in the world [1].

To electrify of about 270 million populations, the country has developed electric power network with the highest transmission voltage of 500 kV. As in the beginning of 2020, the installed capacity of electricity power plants is 63 GW with annual production reached 278,941 GWh of which about 85,398 GWh came from independent power plants.

The electricity was generated from various type of power plants. From the installed capacity of 63 GW, the percentage of capacity per type of generator is as follows: Steam power plant (coal) 20,750.50 MW (47.31%), Steam-gas power plant 10,708.76 MW (24.42%), Diesel power plant 3,692.38 MW (8.42%), Oil-gas power plant 1,336.93 MW (3.05%), Hydropower plant 3,583.98 MW (8.17%), Gas power plant 3,188.90 MW (7.27%), Geothermal power plant 579.50 MW (1.32%), Solar and wind power plant 15, 62 MW (0.04%). The peak load in 2019 was 41,670.85 MW.

2. Transmission and distribution systems

In order to transmit a huge electric energy from generating plants to the customers, transmission and distribution systems using low, medium and high voltages are needed.

Currently, the total length of the transmission network is 58,959.05 kms, consisting of a 500 kV network of 5,249.52 kms, 275 kV of 3,647.65 kms, 230 kV of 115 kms, 150 kV of 44,563.86 kms, 70 kV of 5,397.06 kms and 25 & 30 kV over 100.95 kms. The total length of the distribution network is 979,855.37 kms, consisting of medium voltage (20 kV) along 401,421.90 kms and low voltage along 578,433.47 kms. The installed capacity of the substation transformer is 144,408 MVA. The number of substation transformers is 2,123 units, consisting of 75 units of 500 kV system transformers, 37 units of 275 kV systems, 1,748 units of 150 kV systems, 261 units of 70 kV systems. The number of electricity users at the end of 2019 was 75,705,614 customers [1].

3. Polymeric Outdoor Insulators

Outdoor insulator is an important component in an electrical system to isolate the conductor from the grounding level. The reliability of the trans-mission system is greatly influenced by the performance of the insulator. In general, isolator failures account for about 30% of system failures. Especially in Indonesia, many transmission systems are located in high polluted areas in coastal areas. Since long time ago ceramic and glass insulators have been widely used, including in Indonesia. The insulators are vulnerable to pollution. Due to various considerations polymeric insulators are also used. In a survey, there are a number of reasons for using polymeric insulators such as good performance in polluted areas, light weight making it suitable for up-rating, easy handling and so on. The survey results are displayed in Fig. 1. The survey results are more or less similar that of reported by CIGRE [3]. Currently, the polymeric insulators are installed in the transmission system at operating voltage of 500 kV, 230 kV, 150 kV and 70 kV with different operating time and reason why the polymeric insulators were used. The percentage of the operating voltage is depicted in Fig. 2.

Example of 70 kV transmission lines with polymeric insulators is shown in Figs. 3 and 4. Polymeric insulators used in Fig. 3 are silicone rubber. The insulators have been in operation for 30 years in highly polluted area to replace ceramic insulators. The application of polymeric insulators has successfully suppressed the insulator corrosions and flashovers in the lines.

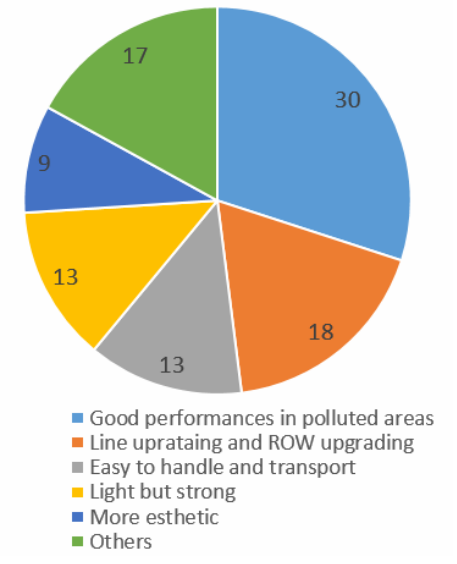

Fig. 1. The reason of using polymeric insulators instead of ceramic or glass insulator

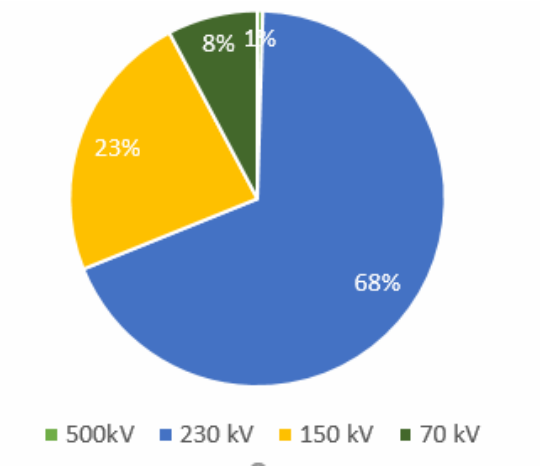

Fig. 2. The percentage of polymeric insulators used in Indonesia according to their operating voltage

Fig. 3. Long rod type suspension insulator with operating voltage of 70 kV (30 years operation)

Fig. 4. Uprated tower from 70 kV to 150 kV using polymeric insulators (26 years operation)

Fig. 4 shows silicone polymeric insulators in 150 kV line. The line was originally operated at 70 kV. Due to the increase of the load then the line was up rated to 150 kV without changing the towers by replacing ceramic insulators with polymers. The polymeric insulators have been in operation since 28 years ago.

Fig. 5 shows 150 kV lattice tower with ceramic, polymeric and glass insulators in the same tower. The tower is located at coastal area with high salt pollution. While Fig. 5 shows 230 kV monopole towers with polymeric insulators operated at highly polluted area that have performed well for more than 24 years.

In general, the use of polymeric insulators in Indonesia has had a positive impact in reducing failures, especially in polluted areas. The experience that insulators can operate for more than 28 years shows the promising prospects of using polymeric insulators. Currently the use of polymeric insulators in the 500 kV network is being tested.

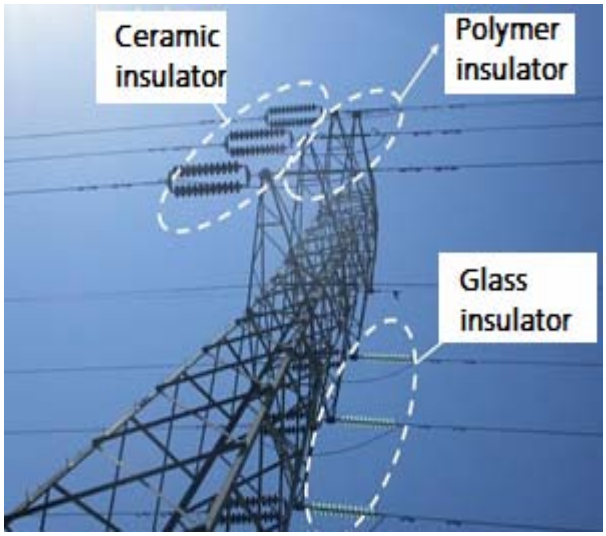

Fig. 5. 150 kV Lattice Tower with ceramic, glass and polymeric insulators

Fig. 6. 230 kV lines with polymeric insulators (24 years in operation)

4. Polymeric outdoor insulator condition monitoring, aging and failures

Fig. 4 shows silicone polymeric insulators in 150 kV line. The line was originally operated at 70 kV. Due to the increase of the load then the line was up rated to 150 kV without changing the towers by replacing ceramic insulators with polymers. The polymeric insulators have been in operation since 28 years ago.

Polymeric insulators are installed in the hope of solving the failure problem. During the operation of the polymeric insulator, condition monitoring is carried out. Several inspection methods used are: (a) visual inspection from ground or from the tower (b) corona monitoring (c) infra-red thermography and (d) hydrophobicity monitoring. The time interval between inspection may vary from 6 months to 2 years.

Some aged insulator defects detected are shown in the following figures. Fig. 7 shows a picture of 70 kV polymeric insulator taken out from line after 27 years in operation in volcanic polluted area. Actually the insulator is still in normal operation (no flashover/failure). However, due to visually observed defect the insulator was taken out from service. It is clearly seen that there are serious cracks along the insulator housing. It is expected if the insulator is kept in operation then the water intrusion into the main road of the insulator and mechanical failure may take place.

Fig. 8 shows a picture of 150 kV silicon rubber polymeric insulator with tear on the insulator shed. The insulator was taken out from the line after 5 years operation in a coastal area with high salt pollution.

Fig. 9 shows a picture of failed 230 kV insulator operated at high land with very high rain intensity. It is clearly seen that there are scratches near grading ring.

Fig. 7. Housing scratch on polymeric insulator 70 kV, 27 years operation, volcanic polluted area.

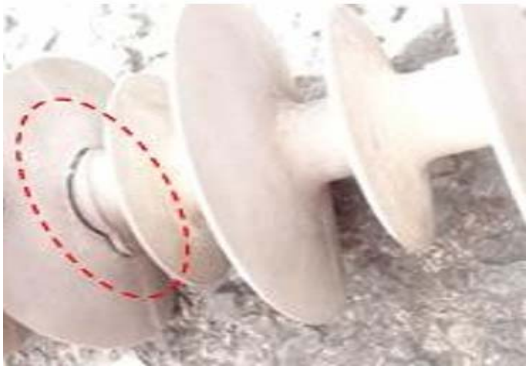

Fig. 8. 150 kV, coastal area, 5 years, corrosion of end fitting.

Fig. 9. 230 kV Polymeric Insulator with housing scratch after 16 years operated at high land with high rain intensity.

5. Conclusion

Since the beginning of its operation, the electrical system in Indonesia has used ceramic insulators. With the introduction of polymeric insulators in the world, Indonesia has started using polymeric insulators since 28 years ago at various voltage levels ranging from 70 kV, 250 kV, 230 kV and even up to 500 kV. A number of reasons were discovered why polymeric insulators were used. So far the experience with using polymeric insulators shows a number of advantages in particular reducing insulator flashover in high polluted areas. With these conditions, there are good prospects for the use of polymeric insulators in Indonesia in the future.

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Recent activities of international students in Japan

Sharing My Experiences and Impressions During Research in The Midst of COVID-19 PANDEMIC

at Mojiko (middle: Kristiawan, right: Satya)

Affiliation in Japan: Kyushu Institute of Technology
Nationality: Indonesia
Term: October 2019 – May 2020
Current affiliation: PT PLN(Persero) Indonesia

Let us introduce ourselves. We are an employee of the Indonesian electricity company PT PLN (Persero). We have completed our scholarship program for a Master's Degree in the Department of Electrical Engineering at the Bandung Institute of Technology (ITB) for July 2018-June 2020. Furthermore, we took our thesis research at the Kyushu Institute of Technology (Kyutech), Japan. There are so many stories and memories during our study. Both for the Master's study at the ITB and the joint research program at the Kyutech. However, on this occasion, we will try to share experiences and memories during our thesis research at the Kyutech, Japan.

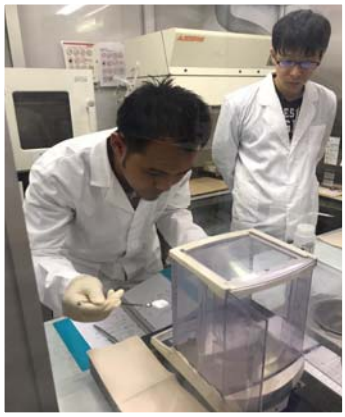
After completing the lecture materials at the ITB, Indonesia, in May 2019, we submitted our proposal for a research thesis at the Electrical Engineering Department of Kyutech, Japan. Thank God the proposal was approved. On October 1, 2019, we arrived in Kitakyushu city, Fukuoka Prefecture, Japan, to do a joint research program between ITB Electrical Engineering and Kyutech Electrical Engineering for October 2019-May 2020.

During our research at Kyutech, we got companion mentors who are also the master student, Mr. Kotaro Ohzuno, Mr. Yoshiyuki Inoue, Mr. Yatsutomo Kakimoto, and Mr. Tatsuki Jogo. In the first week, our activity was for resident registration at the Tobata Ward Office.

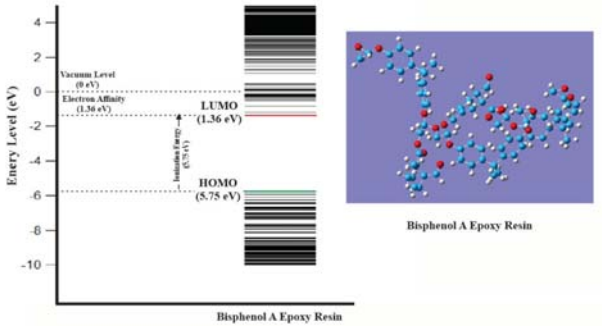
The research activities began with a campus and laboratory tour. Our research advisors, Emeritus Prof. Masayuki Hikita and Assoc. Prof. Masahiro Kozako, asked to join all laboratory research on the High Voltage Engineering Laboratory. In December 2019, it was decided that the research topics are focused on solid insulation materials (epoxy resin) and partial discharge sensors.

A. Mr. Kristiawan Agung Satria research activities:

Solid insulation material (epoxy resin) topic was a new challenge for me. I had to study the chemical reactions that need to analyze the energy band of dielectric materials using the Quantum Chemical Calculation (QCC) software, which was the last time I studied chemistry in high school, 20 years ago. In the beginning, everything went well. Some QCC analyses were performed for several dielectric material models using GaussView 5.09 software and then considered with the measured dielectric properties and dielectric breakdown strength.



Epoxy Nanocomposite Preparation

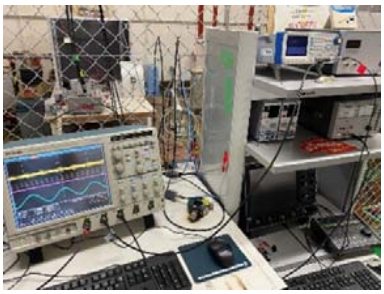


Energy state analysis by QCC

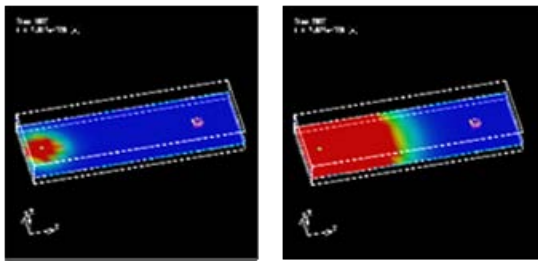
B. Mr. Satya Hari Wibowo research activities:

My research topic was about the partial discharge sensor, entitled "Partial Discharge Detection Sensitivity Optimization of Transient Earth Voltage (TEV) Sensor Using FDTD Modeling." The sensor structure was developed and optimized using 3D electromagnetic simulation software (Magna/TDM Version 8.3), before the physical sensor was fabricated and tested. The simulation was performed to observe the electromagnetic propagation through the metal surfaces and the sensor's

characteristics with several dimensions. The approach of this paper will help to make TEV sensor designs more compact in certain applications in the future.



Partial discharge measurement



Simulation of PD induced electromagnetic wave propagation for visualization

Since the COVID-19 cases increased significantly in April 2020, the Japanese government decided to declare the emergency state of several prefectures in Japan, including the Fukuoka Prefecture.

Since then, the Kitakyushu city's local government decided to close down several public facilities, including schools and universities. Through that policy, the Kyushu Institute of Technology was closed until May 7, 2020. It forced us to stop all research activities, while our research progress is only about 50%. Academic members were prohibited from entering the campus area, and all academic activities were held through online meetings. Due to this condition, we tried to finish our research simulation in the dormitory by remote desktop and compiled a draft thesis report.

However, on May 7, 2020, Japan government declared a new policy. The emergency state extended until the end of May 2020, and the Kyutech decided to close the campus activities until June 30, 2020. It was a very complicated situation. We had to finish our research in May 2020 and present it for our final exam in June 2020. Due to this condition, Kozako-sensei helped us ask for special permission from the campus to do laboratory measurements. The Dean's faculty permitted us to enter the campus three times a week for laboratory measurements. With this special permit, we could continue our research while implemented several protocols for the prevention of COVID-19.

At the end of May 2020, we were completed our research at Kyutech. After taking care of several documents on campus and Tobata Ward Office. We safely returned to Indonesia on June 15, 2020. Furthermore, we presented our final exam on June 20, 2020, while doing self-quarantine as a COVID-19 health protocol. It was an amazing experience researching in a pandemic condition.

Finally, the most special experience was to stay for eight months in Japan, especially in Kitakyushu. Nice environment, culture, humble and helpful people. Our special greetings to Emeritus Prof. Masayuki Hikita and Assoc. Prof. Masahiro Kozako, and Kyushu Institute of Technology, the electrical and electronics laboratory members. It is an honor for us to join the research program at the Kyushu Institute of Technology.

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IMPACTS OF THE COVID-19 PANDEMIC ON RESEARCH ACTIVITIES

COVID-19 Infection Control at the Society of Fundamentals and Materials, IEE Japan

During the period close to the end of the term as the chairman of the board of Fundamentals and Materials Society (FMS) of the Institute of Electrical Engineers of Japan (IEEJ), the rapid spread of COVID-19 infection and the declaration of a state of emergency by the government made the operation of the society difficult and had a great impact. The following is a summary of the events during this period.

In January of 2020, there was a growing sense of urgency due to the increasing number of the COVID-19 cases overseas and in Japan. During this period, special board meetings were held online to discuss measures to deal with the ever-changing situation. As of February 25, we did not uniformly decide to hold or cancel the various workshops, lectures, and meetings of the society. The decision was left to the organizers, while they were asked to manage the meeting by the guidelines set by the IEEJ headquarters when it is held or canceled. At the same time, the use of teleconferencing within the division was considered in the Society meetings. The introduction of specific web conferencing tools was discussed, and some committees and study groups decided to try them out.

After the declaration of the state of emergency by the government on April 7, the head office of the IEEJ was suspended until the lifting of the declaration, including the extended period until May 25th. It was requested to postpone the meetings of the Technical Committee and the Research Committee, or if necessary, to hold the meetings by e-mail or online. All the workshop was also canceled during this period.

On February 21, the cancellation of the 2020 IEEJ National Conference (March 11-13, 2020, Tokyo Denki University) was officially decided by the IEEJ headquarter. Papers already submitted were published on the March 1, and they were considered to have been presented. This was an unavoidable decision for the IEEJ, since other societies, such as the Institute of Electronics, Information and Communication Engineers, also decided to cancel the conference due to the worsening of the infection situation.

At that time, although there were about six months to go until the Annual Conference of the Society in September 2020, we needed to decide on a policy by the time when the call for papers came in June at the latest. We discussed the feasibility of holding the conference on-site and/or online while watching the situation until the last minute. We would like to pay tribute to the local organizing committee for successfully hosting the event online (see pictures in Fig. 1), which was unprecedented for the Society under such difficult circumstances.

(a)

(b)

Fig. 1. Pictures of the Annual Conference of the FMS 2020 (president: Takanori Yamazaki, Sumitomo Electric Industries, Ltd.), which was held online from Sep. 1-3, 2020, (a) The local secretariat office and (b) Prof. Keizo Kato (Niigata University) and Dr. Kenji Okamoto (Fuji Electric Co., Ltd.), the vice-presidents of the FMS.

All board decisions during the above period were made at online meetings. It was a hectic period for the board members of the Society as they worked together to overcome the unprecedented time of the COVID-19 pandemic. I would like to take this opportunity to thank everyone involved for their cooperation.

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(Manuscript was received on 30 Nov., 2020)

Education and Research Activities during the COVID-19 Pandemic at Kyushu Institute of Technology, Japan

Remote learning (online lessons), begun as a countermeasure against the COVID-19 infection, is changing the nature of Japanese universities. The question is whether ICT can be used to improve the efficiency and depth of education. Universities and faculty are under pressure to transform themselves in order to be ready for the post-COVID-19 era. Here, as an example of a university, I would like to introduce the situation of research and education during the COVID-19 pandemic at Kyushu Institute of Technology, to which I belong.

In March 2020, graduation ceremonies and other events that are generally held in person were cancelled due to the idea of self-distancing and restraint. The entrance ceremony for the new semester was also cancelled and following Prime Minister Abe's declaration of a “State of Emergency” on April 7, the university was closed to students 2 days later on April 9. Classes were cancelled for a month, and during that time the faculty prepared for remote classes, which began on May 7. The lectures were based on a distance learning management system called "Moodle", and were basically conducted via Zoom. The lecture materials were uploaded beforehand, and the students attended the lectures while viewing the materials on a shared screen. Attendance collection, report submission, and chat functions were also provided in Moodle. The instructor decided whether the remote lecture is synchronous or asynchronous. Students start by determining which type of course they want to take. Establishing a communication network between the university and students is a top priority, and several questionnaires were taken to confirm safety, communication status, and attendance at remote lectures. Most of the new students who had rented apartments around the university returned home to live at their parents' houses to attend the remote lectures.

The following is an example of remote lecture implementation. All lecture materials are prepared on PowerPoint and the PDF files are distributed to students in advance. The lecture materials are shared on the screen, and the lecture is given using a mouse pointer. During the lecture, the students' cameras and microphones are turned off, so the lecturer cannot see them at all. Questions from students are exchanged via voice or chat. The lecture is recorded and streamed using Zoom's tools, so that students who could not connect remotely due to communication problems can take the lecture asynchronously, which is also useful for review. The exam questions are delivered as PDF files with passwords or shared on the screen, and students prepare their answer sheets in advance and submit them electronically after the exam by taking pictures with their smartphones. In order to prevent cheating, a series of synchronized photographs were taken. When a spacious classroom was available,

Fig. 1. Snapshot in a remote lecture

Fig. 2. Isolation table in the campus cafeteria

face-to-face examinations were conducted. Recently, more face-to-face classes have been conducted with temperature checks, disinfection of hands, and a space between seats. There is an increase in the introduction of the high-flex type, which allows students to take classes both face-to-face and remotely by relaying the classes conducted in the classroom. On the other hand, experiments and practical training are conducted in a blended format, i.e., an appropriate combination of face-to-face and remote classes is used each time.

I would like to introduce some of the research activities in my laboratory. During the period when we are not able to enter the campus, I implemented content that students can examine at home. That is to say, research on reference literature, additional analysis of past experimental data, numerical analysis simulation (LabVIEW, COMSOL, Ansys, Gaussian, MAGNA/ TDM, MATLAB, etc.), and writing papers. A follow-up seminar was held once a week using Zoom. However, it is quite difficult for my laboratory, which mainly conducts experiments using equipment, to conduct such remote activities. So far, we have participated in all domestic and international conferences virtually. Although we have been able to save a lot of time and money in traveling to the venue, we have realized once again that there are things that can be gained only through face-to-face meetings. Currently, we are conducting experiments and

meetings on campus while avoiding the three densities. However, we are working hard with the students to proceed with the experiments as soon as possible because we are not sure when the ban will come again.

If there is an opportunity, I would like to report on the progress made after the disaster.

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(*Manuscript was received on 20 December 2020*)

Research Activities under the Threats Posed by COVID-19 in the Solid Insulation Sector, CRIEPI Japan

How would you describe the year 2020 in one word? There is a Japanese publisher that selects an annual buzzword every year, and this year, half of the 30 terms nominated were related to the COVID-19 pandemic. Needless to say, 2020 was a year defined by the coronavirus outbreak. Our safety and well-being occupy the top priority in our daily lives more than ever before, and the media frequently uses catchphrases such as “stay at home” and “practice social distancing.” Business services including research activities also need to operate under such policies and amid many difficulties. Both work and lifestyles have needed to change to fit government responses to the coronavirus, which have changed at a dizzying pace. Families with small children or members in need of nursing care need to maintain the atmosphere of their home while still engaging in their work. CRIEPI’s Solid Insulation & Deterioration Phenomena Sector administers research topics to develop lifetime evaluation and diagnostic methods for power apparatus for transmission and distribution systems. Its main target apparatus are power cables and transformers, as well as some electric generators. The section also deals with fundamental research on measurement and analysis techniques for inspections and diagnosis. It has achieved its goals in these topics, running many experimental and testing operations. However, such conventional working styles cannot continue amid the coronavirus outbreak, and each member of the sector has been searching for their own new style of research. This article describes the timeline of the coronavirus situation in Japan and the current situation of daily life from the viewpoint of researchers.

At the end of January, the Japanese government started to provide repatriation services for all Japanese citizens in Hubei Province. At the beginning of February, a cruise ship carrying 10 passengers diagnosed with COVID-19 was approaching the Port of Yokohama, but was refused and quarantined. These two events caused heightened feelings of tension in Japan with regard to the outbreak. CRIEPI’s headquarters prohibited its employees from attending large events and also started to refuse all requests for facility tours. In March, both domestic and international business trips were also prohibited, and working from home has become the basic style by which services are provided. CRIEPI’s Solid Insulation Sector routinely handles apparatus used by electric utilities to evaluate the degree of degradation and residual performance. Power companies continued their repair work even during the outbreak, so we needed to arrange to receive the dismantled apparatus. This caused conflicts between work in the facility and the stay-at-home policy. In addition, the Prime Minister asked all elementary, junior high, and high schools nationwide to close from the end of February, which meant that parents needed to take care of their children during the daytime. Families with members in need of nursing care also experienced something similar. As long as people are working from home, businesses and everyday lives must be promoted concurrently.

It was decided to postpone the Tokyo 2020 Olympics, and at the end of March, the media reported the death of a veteran Japanese slapstick comedian. Tension about the outbreak increased sharply after the Prime Minister declared a state of emergency on April 7. Some members of the sector set out to write papers for scientific journals, or to learn new methods for data analysis and numerical calculations in this season. The atmosphere of stay-at-home work was good for resolving desk work, such as contracting procedures and compiling technical report articles for society activities. As the laptop computers usually used for business trips are allowed to connect to the office remotely, most of the members of the sector used them for work. Sometimes the workability of these laptops suffered due to small computer screens or bad internet connections. Research meetings that were previously held face-to-face were moved to online systems. In committee meetings for society activities, managers needed to familiarize themselves with how the systems worked. Many business activities have also paused at this time, causing delays in paper procedures and outsourcing. Some contract procedures were stalemated, and some deliveries were delayed for a month. Online meetings were held frequently as members gradually got used to things. Sometimes, participants seemed to feel reluctant and meetings ended without deep discussions taking place. This might be because the online system can pick up even private utterances and broadcast them to the whole meeting. The Solid Insulation Sector routinely accepts trainees from Japan and overseas. Because of fear of the virus, their activities were restricted to only data

analysis and numerical calculations. One trainee from Indonesia completed his program at the end of May and returned to his country with his family. He sent us a message saying that they had arrived home safely, after a period of quarantine for preventative measures. Each of us had to manage the 'new normal' in our daily lives. Parents had to carve time out of their working hours to take turns taking their children out. There were good things as well, like learning new hobbies, getting takeaway meals instead of dining out, sharing housework, and having dinner as a family.

The Japanese government ended its COVID-19 state of emergency at the end of May. Business activities started to resume as restrictions on mass movement were eased, but CRIEPI and many other companies reduced the frequency of in-person work. Schools in many regions across the nation started to reopen, but local governments continued announcing requests to avoid unnecessary outings and the use of social services. As for the Solid Insulation Sector, some members continued stay-at-home work. Others began avoiding public transport and switched to driving to protect themselves from packed commuter trains and buses. The office was quiet. Some people intentionally stayed alone in their experiment rooms, and others focused on experiments and classified papers while going to the facility. Daily desk work was resolved while working from home. Shipments and deliveries were still delayed, and it was hard to make up the lost time. Only small experiments had prospects for resumption.

Academic conferences were held online to maintain a platform to share research outcomes. Many international conferences had to take into account the time differences around the world to settle their scientific programs. This was fortunate for Japanese participants because they were able to leave the sessions around nine o'clock at night. However, in hindsight, there are questions as to whether we participated only to sessions and presentations what they paid attention to. It was easy to feel the difference with face-to-face conferences in terms of discovering new things and meeting new people.

Japan suffered its second wave of infections in the summer and is now facing the third wave. The latest information on coronavirus infections is always at the top of the news, and workers need to make judgments on work styles depending on the situation. The media reports that many people feel a lack of communication among workers. There are dramatically fewer opportunities or chances to have discussions or work together with co-researchers. There are also obstacles to building consensus on research promotion. Online systems cannot offer equivalent communication quality to face-to-face conversation, but we still need to maintain physical distance. People are now inclined to use words like 'unity' and 'solidarity.' We hope these words will describe the upcoming year.

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(Manuscript was received on 8 December 2020)

The Research Experience of Electrical Insulation Combined with the COVID-19 Pandemic and Infectious Disease Prevention and Control in China

The Covid-19 pandemic has brought some difficulties to our research. We have actively adjusted our research strategies and methods to meet this challenge. By combining with experimental results, we used theoretical analysis and modeling to carry out research. We also combined theories in the electrical insulation discipline with the spread of viruses and the prevention and control of infectious diseases to carry out research. Here are some of our research experiences during the Covid-19 pandemic.

We used thermally stimulated response theory to establish a model of the Covid-19 pandemic. For the spread of infectious diseases without human intervention, the spread rate $v(t)$ of the virus will gradually increase with time t, which can be expressed as $v(t) = v_0\exp(-\tau_0/t)$. Here, v_0 is the pre-factor of the exponential function and τ_0 is a time constant. The number of new cases per unit time $dn(t)/dt$ is equal to the number of people in an area who have not been infected by the virus multiplied by the spread rate of the virus, $dn(t)/dt = [N_0 - n(t)]v(t) = [N_0 - n(t)]v_0 \exp(-\tau_0/t)$. Here, N_0 is the final number of cases in this area. By integrating the differential equation of virus diffusion and considering that the number of patients at the initial moment is 0, we can derive the analytical formula for the number of patients at time t, $n(t) = N_0[1 - \exp[-v_0\int\exp(-\tau_0/t)dt]]$, which is similar to the sigmoid function as shown in Fig. 1(a). Derivation of the number of patients with time can get the infection rate as, $dn(t)/dt = N_0v_0\exp(-\tau_0/t)\exp[-v_0\int\exp(-\tau_0/t)dt]$, which is akin to the Λ-shaped curve as shown in Fig. 1(a). When the virus speed $v(t)$ is too fast, the number of patients will increase sharply in a short time. Due to the limited number of hospitals and doctors, as well as limited supplies of infectious disease-related treatment equipment and medicines, local hospitals do not have enough capacity to treat all patients. There will be patients who cannot get treatment or do not have sufficiently effective treatment. To provide response time for limited medical resources and replenishment,

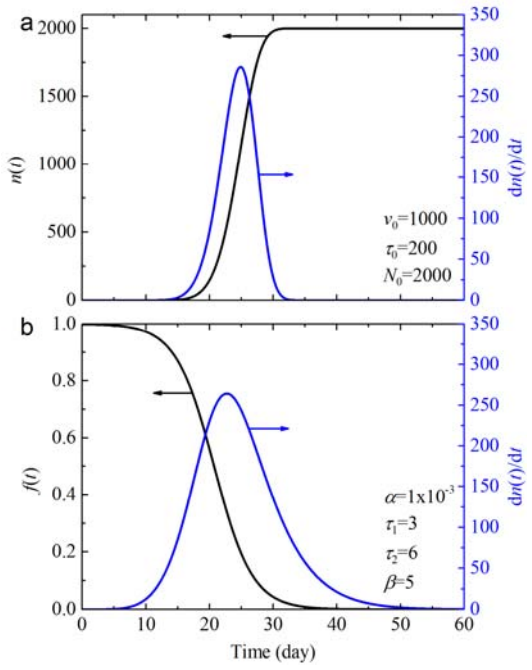

Fig. 1. Spread of virus calculated by thermally stimulated response theory (a) and solid energy band theory (b).

it is necessary to flatten the disease spread rate. Increasing the time constant τ_0 through isolation, reducing gathering activities, wearing masks, and washing hands frequently, will effectively reduce the virus spread rate $v(t)$ and flatten the Λ-type disease rate curve.

We also used the solid energy band theory to calculate the electron density to analyze the spread and prevention of Covid-19 disease. The infection probability of viruses can be expressed as the quasi-Fermi-Dirac function $f(t) = 1/(1 + \alpha\exp(t/\tau_1))$. The infectious ability of the virus in the early stage is very strong, and it will gradually weaken over time. As the crowd gathers, the virus will spread among the crowd. Assume that the number of people who may be exposed to the virus at time t is represented by a power function: $\psi(t) = (t/\tau_2)\beta$. The number of people infected at time t can be calculated by the product of the quasi-Fermi-Dirac function and the power function, $dn(t)/dt = \psi(t)f(t) = (t/\tau_2)\beta/(1 + \alpha\exp(t/\tau_1))$. The relationship of the number of patients per day with time is also a Λ-shaped curve as shown in Fig. 1(b). Under the condition that the infectious ability of the virus remains unchanged, effective isolation measures can reduce the number of people in contact with the virus, which can effectively prevent the spread of the virus.

In this special period of coexistence of challenges and opportunities, adopting new research methods to meet the challenges, discovering new innovative research directions, will create new opportunities for the development of science and technology. Finally, we hope that Covid-19 can be brought under control as soon as possible and everyone stays healthy and safe during this extraordinary period.

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High Voltage Educational and Research Activities at Universiti Teknologi Malaysia under COVID-19 Pandemic

A. Introduction

The COVID-19 pandemic has certainly made itself on the top of the list as the most infectious disease in 2020, all over the world. At the time of this writing, relentless efforts are still ongoing to combat the outbreak of COVID-19 worldwide. Similarly, in Malaysia, a nationwide "Movement Control Order" has been in place since March 2020, and this has largely restricted nationwide activities across the country. One thing for sure, the arrival of COVID-19 has never been welcomed. The pandemic has forced the adoption of new ways of working, not least in conducting high voltage educational and research activities at Universiti Teknologi Malaysia.

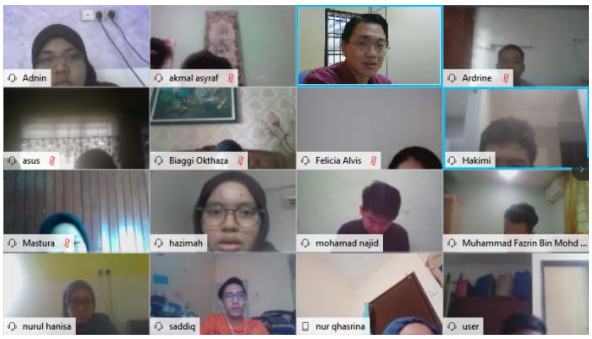

Fig. 1. Online learning with students undertaking the "High Voltage Technology" course

B. High Voltage Educational and Research Activities at Universiti Teknologi Malaysia under COVID-19

Since the implementation of "Movement Control Order" in Malaysia, all educational and research activities have been put to a halt back then, physically. Nevertheless, this has led to a new chapter of learning – online learning. This has included the lectures for the "High Voltage Technology" course at Universiti Teknologi Malaysia; physical classrooms have been transformed into virtual classrooms, thanks to the

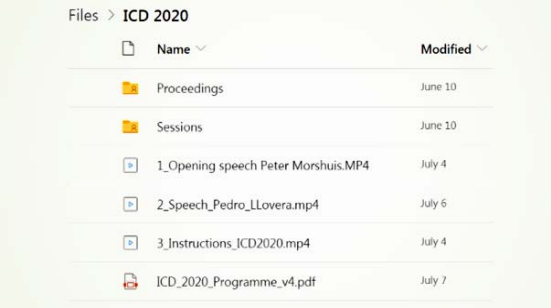

Fig. 2. Participation in ICD 2020 virtual conference.

advancement of online learning tools. This has allowed lectures to be conducted without much affecting the course progress of the students. While the first few attempts on online lectures have appeared clueless for many first-time users, the benefits of online learning have later prevailed; online-based interactive learning, as shown in Fig. 1, has become as effective as physical learning.

During the unprecedented COVID-19 outbreak, some international conferences have been delayed, with many have been changed to a virtual presentation format. The later has included the 2020 IEEE International Conference on Dielectrics. Two papers from Universiti Teknologi Malaysia, namely, "Effects of Water on the Dielectric Response of Calcined Silica-based Polyethylene Nanocomposites" and "Effects of Thermal Aging on Structure and Dielectric Properties of Polypropylene/Calcium Carbonate Nanocomposites", have been presented through virtual presentations accessible via a shared conference link, as illustrated in Fig. 2.

As the outbreak of COVID-19 in Malaysia has slowed down, high voltage research activities at Universiti Teknologi Malaysia have resumed physically since July 2020, but with a "new normal" in place. All researchers have been required to declare their health status and apply for entry to work areas. In addition, all researchers have been required to take precautionary measures to combat the possible spread of COVID-19, including taking their attendances, recording their body temperatures, wearing their face masks, and keeping themselves 1-meter apart while working in the laboratory, as illustrated in Fig. 3.

Fig. 3. Discussion in laboratory with "new normal" in place.

Meanwhile, work routine of the staff at the high voltage laboratory has also been carried out with the "new normal" in place. Many educational and research related works, including the International Conference on the Properties and Applications of Dielectric Materials (ICPADM), which has been scheduled to be held in Johor Bahru on 11-15 July 2021, have been progressively planned and executed. Although COVID-19 has undeniably caused devastating losses in working hours, high voltage educational and research activities at Universiti Teknologi Malaysia have thus far remained resilient.

C. Summary

With the outbreak of the COVID-19 pandemic worldwide, 2020 has been a challenging year so far for many. At the time of this writing, the impacts of COVID-19 are still being largely felt around the world. Nevertheless, many new opportunities have also been brought about by the virus. As the old saying goes, every cloud has a silver lining; it is often at times of difficulties that more breakthroughs can be achieved. For high voltage educational and research activities at Universiti Teknologi Malaysia, they will definitely live up to expectations.

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Spirit in Creation: Vent-I, An Innovation Product against Covid19 Pandemic in Indonesia

"I just could not stay at home during the lockdown. I'd prefer to die standing up rather than die kneeling" Dr. Syarif Hidayat, M.T., the leader of Vent-I team.

The advent of Vent-I came from challenges and threats posed by SARS-Cov2 outbreak in Indonesia, at the beginning of 2020, during which we were strongly encouraged to socially withdraw ourselves and minimize activities outside home. One of the major challenges during Covid19 pandemic was the vast increase of covid19 cases while the limited supply of logistic needed to treat patients. This is clearly catastrophic especially for severe and critical patients

Dr. Syarif Hidayat, M.T. the leader of Vent-I team

who must be treated immediately. Therefore, to circumvent the situation, a small team, initially consists of Dr. Syarief Hidayat, Jam'ah Halid, S.Si. , M.Si., Ir. Hari Utomo dan Ir. Mipi Ananta Kusuma was formed on 23 March 2020 o create ventilator and it got well reception from a varied parties. The early development of the vent-I was initially funded by Rumah Amal Salman (RAS), a non-profit organization of Salman Mosque of ITB, then, many lecturers of ITB, Professor Tatacipta Dirgantara, Dr. Sandro Mihrasi, Dr. Sri Raharno, Professor Trio Adiono dan Adi Indrayanto, Ph.D, as well as an alumni of ITB, Ir. Hari Tjahjono decided to join the group. Additionally, the project is also conducted by physicians of various expertise, Dr. dr. Ike Sri Redjeki, Sp.AnKIC, KMN, M.Kes., dr. Dadang Rukanta, Sp.OT., dr. Reza Widianto Sudjud, Sp.AnKIC, KAKV, M.Kes., dr. Rully Herman Sitanggang, Sp.AnKIC, KAP,M.Kes in order to guarantee the quality of the ventilator to accordingly meet the clinical standards. Ultimately, the group involves a multidisciplinary professionals coming from three institutions, Institut Teknologi Bandung, Universitas Padjajaran, and Salman Mosque of ITB Founder Institution (YPM Salman ITB). In accordance with its vision to empower its mosque as the center of civilization, Salman mosque of ITB has been turned into a laboratory where the development of Ven-I was taken place.

Vent-I, which was initially made of plastic box and washing machine hose (Fig. 1), is now transformed into a high-quality product complying with the strict health requirements.

Research and development team involves volunteers of an interdisciplinary students from various universities, Institut Teknologi Bandung, Universitas Pendidikan Indonesia, and Telkom University. One of the volunteers, Ashari (ITB 2016) said, "I have gained invaluable lessons and experience by conducting research on Vent-I because I meet and work with people from various knowledge backgrounds, both fellow students and teaching staffs of notable universities. Also, I am thankful to my parents for giving me their blessing in joining this team"

Through a long process of product testing conducted by Department of Public Health, Indonesian Ministry of Health, Vent-I has successfully passed the test on 22 April 2020. Despite the laborious task, the great work of the team, supported by the proactive supervision of the authorities, is the key to have the Vent-I achieved the

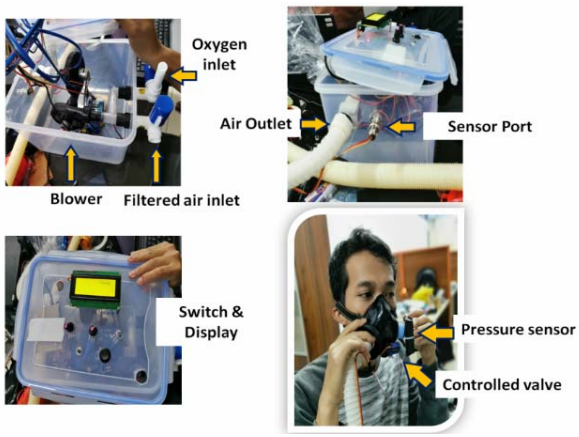


Fig 1. Prototype of Vent-I Beta

standard set by the government without compromising its quality.

In addition, Vent-I has undergone the clinical test for two weeks at different hospitals, such as RSUP Dr. Hasan Sadikin of Public Hospital Center of Bandung, Advent Hospital of Bandung, Santosa Hospital Bandung Central, Al-Ihsan Public Regional Hospital, Tk.II Dustira Hospital, Pulmonary Hospital, Melinda 2 Hospital, dr. Suyoto rehabilitation hospital of Indonesian Ministry of Defense, and Public Regional Hospital of Cibabat, and Wisma Atlet Hospital.

Several crucial parameters were examined during test, such as effect of Vent-I usage on oxygen saturation level of patients' blood (SpO2), patients' pulse rate and blood pressure. Dr. Reza explained that the clinical tests resulted in improvement of patients' condition. This was attributable to the improvement of patients' oxygenation level, causing the organs to function better.

Additional parameters were assessed, such as Positive End Expiratory Pressure (PEEP) stability, patients' comfort level when using the machine, machine stability and electricity, machine noise level. The clinical testing result was submitted to the Directorate General of Pharmacy and Medical Device Services of the Indonesian Ministry of Health on 13 May 2020.

Then, Vent-I obtained distribution license by the Indonesian Ministry of Health. In response to this, the fundraising team of Rumah Amal Salman (RAS) ITB started to launch a massive campaign to gain financial support. With the immense response from the society, the initial target of producing 100 ventilators increased to 1000 ventilators, supported by 2048 donors, which include individuals, communities, and companies, donating more than 12 billion IDR.

The production started from the middle of May 2020 until July 2020. The production team had to work round-the-clock to produce thousands of Vent-I. At the same time, three companies, coming from both state-owned and private enterprises, began to work on industrial scale production, aided by the students of different institutions, such as vocational high school, polytechnic institution, and universities.

Fig. 2. Manufacture of Vent-I

Simultaneously, Vent-I ventilators were distributed to hospitals throughout Indonesia (Fig. 3) to receive feedbacks from healthcare workers because feedbacks are essential to improve the quality of the Vent-I. The team also arranged a webinar to educate the healthcare workers about Vent-I.

Finally, Vent-I team organize a public agenda to present its accountability report regarding the Vent-I production. It was arranged in a leisure event on 24 July 2020, titled "Sharing the final progress of Vent-I". Vent-I is one of the products coming from the collaboration between academy, business, community, government, and media (ABCGM) with its spirit of "Innovation and Communal Work"

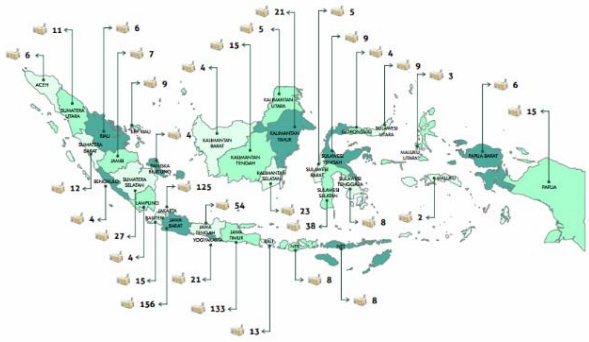


Fig 3. The Distribution Map of Vent-I

Fig. 4. Different models of Vent-I

Key features of Vent-I

a. User-friendly
b. Portable
c. Economical
d. Safe
e. 100% National Product

Fig. 5. A visit from Regional Military Commander III Siliwangi Mayor General Nugroho Budi Wiryanto on 5 April 2020

Fig. 6. Product testing at Department of Public Health, Indonesian Ministry of Health on 14 April 2020

Fig. 7. Vent-I with Indonesian Minister of State-Owned Enterprises, Erick Thohir, on 16 April 2020

Fig. 8. Governor of West Java, Ridwan Kamil, met the Vent-I team at PT.Dirgantara Indonesia (Indonesian Aerospace, Inc). "Let's support our nation's innovation" said Ridwan Kamil, on 24 April 2020

Table 1. Specification of Vent-I

Model	CPAP Ventilator
PEEP Mechanism	Water hydrostatic
Heating mechanism for humidifier	Plate water heater with separated container
Device operation	Room pressure, temperature, and humidity
Pressure and total flow rate control	Microcomputer control system
Display	LCD 48 x 36 x 24 cm
Temperature control	Microcomputer control system, separated from pressure and total flow rate control
Blower specification	Centrifugal Fan 0-7 KPa
Air filter	H13 HEPA filter
Power supply	AC 220-240 V ; 50/60 Hz
Voltage	AC (230 +/- 10%) V
Frequency	50/60 Hz
Pressure setting range	5 cmH_2O, 10 cmH_2O, or 15 cmH_2O
Oxygen input pressure	2 - 4 bar (according to the regulator of oxygen)
FiO_2 oxygen level	52% to 55%
Mixed air flow rate	· 30 to 35 liters per minute (automatic)
	· Maximum 45 liters per minute (manual)
Relative humidity	Up to 100%
Pressure alarm (audio)	Buzzer, activated when the pressure exceeds 20 cmH_2O
Temperature setting range	33°C to 37°C on mask
Noise level	< 50 dB
Ambience condition for usage	Temperature: 5 °C to 40°C
	Relative humidity: up to 80%

Fig. 9. The President of Republic of Indonesia, Ir. Joko Widodo with Vent-I, "I guess when we feel urged to do something, the idea would come up and we will do everything we can. Likewise, the team has started this on March, when the outbreak started in Indonesia

Fig. 10. On 5 May 2020, Indonesian Minister of Defense, Lieutenant General Prabowo Subianto met with Vent-I Team Leader and Initiator, Dr.Syarif Hidayat, M.T.,"We are proud to say that we can independently produce the urgently-needed medical device, not only in Indonesia but also around the world" said the Vent-I team leader

Fig. 11. Vent-I team with the deputy of relevance and productivity at the ministry of research and technology/national research and innovation agency, Prof. Ismunandar, "Vent-I proves the nation that our own innovation can solve the covid19 crisis, with the collaboration between universities, industry, and government" on 28 April 2020

Fig. 12. Vent-I team with the Indonesian Minister of Health, Lieutenant General Dr. dr. Terawan Agus Putranto, Sp. Rad, " I strongly believe that Vent-I will always be developed and will motivate the nation's youth", on 19 June 2020

Prof. Suwarno
School of Electrical Engineering and informatics
Bandung Institute of Technology, Bandung
Indonesia
(Manuscript was received on 23 Nov., 2020)

Prevention of Partial Discharge by Newly Applied RTV Coated Insulator under Polluted Conditions

1. Introduction

Partial discharge may happen on insulator strings in overhead lines under polluted conditions. Partial discharge causes audible noises and visible scintillation. It has the possibility that these noises and visible discharge cause neighborhood inhabitants anxiety or unpleasant feelings. Insulators coated with room temperature vulcanizing (RTV) silicone rubber (hereinafter called "RTV coated insulator"), which have good hydrophobic surface, are sometimes applied in order to prevent flashover accidents in heavy polluted areas. It is expected that RTV coated insulator has also effects of prevention of partial discharge under polluted conditions. In this article, research results of laboratory test and field test are reported.

2. Characteristics of RTV coated insulator

Fig. 1 shows RTV coated insulator with only bottom surface. Characteristics of RTV coated insulator are shown as follows.

Fig. 1. RTV coated insulator

2.1 Superior anti-pollution performance

In case of conventional insulator such as porcelain insulators, insulation performance is significantly decreased under polluted conditions. Silicone rubber surface has hydrophobicity and it keeps long time even if pollution covers the surface, because low-molecular weight silicone migrates on pollution layer. Hydrophobic surface contributes superior withstand voltage performance under polluted conditions and is effective as a countermeasure against audible noise and visible discharge.

2.2 High reliability

The mechanical strength of RTV coated insulator is the same as that of the conventional disc type insulator. It has long experience and high reliability. If RTV silicone rubber is damaged by erosion and then disappeared in the worst case, these characteristics are just returning to conventional insulators.

3. Laboratory tests (Partial discharge tests under polluted condition)

Visible discharge, audible noise and the maximum leakage current were observed or measured under polluted and wet condition. The single tension strings with 38 normal disc type insulators (Φ320) were installed on these tests. The specimens were artificially polluted and the tests were performed after the RTV surface recovered hydrophobicity to some extent. The pollution degrees are salt deposit density (SDD) of 0.25 and 0.5mg/cm^2 which are heavy polluted conditions near the seacoast. After 303kV (phase-to-earth voltage of 500kV line: Max. 525kV) was applied to the specimen continuously, the specimen was wetted by-steam fog.

The test results are shown in Table 1. Discharge activities and leakage current waveforms at SDD of 0.5mg/cm^2 are shown in Figs. 2 and 3. It is confirmed that both audible noise and visible discharge can be drastically reduced by RTV coating on both polluted conditions.

Table 1. Test results of discharge activity

No.	Specimen	SDD	Visible discharge	Audible noise (Noise level)	Maximum leakage current
1	Non-coated insulator (38 discs)	0.25 mg/cm^2	Yes	Large (87.4 dB)	225 mA
2	RTV coated insulator (38 discs)		No	Small (57.3 dB)	8 mA
3	Non-coated insulator (38 discs)	0.5 mg/cm^2	Yes	Large (71.2 dB)	301 mA
4	RTV coated insulator (38 discs)		No	Small (53.9 dB)	10 mA

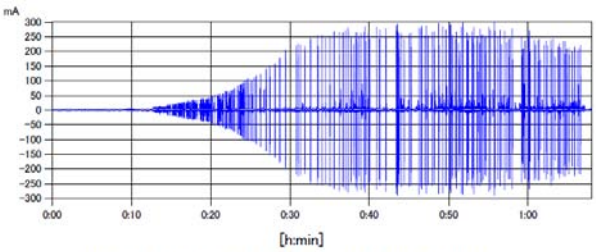
* Back noise of testing environment: 47.7 dB

(a) Arrangement of specimen insulators

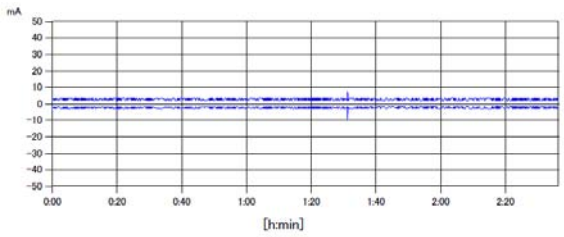
(b) Non-coated insulators (Test No.3)

(c) RTV coated insulator (Test No.4)

Fig. 2. Discharge activity simulating 500kV line.



(a) Non-coated insulators (Test No.3)



(b) RTV coated insulator (Test No.4)

Fig. 3. Leakage current waveform

4. Field test

Field test for operating 500 kV transmission line is carried out at the tower located about 480 m from the seacoast. After one of all double tension strings

(a) Non-coated insulator string

(b) RTV coated insulator string

Fig. 4. Discharge activity in the field

replaced with RTV coated from non-coated insulators, the observation was started by using a digital SLR camera.

Fig. 4 shows the partial discharge activities of non-coated and RTV coated insulator strings on a night of high humidity. Visible discharge could be observed with the non-coated insulator string, while no visible discharge was observed with RTV coated insulator one.

5. Conclusion

From laboratory tests and field test, it is confirmed that audible noise and visible discharge can be suppressed with RTV coated insulators. The newly developed RTV coated insulators would be widely adopted such under heavy pollution environments around the world.

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https://www.ngk-insulators.com/
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Non-Destructive Inspection Method for Defects in Epoxy Resin by using THz Waves

Non-destructive inspection method by using terahertz (THz) waves will be discussed to detect defects in epoxy resin which is widely used as insulating materials in power equipment.

In electrical insulation, defects in the resin lead to poor performance. This is because the electric field in the defects is high, and partial discharge occurs because of dielectric breakdown. In order to find a way to prevent generation of defects, it is necessary to identify the positions and types of defects. Thus, we have developed a nondestructive inspection method using terahertz (THz) waves. Electromagnetic waves of about 0.1-10 THz are designated as "THz waves". THz waves have good transmission properties in polymers. This inspection method can be applied without contact and it has relatively good spatial resolution compared to other methods. Thus, it has been actively studied as a nondestructive testing method for resins in recent years.

We tested epoxy resin with fillers samples with different kinds of internal defects: voids, metallic fragments, resin burrs. Sample thickness were also varied. Fig.1 illustrates the sample compositions. For the measurement, Terahertz time domain spectroscopy (THz-TDS) was used.

Fig.2 shows a scanning image of defect samples. Scanning images drew in grayscale using reflection intensity in the most changed time domain depending on defects. Resin thickness on the defect can be calculated from the refractive index, n. The calculated values of n were 1.82 for the epoxy resin with fillers. The error between the actual and the calculated defect depth was about ± 2mm.

Differences between the THz reflected waves for different defect types were confirmed using the reflection intensity. Here, reflection intensity is defined by the maximum amplitude of the reflected waveform caused by the defect through the entire range frequency range.

Fig.3 shows the results of the measured electric field strength of the THz wave for each defect type. As shown, reflection intensity increased in the order of metal fragment > void > resin burr. There are 2 important factors that affect the reflection intensity. One is THz wave attenuation in the resin. The other is THz wave reflectance at the defect/resin interface. Since the same resin was used in all samples and the defect depths were the same, the attenuation shows the same value regardless of defect type. When the incident angle of the THz waves is constant, The reflectance, R is given by the relative permittivity, ε_r of the defect material, and R decreases with increase in ε_r. R at the metal interface is 1.0. On the other hand, since ε_{void} (ε_{vacuum}) is 1 and $\varepsilon_{resin\ burr}$ is 3.47, R at the void/resin interface would be larger than that at the resin burr/resin interface. Therefore, in principle, the reflection intensity is in the order of metal fragment > void > resin burr.

As above, development of a non-destructive inspection method by using THz waves was investigated to inspect defects in epoxy resin. It is concluded that THz wave technique will be used for non-destructive inspection of resins.

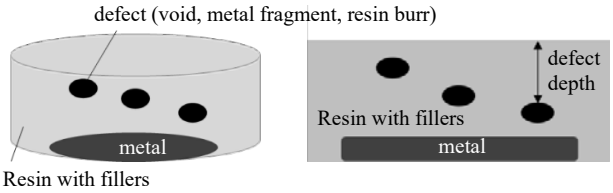


Fig.1 Defect samples.

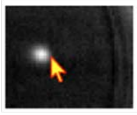
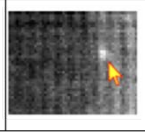
Defect type	Metal fragment	Void	Resin burr
Defect size	1×1 mm	Φ1 mm	5×5 mm
Defect depth	60 mm	60 mm	30 mm
Measurement image			

Fig.2 Scanning images of defects in samples.

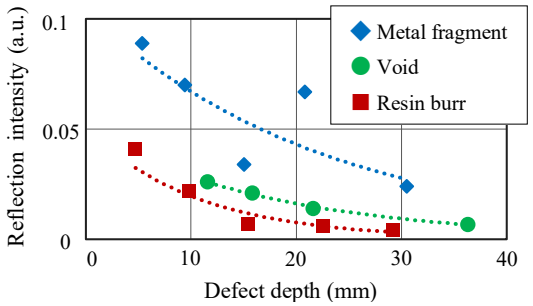


Fig.3 Relationship between defect depth and electric field amplitude for each defect type.

By **Rieko Mizuuchi**
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1, Toshiba-Cho, Fuchu-Shi, Tokyo 183-8511, Japan
Tel.+81-42-333-2548 FAX.+81-42-340-8060

Standardization of Calibration and Advanced Measurements of Space Charge Distribution at High Temperature Using the Pulsed Electro-acoustic Method
-Advanced Measurement Techniques and Typical Applications-

IEEJ Investigation Committee on Standardization of Calibration and Advanced Measurements for Space Charge Distribution at High Temperature using Pulsed Electro-acoustic Method (HT-PEA)

Chairperson: Yasuhiro Tanaka, Tokyo City University

IEEJ Technical Report No. 1491 (in English), Published on August 11th, 2020

IEEJ Investigation Committee on Standardization of Calibration and Advanced Measurements for Space Charge Distribution at High Temperature using Pulsed Electro-acoustic Method (HT-PEA) published the technical report No. 1491 as shown in Figure 1, on August 11th, 2020. As you know, there is a lot of measurement results obtained using the PEA are published on Journal and conference papers. The PEA measurement system was established by Prof. Takada, and many Japanese researchers have been concerning its improvements. The book introduces the fundamental of the measurement, applications, and typical results by the Japanese researchers, and it must be useful for many researches in this field. The committee The committee is composed of 16 members, and investigating the followings:

1) Proposal of the calibration method of PEA measurement at temperature from room temperature to 90 ˚C,
2) Evaluation of the proposed method,
3) Investigation of the advanced measurement techniques.

The committee has already published a technical report (JEC-TR-61010) in Japanese for JEC (Japanese Electrotechnical Committee) about a high temperature measurement concerning to the above (1) and (2) activities. Furthermore, the committee had decided to publish the technical report in English about the advanced technic of PEA method concerning to the above (3) activity.

Figure 1. IEEJ technical report No. 1491.

Chapter 1 Preface
Chapter 2 Principle of PEA Measurement
Chapter 3 Improvement of Measurement
Chapter 4 Measurement under Specific Environments
Chapter 5 Under Various Electric Field
Chapter 6 Various Shape
Chapter 7 Various Materials
Chapter 8 DC Current Integrated Charge (Q(t)) Method

As shown in Fig. 1, since a principle, a recommended procedure and typical results of the PEA measurements are introduced in the technical report, it is useful for beginners. Since it is including some historically significant measurement results, you must be inspired by them. Figure 2 shows that a typical result of the Packet-like charge generation, and it is important to relate the space charge accumulation and the breakdown. Furthermore, it is sufficiently available for the experts on the PEA measurement, because some results obtained under various measurement conditions using some improved measurement systems are also introduced in the technical report. Figure 3 shows a typical technic to measure the space charge distribution in an insulating layer with cable geometry.

I hope the technical report will be helpful and useful for investigation of the insulating materials to create the future power networking systems.

Prof. Yasuhiro Tanaka, Tokyo City University, Japan

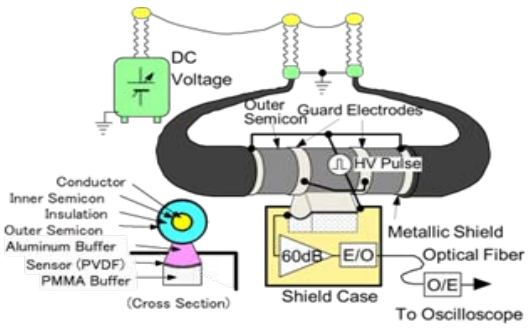

Figure 3. Pulse application to a cable of long length and its equivalent circuit.

URL: https://www.bookpark.ne.jp/cm/ieej/detail/IEEJ-GH1491-PDF/

BOOK REVIEW

Problems and Puzzles in Electric Fields

Authors: Dr. T. Takuma and Dr. T. Shindo
Publisher: Springer (1st Ed.: March 24, 2020)

A book with the title "Problems and Puzzles in Electric Fields" written by Tadasu Takuma and Takatoshi Shindo was published in 2020 by Springer Nature Singapore Pte Ltd.

The book deals with the 49 questions with many unexpected answers. The contents of the book are based on the original Japanese book written by one of author; T.Takuma: Panorama of Electric Fields (in Japanese) IEE Japan, 2003.

Many readers know that the electromagnetic phenomenon are caused by the electrons. The moving electrons carry the electrical energy while creating the scalar and vector potentials. Those electromagnetic potentials induce the electric and magnetic fields. The characteristics of the fields are classified by a combination with divergence and rotational vector operations according to Helmholtz's theorem.

The questions in the book seem simple and easy to answer at a glance. After trying to solve them, they will be either misunderstanding or rarely completely understood.

Many of the contents are unique and interesting ideas focusing on the electrostatic field, those are directly related to the insulation design of high-voltage equipment, and therefore their practicality is extremely high.

It goes without saying that electromagnetic phenomena are expressed by mathematical formulas and are closely related to mathematics, but there are few of analytical solutions available in electromagnetism problems. In contrast, I can feel a generous passion for learning in the appearance of incorporating problems similar to the singularity problem of mathematics, special functions, infinite series, etc., and trying to get into the essence of physical phenomena.

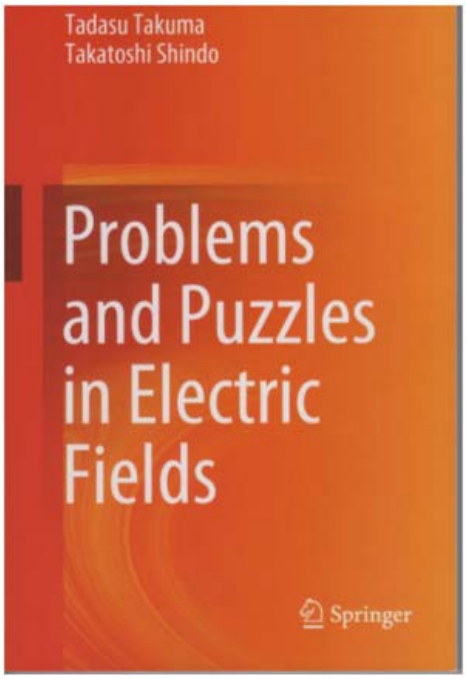

Fig. 1. The book cover

I would like to express my sincere respect.

Prof. Satoshi Matsumoto
Shibaura Institute of Technology,
Tokyo, **Japan**

Standardization of Calibration and Advanced Measurements of Space Charge Distribution at High Temperature Using the Pulsed Electro-acoustic Method
-Advanced Measurement Techniques and Typical Applications-

IEEJ Investigation Committee on Standardization of Calibration and Advanced Measurements for Space Charge Distribution at High Temperature using Pulsed Electro-acoustic Method (HT-PEA)

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I hope the technical report will be helpful and useful for investigation of the insulating materials to create the future power networking systems.

Prof. Yasuhiro Tanaka,
Tokyo City University, **Japan**

URL:https://www.bookpark.ne.jp/cm/ieej/detail/IEEJ-GH1491-PDF/

Chapter 1
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Chapter 2
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Chapter 3
Improvement of Measurement
Chapter 4
Measurement under Specific Environments
Chapter 5
Under Various Electric Field
Chapter 6
Various Shape
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Chapter 8
DC Current Integrated Charge (Q(t)) Method

Fig. 1. IEEJ technical report No. 1491.

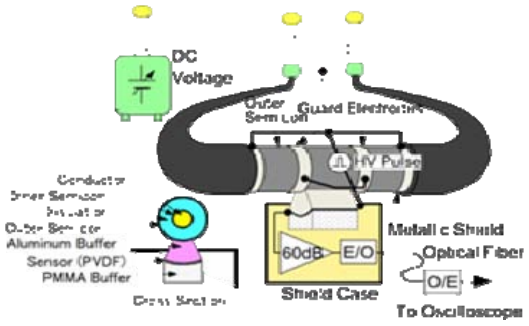


Fig. 3. Pulse application to a cable of long length and its equivalent circuit.

MISCELLANEOUS

Photos on Front and Rear Covers

Front Cover

World's first DC 400 kV XLPE Cable System Has Started Operation

A 400-kV HVDC XLPE cable system connecting between the United Kingdom (UK) and Belgium has been operated more than a year without any problem. This is world's first extruded insulation cable in this voltage class which can be operated up to 90°C. The overall length of the UK-Belgium interconnector is 141.5 km. The project is a large one, with its submarine section alone being 130 km long.

The manufacture of the cable was started in April 2016 in Ibaraki Works of Sumitomo Electric Industries, Ltd. and completed in February 2018. The front cover photograph (left) is a photograph that shows a scene of loading the cable into a transport ship from an onshore cable yard in Ibaraki Works.

After arrival at North Sea dipole cables were installed on shore and under sea. As the sea is shallow off the shore in this region, two cables are appears on the shore at the time of ebb tide as shown in the photograph (right). All cables were finally embedded under seabed.

The cable system has started the operation from January 2019 to deliver 1000MW electricity to interlink two countries, and we feel so much gladness and honors to contribute to some of social challenges in Europe through our technology.

Shoji Mashio
Sumitomo Electric Industries, Ltd..
Power Cable Project Engineering Division
1-1-3 Shimaya, Konohana-ku, Osaka, 554-0024, Japan

Rear Cover

Epoxy / Silica Nanocomposite Thin Films

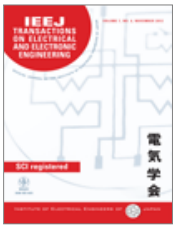
Nanocomposite has attracted attention as an effective method to improve the insulating performance of organic polymer insulating materials. It is known that the addition of the inorganic nano-filler to the organic polymer suppresses the propagation of electrical trees. However, the detailed mechanisms of the generation and propagation of electrical trees are still unclear. Our research group has investigated these electrical trees in epoxy / silica nanocomposite (NC) utilizing micro-fabrication techniques.

The top picture is a cross-sectional SEM image of the NC thin film, which was prepared by spin-coating the NC resin on a silicon wafer and then thermally hardened. Each of the nanoparticles is found to be dispersed independently in the 600 nm epoxy layer. The bottom figures show the electrical tree generated at the tip of Al film electrodes fabricated on a quartz glass substrate. A surface-active agent of nanoparticle is treated on a quartz glass substrate to imitate the interface between the filler and the polymer. The bottom right pictures are SEM images of the cross-section at the electrical trees. Fine tree holes with 3-5 μm diameters are formed at the interface. Making full use of the microfabrication technique, we are trying to clarify the role of nano-fillers on the insulating properties of organic polymer materials.

B.E. Kohei TAKAHASHI, Prof./Dr. Takanobu WATANABE
Waseda University
Faculty of Science and Engineering,
3-4-1 Ookubo, Shinjuku-ku, Tokyo, 169-8555, Japan

Journals of IEEJ

A Journal which is edited by the headquarters of the Institute and five transactions which are edited by five technical societies* A to E are monthly published.



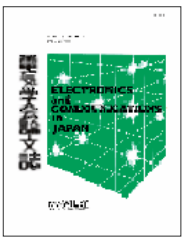
Another transaction "IEEJ Transactions on Electrical and Electronic Engineering (TEEE)" is edited in English by the five technical societies and published by John Wiley & Sons. , (SCI registered)

An English journal "IEEJ Journal of Industry Applications" is edited by the society D and published bimonthly. The papers can be downloaded free at present.

Papers in all kinds of journals published by IEEJ can be browsed at

Portal site of IEEJ > English Top > Journal & Paper > Online Journal (http://denki.iee.jp/?page_id=5941)

Two journals "Electrical Engineering in Japan" and "Electronics and Communications in Japan" are translation of the IEEJ Transactions A, B, C, D and E from Japanese into English both edited and published by John Wiley & Sons (not all articles).



Right: Electronics and Communications in Japan
https://onlinelibrary.wiley.com/journal/19429541
/(ISSN)1942-9541, (SCI registered)

Left: Electrical Engineering in Japan
https://onlinelibrary.wiley.com/journal/15206416
/(ISSN)1520-6416, (SCI registered)

They can be accessed from the website above:
Portal site of IEEJ > English Top > Journal & Paper > Journal

(*) Five technical societies in IEEJ are as follows:

A: Fundamentals and Materials Society (This magazine is published from EINA Committee under this society.)
B: Power and Energy Society
C: Electronics, Information and Systems Society
D: Industry Applications Society
E: Sensors and Micromachines Society
(please visit Portal site of IEEJ > English Top > Technical Societies)

IEEJ Technical Reports

The A4 size technical reports listed below were prepared by investigation committees in technical societies A to E in IEEJ and published from December 2019 to November 2020. The extended summaries can be browsed in English on the web site below but the texts of technical reports are described in Japanese except No. 1491 (see Book Review in this issue).

Abstracts of the technical reports can be browsed on the web site:
Portal site of IEEJ > English Top > Publications > Abstract of Technical Report (http://denki.iee.jp/?page_id=1590)

No.	Title	Pages	Issue Date (y/m/d)
1501	Trends in the Latest Technology for Maintaining the Lightning Resistance and Improving the Operating Rate of Wind Power Generation Facilities	51	2020/11/27
1497	System technology for efficient operation of water and sewage facilities	57	2020/11/27
1495	Wireless Power Transfer Technologies on Power Electronics	80	2020/10/8
1494	Research and development trends in high-performance permanent magnets	77	2020/10/8
1493	Magnetic Material and Its Evaluation Technology for Electromagnetic Actuator	98	2020/8/11
1492	Technical Trend of Next-generation Application Specific Electric Motors and Electromechanical Integration Technology	56	2020/8/11
1491	Standardization of Calibration and Advanced Measurements of Space Charge Distribution at High Temperature Using the Pulsed Electro-acoustic Method (written in english)	95	2020/8/11
1490	The role and performance of the capacitor in the next generation HVDC	62	2020/7/22

1489	Progress of performance improvement of power semiconductor devices and Ics	62	2020/7/22
1488	Technical Report on Techniques for Gas-Phase Simulations of Electric Discharges and Plasmas	91	2020/6/17
1487	Models for Power System Analysis with Integration of Distributed Generators	82	2020/7/7
1486	Grid Integration Technology under large amount Wind Power	58	2020/9/4
1485	Common Fundamental Technologies for High Precision Servo Systems	92	2020/6/17
1484	Current situation after the Fukushima Daiichi nuclear power plant accident and possibility of waste treatment using superconducting magnetic force control technology	52	2020/6/9
1483	Recent Progress in Motion Control for High-Performance	94	2020/6/9
1482	System Integration Technology driving a Future Power Electronics−An Fundamental Technology and Road Map to High Power Density−	60	2020/6/16
1481	The actual situation and problem of a diagnosis, the evaluation technique for Distribution Electric Wire and Cable	74	2020/4/6
1480	Technical trend of medium voltage switchgear for application expansion and corresponding to overseas market or special specifications	72	2020/6/9
1479	MHD Power Generation Technology and Its Application Aiming for Environmental Load Reduction	68	2020/6/9
1478	Recent Trend on Diversification of Functions and Properties of Transformer	79	2020/6/9
1477	Energy services by customer power resources	167	2020/6/9
1476	Comprehensive Evaluation Techniques of Electromagnetic Field Analysis for Rotating Machines	99	2020/6/16
1474	Backgrounds and Reasons for Revision of JEC-2300 Alternating-current Circuit-breaker Standard	114	2020/4/6
1473	The Latest High Frequency Power Conversion Technology for Adapting to Advance of Energy Use	53	2020/2/5
1472	The Technical Transition and Issues of Insulated Electric Wires, Cables and Accessories in Several Distribution Line Environments	82	2020/3/5
1471	Improving Accuracy of Electromagnetic Field Analysis	83	2020/3/10
1468	The Latest High-frequency Power Conversion Technology Corresponding to the Energy Issues	48	2020/3/1
1465	Application Techniques on Real-world Haptics	43	2020/6/16
1434	Technical trend of applied IT and response to renewable energy as for gas-insulated switchgear	66	2020/4/15

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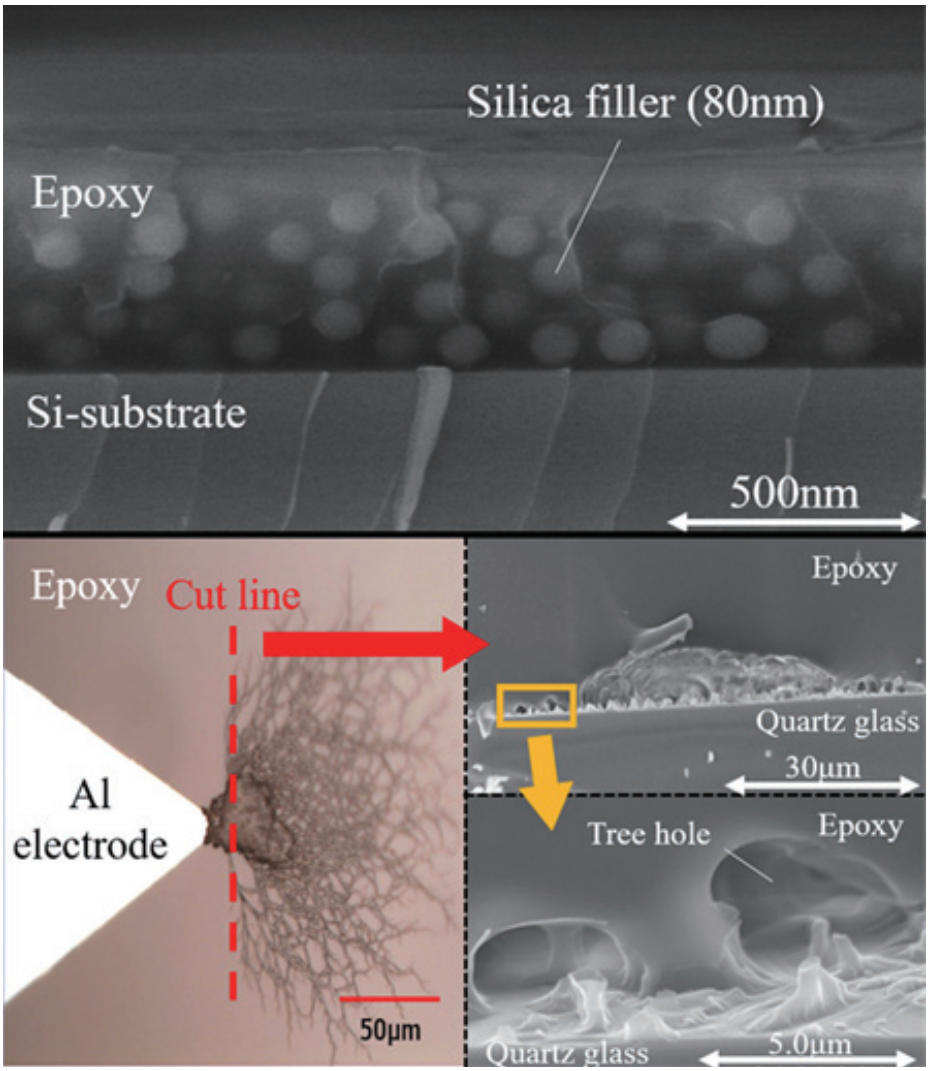

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