Electrical Insulation News in Asia

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IEEJ

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MISCELLANEOUS

PREFACE

Dr. Futao KANEKO

Collaborative Researches between Asian Universities

It is well known that collaborative researches beyond boundaries are very important to develop science, technology and industry. Most of novel ideas and new manufacturing things and systems are expected to be created by such collaborative researches. It is thought that such collaborations between researchers and engineers in Asian countries are also needed for providing advanced, more stable and more safety equipment and systems with higher performance under globalization.

Collaborative researches in universities may be almost established according to individual relationships between professors based on advanced or distinguished researches through discussing at international conferences and/or visiting laboratories. International collaborations are also very important for education and researches in universities, and international programs are needed for graduate students to be able to have a chance to study and research in other foreign universities. Studying abroad and short-term visiting have been prepared for the students by most universities, but they are not sufficient to develop collaborative researches between universities. One of the fruitful methods is thought to be a double degree doctoral program for graduate students to be able to carry out researches on a little different particular field at a foreign partner university added to the majoring one at the primary university. The double degree programs (DDPs) have some advantages that not only a global standard curriculum is formed, but also graduate students study and research in some extensive fields at two universities of the primary university and a secondary foreign one with some exchange credits and can earn a doctoral degree from each university. It is thought that such programs also develop collaborative researches for professors at two universities cooperatively supervising the same students.

Niigata University has provided such a DDP for graduate students in doctoral course with some Asian universities (http://www.gs.niigata-u.ac.jp/~gsweb/gs /english/about/index.html). There are six students studying and researching in my group for seeking the double doctoral degree from Chulalongkorn, Mahidol and Chiang Mai Universities in Thailand. I have been researching on nano-structured organic film devices, surface plasmon resonance excitation and sensors with other professors in my group at Electrical and Electronic Engineering Department, Niigata, and for example, Prof. Sanong Ekgasit, one of the counterpart professors is researching on fabricating metal nano-particles at Chemistry Department, Chulalongkorn. Sensors and solar cells with higher performance are expected to be developed using local surface plasmon resonance in a combination of the surface plasmon resonance and the metal nano-particles. There are seventeen peer reviewed papers with the DDP students in my group that have been already published from the collaborative researches with these partner universities.

I hope such collaborative researches between universities make the progress of science, technology and industry in Asian countries.

Dr. Futao KANEKO
Professor Emeritus of **Niigata University**, Japan
Fellow of Institute of Science and Technology of Niigata University

MEMORIAL ADDRESS

Prof. Y. Muramoto

Great Contributions of Late Prof. N. SHIMIZU

It is very sad to report that Professor Noriyuki Shimizu suddenly passed away on February 17, 2016 by a pulmonary disease at the age of 64. He was a great worldwide leader in the field of Electrical Insulation and he made great contributions to bridge between Japan and International world (Asia, Europe and America) and also between Material Sciences and Technologies.

His main research achievements were many pioneering works in the fundamental process of high field degradation of polymer materials, including electrical tree initiation and electroluminescence. Recent studies were “Material Engineering for Energy and Environment “. Its concept includes high reliable and highly efficient manners of generation, transportation, storage and conversion of electric energy. His research subjects were classified to 4 groups. 1. Electrical Insulating Materials under Extreme Environments such as cryogenic, high temperature, high vacuum, high magnetic field and high energy beam etc, 2. Functional Materials and their Energy Application (Electronic properties of TO_2, Light triggered oxide superconductor switch with high response speed), 3. New Principles of Energy Storage and Materials required for them (Fundamentals of electric double layer), 4. Bio-Based Materials and their Energy Application (Growth acceleration of plants by application of electric field, High voltage pulse sterilization of liquid food, Natural materials (such as Bamboo, Kenaf and Cotton Fabric) -ice composite system for cryogenic electrical insulation). He was the author or co-author of over 200 transactions and refereed conference papers. Many students who received their training in Prof. Shimizu’s scientific accomplishments earned him a worldwide reputation. He received many other awards such as the Paper Award from IEE Japan in 1979, the 1906 Award from IEC in 2007 and the Prof. Ieda’s Award from DEI of IEE Japan in 2013.

Prof. Shimizu had served as Convener of IEC TC112 WG.8, since November 2005 and Chairman of IEC TC112 National Committee in Japan, since October 2005. He was General Chairman of the IEC TC112 WG.8 in Nagoya, 2007. He was Board Member of IEEE CEIDP (international conference) from 2001 to 2006. He played a major role in the 16 Committees investigating electrical insulation in DEI of IEE Japan. From 1998 to 2001, he was chairman of the Investigation Committee on Mechanism of Treeing Degradation and Influence of Polymer Morphology. He devoted himself to the development of electrical insulation technologies and electrical engineering and also to the development of Science and Technology in Japan.

Prof. Shimizu was born on July 19, 1951 in Nagoya, Japan. He received the Bachelor’s Degree in Electrical Engineering in 1974 and the Doctor Engineering in 1979 from Nagoya University, where he joined the faculty as Research Associate, later becoming Associate Professor of Electrical Engineering. In 1999, he became the Professor of Electrical and Electronic Engineering, Meijo University. He spent 1.5 years, 1981-1983, as a Visiting research Officer at National Research Council of Canada. He received IEEE Fellow in 2008.

Professor Shimizu will be remembered by scientific and engineering community not only as an eminent scholar but also as a great leader.

Prof. Yuji MURAMOTO
Meijo University
Nagoya, Japan

Late Prof. N. Shimizu (1951-2016)

OUTLINE OF TECHNICAL COMMITTEES IN IEEJ

Dielectrics and Electrical Insulation (DEI)

Chairperson: Yasuhiro Tanaka (Tokyo City University)
Secretaries: Hiroyuki Nishikawa (Shibaura Institute of Technology)
Yoitsu Sekiguchi (Sumitomo Electric Co. Ltd.)
Assistant Secretaries: Norikazu Fuse (CRIEPI*)
Yuji Hayase (Fuji Electric Co., Ltd.)
*CRIEPI: Central Research Institute of Electric Power Industry

The Technical Committee on Dielectrics and Electrical Insulation (**TC-DEI**) has a long history from 1970, in which the former committee named as the Permanent Committee on Electrical Insulating Materials was established in IEEJ (the Institute of Electrical Engineers in Japan). The TC-DEI has a new season from June 2016 with the second season as the chairperson of Prof. Y. Tanaka. TC-DEI also has had a new talented assistant secretary, Dr. Yuji Hayase, instead of the former capable Dr. Takahiro Imai, from September, 2016. The activity of the Committee has been covering mainly solid and composite dielectric materials and their technologies.

Organized events by TC-DEI

The important activity of TC-DEI is the annual domestic Symposium on Electrical and Electronic Insulating Materials and Application in Systems (**SEEIMAS**), formerly called Symposium on Electrical Insulating Materials.

The 47th SEEIMAS was held at a Satellite Campus of Gifu University, Gifu Prefecture from 31st August to 2nd September 2016, technically cosponsored by IEEE DEIS Japan chapter, arranged by colleagues of Tokai-area (Prof. T. Tokoro, NIT Gifu College, Dr. N. Murakami, Toyohashi Univ. Tech. and Dr. M. Kurimoto, Nagoya Univ.). Totally 61 papers including 2 invited papers were listed in the symposium proceedings. There were 25 oral and 36 poster presentations. During the conference, totally113 participants working in industries, government, research and academic institutions shared their experiences and discussed the latest developments and future challenges confronting the field. The symposium covered the topics of diagnostic techniques, inverter surge and partial discharge phenomena, functional and new materials. Especially in this year's symposium, the special session featuring the Analysis for Polymeric Insulating materials using Advanced Numerical Simulation (APIANS). In this session, recent research results were introduced and active discussions were carried out. Furthermore, a practical seminar about the numerical simulation was held as an event of DEI Young Researchers' Seminar held after the symposium, introduced later. In the practical seminar, more than 30 participants, students from universities and young researchers from industries, tried to use an advanced software temporary provided by a cooperative company.

Next year, the 48th SEEIMAS will be held as the 8th International Symposium on Electrical Insulating Materials (**2017 ISEIM**) at the building of Toyohashi chamber of commerce and industry, Toyohashi, Japan, technically cosponsored by IEEE DEIS, in cooperation with IEEE DEIS Japan chapter. In every 3 years, we hold SEEIMAS as an international one. Last time, we held the 7th international symposium (**2014 ISEIM**) with Honorary Chair of Prof. M. Nagao and the General Chair of Prof. Y. Tanaka, in June 1-5, 2013 at Toki Messe, Niigata. The next ISEIM will be held organized by Honorary Chair of Prof. N. Hozumi and General Chair of Prof. Y. Tanaka. We are grateful to welcome you to the next ISEIM. Details must be introduced elsewhere on this magazine.

Following the 47th SEEIMAS, **the 31st Young Researchers' Seminar** was started at the same site of the symposium, and followed by the seminars in a famous traditional hot spring area, "Nagaragawa"

Fig.1 MVP and SS sessions in the 47th SEEIMAS

close to the symposium site. This event is basically organized by the committee members selected from students and researchers in industries. In this year, as mentioned above, the practical experience of the numerical simulation was carried out by having the lecture and the support by Prof. T. Takada and his pupils in Tokyo City University, respectively. Thanks to their good coaching and support, most of participants can achieve to calculate the energy band structure of a simple model of polymer molecular, while most of them were first-timers for such analysis. After above event, the participants enjoy the event of a program-based learning, a party and a lecture by Dr. Okazawa, a consultant engineer for high voltage equipment. Members of TC-DEI recognize the seminar is important event and good opportunity to know the young researchers each other, and they have willing to continue this event. (Profs. N. Hozumi, Y. Tanaka and Dr. K. Fukunaga were typical frequent participants of the seminar.)

Fig. 2 Practical experience of numerical calculation for energy band structure using an advanced software, in the 31st Young Researchers Seminar

Investigation Committees run by TC-DEI

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

New materials including nano-materials related

> Advanced Nanostructure Control for High-Performance Organic Devises and Life Science (07/2014 - 06/2017, Chairperson: K.Kato (Niigata University)).

> Application to the Next-generation Electronics of the Study of Organic Dielectricity and Functionality of Electrical and Electronic Materials in the District of Asia (04/2014 - 03/2017, Chairperson: M. Iwamoto (Tokyo Institute of Technology)).

> Advancing Tailor-made Composite Insulation Materials (07/2015 - 06/2018, Chairperson: T. Tanaka (Waseda University)).

Ageing and diagnosis of electric and electronic equipment related

> Degradation Diagnosis Technology of Electric Power Apparatus for its Transfer (04/2013 - 03/2016, Chairperson: Y. Ehara (Tokyo City University)). *They have just finished their work and published a report in Japanese.*

> Testing methods of winding insulation systems for Invertor-fed motors (05/2013 - 04/2016, Chairperson: M. Nagata (University of Hyogo)). *They have just finished their work and supposed to publish a report (in Japanese). Their work is supposed to be introduced in 2017 ISEIM.*

Basic dielectric and breakdown phenomena related

> Electrical insulation technologies under cryogenic temperature (10/2015 – 09/2018, Chairperson: N. Hayakawa (Nagoya University)).

Electrical Discharges (ED)

Chairperson: Haruaki Akashi (National Defense Academy)
Secretaries: Akiko Kumada (The University of Tokyo)
Hiroshi Kojima (Nagoya University)
Assistant Secretaries: Yasushi Yamano (Saitama University)
Naohiko Shimura (Toshiba Corporation)

The Technical Committee on Electrical Discharge (TC-ED) belongs to the Fundamentals and Materials Society of the IEE Japan. The origin of the TC-ED is the Expert Committee on Electrical Discharges, which was established in January 1954. That is, the TC-ED has supported the development of science and technologies on electrical discharges in Japan for a long time.

The purposes of the TC-ED are mainly the wide promotion of the research activities concerning to a variety of electrical discharges in vacuum, gas, liquid and on surfaces of materials and their applications to high technologies, especially aiming an environmentally sustainable technology for the next

generation.

Several investigation committees, which are the affiliates of the TC-ED, are established every year to survey the up-to-date research subjects. The activities of these committees usually continue for three years. Each committee generates very useful technical report at the end of the active period. Two investigation committees shown in Table 1 are currently active.

The TC-ED organizes about six domestic technical meetings on electrical discharges every year. In these meetings, nearly 200 papers are presented from both academic and industrial sides. The technical meeting is also useful to train and encourage young researchers including students. The domestic technical meetings are sometimes co-organized by other Technical Committees such as Dielectrics and Electrical Insulation, Pulse Electromagnetic Energy, Plasma Science and Technology, High Voltage Engineering, and Switching and Protecting Engineering.

In order to promote the international activities in electrical discharges, 21st International Conference on Gas Discharges and Their Applications (GD2016) was held in Nagoya University on September 11 to 16. 6 invited papers + 175 contributed papers are presented and 247 registrations (see Fig.1). On November 4 to 5, Joint Conference of The 10th International Workshop on High Voltage Engineering (IWHV 2016), and 2016 Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering (JK2016 on ED&HVE) was also held in Miyazaki University. Two invited lectures and 55 contributed papers are presented.

The TC-ED also contributes to organize an annual young researcher seminar in cooperation with the Institute of Engineers on Electrical Discharges in Japan for encouraging the young researchers in the field of electrical discharges. The seminar consists of lectures by a senior researcher, poster presentation by the participants, and the visit tour to the facilities. About 30 young researchers and engineers participate in the seminar and discuss vigorously the topics for two days.

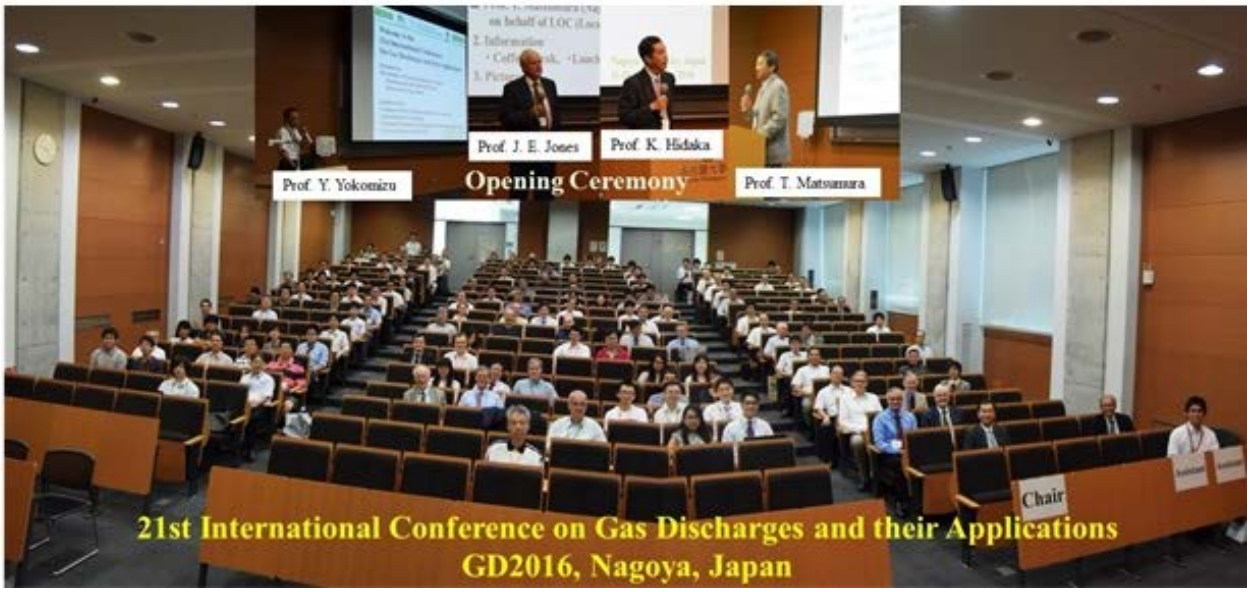

Fig. 1 Photograph of opening ceremony in GD2016.

Table 1 Investigation Committee in TE-ED

Chairperson	Research subjects and established time
H. Sugawara (Hokkaido University)	Gas-phase simulation technologies for analyses of electrical discharges and plasmas (established in October 2014)

Pulsed Electromagnetic Energy (PEE)

Chairperson: Sunao Katsuki (Kumamoto University)
Vice-Chairperson: Koichi Takaki (Iwate University)
Secretary: Jun Hasegawa (Tokyo Institute of Technology)
Assistant Secretary: Toru Sasaki (Nagaoka University of Technology)

Pulsed electromagnetic energy produced by pulsed power, which refers to huge power within an extremely short period of time. The power level reaches 300 TW. The period of time goes down to sub-nanosecond range. Pulsed power is often focused in a narrow space to produce an extremely high power density. Pulsed power is basically produced by means of a rapid energy transfer from an energy storage medium to the load. The pulse power technology and the pulsed electromagnetic energy have greatly expanded their regimes in technological and application fields, based on the state-of-the-art technology of power devices. Trend of the device is shifted from a single-shot huge machine to highly repetitive compact devices.

The research field of the Technical Committee on Pulsed Electromagnetic Energy (TC-PEE) covers electric power engineering, plasma and discharge engineering, high energy density physics, accelerator engineering, bio-medical engineering. By the modification of pulsed electromagnetic energy, we can make an extremely high energy density (high temperature and/or high density) state with well-defined condition, which can be utilized for generations of high power lasers, intense radiation sources, high current particle beams and also for formation of new materials. The pulsed power technology is also capable of efficiently producing non-thermal equilibrium plasmas. A large volume, atmospheric pressure non-thermal plasmas is utilized for decomposition of toxic gases, ozone synthesis and sterilization. The pulsed power driven underwater discharge plasmas can be utilized for cleaning the water environment. The pulsed power discharges in composite matter are used for the recycling of aggregate in concrete blocks and of electronic parts in circuit board. Here we introduce a couple of topics in the field of pulsed electromagnetic energy and pulsed power technology.

Recent activities of TC-PEE

The major activity of TC-PEE is to collect the cutting-edge science and technology through the activity of the investigation committees and to organize several technical meetings every year to exchange information on pulsed power technology and its applications. In 2016, four technical meetings have been held, including the meetings in cooperation with the Technical Committees on Electrical Discharges or Plasma Science and Technology; in January at National Institute for Fusion Science (NIFS) in Toki, in May at Iwate University in Morioka, in August at Tokushima University in Tokushima, and in October at Saga University in Saga. Young researchers who make excellent presentations were selected to be awarded. In 2013, 3 students and young researchers recommended from TC-PEE were awarded.

Recent activities of investigating committee

TC-PEE is currently running two investigation committees. One is the committee on “Advanced Technologies in Highly Repetitive Pulsed Power Generators and Their Industrial Applications” chaired by Prof. Weihua Jiang of Nagaoka University of Technology. This committee covers the high repetition rate ranging to 1 MHz, semiconductor-driven voltage multiplier including Marx and Linear Induction Driver (LTD) circuits, FPGA-controlled smart pulsed power circuits (See Fig. 1) as well as advanced power devices including SiC, GaAs and laser-triggered photoconductive devices.

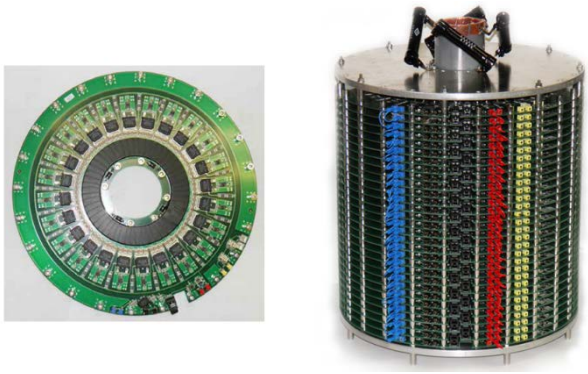

Fig. 1: Smart pulsed power circuit based on linear induction driver technology (Prof. Jiang, Nagaoka University of Technology).

The other committee is on “Physics and Engineering of High Energy Particle Beams using Pulsed Power Technology” chaired by Prof. Takashi Kikuchi of Nagaoka University of Technology, which started in May 2016. This committee is investigating the recent progress on the inertial confinement fusion (ICF), the high energy heavy ion beam as the ICF driver, as well as accelerators and

the related technologies based on pulsed power. Both committees have been carrying out their task actively and contributing to the community.

Reported by
Sunao Katsuki (Kumamoto University)

Plasma Science and Technology (PST)

Chairperson: Yasunori Tanaka (Kanazawa University)
Secretaries: Nozomi Takeuchi (Tokyo Institute of Technology)
Ryuta Ichiki (Oita University)
Assistant Secretaries: Takuya Kuwahara (Nippon Institute of Technology)

The Technical Committee on Plasma Science and Technology (TC-PST) in Institute of Electrical Engineers of Japan (IEEJ) was founded in April 1999. This committee is originally based on the plasma researcher's society that had organized technical meetings on plasma science and technology in IEE Japan several times a year since about 30 years ago. The activity field of this committee includes researches and investigations on fundamentals and applications of various plasmas over wide ranges of their density, temperature, ionization degree such as nuclear fusion, plasma processing, and plasma chemistry.

The TC-PST has 17 members from various fields on plasma science and technology in Japan. The major activity of this committee is to organize several technical meetings on plasma science and technology every year. Recent activities are as follows: In 2015, we had three technical meetings in June at Hokkaido University in Sapporo, in September at Hiroshima University in Hiroshima and in October at Kiten Building in JR Kyushu Hotel in Miyazaki. In 2016, three technical meetings were also held, in May at Iwate University in Morioka, in August at Osaka City University in Osaka, and in October at Saga University in Saga. Each meeting usually has 20–40 oral presentations. The oral presentations by young researchers including undergraduate and graduate students are strongly encouraged, and they are nominated for young presentation award. In addition, some of the technical meetings are jointly organized with the technical meetings of Pulse-Power Technology (TC-PPT) and Electrical Discharges (TC-ED). In 2015 and 2016, we have had four joint meetings with them.

In December 2015, the TC-PST co-hosted a joint international symposium of the 9-th Asia-Pacific International Symposium on the Basics and Applications of Plasma Technology (APSPT-9) and the 28th Symposium on Plasma Science for Materials (SPSM-28) at Nagasaki University, Nagasaki, Japan, together with the APSPT International Organizing Committee, the TC-ED and the JSPS 153 Committee. The APSPT has ever been held every two years in Taiwan over 16 years to promote fundamental and applied plasma researches for scientists and engineers in Japan and Taiwan. The above joint symposium was held in Japan for the first time. Finally, we had 201 presentations and 225 participants. The next APSPT will be held in Taoyuan, Taiwan, in December 2017.

Recently, the TC-PST had finished an investigation committee: "Propulsion Performance of Electrical Propulsive Rocket Engine and Physical Phenomena in Internal Plasmas". This committee is related to the propulsion performance of electrical propulsive rocket engine and physical phenomena in internal plasmas, and investigated the recent progress of the propulsion performance and the understanding of physical phenomena in plasmas. The investigation results were reported in the technical forum in May 2016 at Iwate University.

Fig. 1 A photograph of Joint technical meeting.

Electrical Wire and Cables (EWC)

Chairperson: Masayuki Hikita (Kyushu Institute of Technology)
Secretaries: Yoshihisa Nagoya (Furukawa Electric Co., Ltd.)
Kouji Miura (SWCC Showa Cable Systems Co., Ltd.)
Kenichi Furusawa (Sumitomo Electric Industries, 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 an opportunity to present technical achievements and to promote R&D activities in this field. One technical meeting was so far held in March, 2016, which was on degradation diagnosis and judgement of wires, cables and power apparatuses and was held as a joint meeting of TC-DEI and TC-EWC.

The technical committee plans to hold 4 more technical meetings in FY2016, two of which will be jointly organized by TC-DEI and TC-EWC. The topics of the technical meetings will be ‘technological trends in transmission and distribution cables and splices’, ‘insulation technologies of cable systems, treeing, tracking and insulating materials’, ‘degradation and malfunctions of wire and cables and their countermeasures’, and so on.

The technical committee held a symposium on ‘Status Quo and Issues in Diagnosis and Evaluation Methods for Insulation Dignity of Distribution Wire and Cables’ in Annual Conference of Electric Power and Energy Section of IEEJ in September, 2016.

The Technical Committee also held two forums on ‘Technical Transition and Future Issues of Accessories for Distribution Wire and Cables’ and ‘Status Quo and Technology Trend in Transmission Power Cable System’ in October and June, 2016. The former forum dealt with technological transition in technical standard of the accessories used for overhead wire and cable to aim higher reliability, more compact, easier installation.

Two Lecture classes were also held on ‘Technology Trend of Overhead Wire for Transmission and their Accessories in the Country and Overseas’ and ‘Status Quo and Technology Trend in Recycle of Wire and Cables’ in 2016.

In addition to organizing technical meetings, forums and symposia, the technical committee supervises investigation committees dealing with subjects related to electrical wire and cables. During the last several years, investigation committees were organized on the following subjects, i.e. ‘technology of XLPE power cables and associated accessories for underground power distribution’, ‘technical trend of environmental tests for insulation materials of distribution wires and cables’, ‘recent technological trends in overseas power transmission cables’, ‘trend of recycling technology for wires and power cables’, and ‘domestic and overseas technical trends in overhead transmission cables and their accessories’. The technical report of the second-to-last committee was published in September, 2015. The technical report of the last committee was published in 2016. The Investigation Committee for the Status Quo and Problems of Diagnosis and Evaluation Methods for Distribution Wire and Cables is almost finished, and the technical report of the committee is now under preparation and will be published in early 2017.

The technical committee also organizes a technical visit. This year we will visit Hachoubaru geothermal power station (110,000 kW the largest geothermal plant in Japan) of Kyushu Electric Power Co., Inc. in December, 2016.

IEC TC112 Japanese National Committee

Chairperson: Hiroya Homma (CRIEPI*)
Vice-chairman: Hisaaki Kudoh (The University of Tokyo)
Secretaries: Hiroaki Uehara (Kanto Gakuin University)
Associate Secretary: Kenichi Yamazaki (Toshiba Corporation)

*CRIEPI: Central Research Institute of Electric Power Industry

IEC TC112 deals with many international standards and specifications on evaluation and qualification of electrical insulating materials and systems. TC112 was established in 2005 based on the part of TC15 and TC98. TC98 and the related sub-group in TC15 were disbanded to the establishment of new technical committee. TC112 Japanese National Committee (JNC) was also established in 2005 to correspond to the activities in TC112 and to concern with related Japanese standards.

TC112 involves eight working groups (WG) and dealing with more than 53 standards. TC112 JNC includes eight corresponding WGs and one more WG that relates with the Japanese Industrial Standards (JIS). The WG structure of TC112 JNC is shown in Table 1. Three conveners of the eight international WGs are now taken by Japanese, WG2: Dr. Hisaaki Kudoh, WG7: Prof. Tatsuki Okamoto and WG8: Prof. Yasuhiro Tanaka. In this reason, Japanese members are very active in this standard region.

Table 1 WG structure of TC112 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)

In October of 2016, IEC General Meeting was held in Frankfurt, Germany, and meetings of TC112 were held during the weeks. Six experts from JNC participated in the TC112 meetings including the Plenary, Advisory group and WGs meetings. Mr. Jun Haruhara of Poliplastics Co.,ltd. of JNC received IEC Award 1906 for the year 2015. Also, the secretary of TC112, Dr. Bernd Goettert expressed his retirement and the assistant secretary Dr. Bernd Komanschek was approved to be the succeeding secretary. The next meetings of TC112 will be held in Delft, the Netherlands in September 2017.

Recent standards discussed in TC112 are partly listed:

WG1: IEC/TR 60216-7-2: Electrical insulation 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.

IEC 60216-3: Electrical insulating materials - Thermal endurance properties - Part 3: Instructions for calculating thermal endurance characteristics.

The replacement of convenor for Prof. Gian Carlo Montanari was discussed and election of possible candidates for the convenorship was proposed. Mr. Jun Haruhara was noted as one of the candidates.

WG2: IEC/TR 61244-4: Effects of radiation under non-ambient environments; Effect of temperature.

WG3: IEC 61934: Electrical insulating materials and systems - Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses.

WG4: IEC 62631-2-1: Dielectric and resistive properties of solid insulating materials Part 2-1: Relative Permittivity and dissipation factor – Technical Frequencies (1 – 100 MHz), AC Methods.

IEC 62631-3-11: Dielectric and resistive properties of solid insulating materials – Part 3-11: Determination of resistive properties (DC Methods) – Volume resistance and volume resistivity, method for impregnation and coating materials.

IEC 62631-3-4: Dielectric and resistive properties of solid insulating materials - Part 3-4 Method of test for electrical resistance and resistivity of insulating materials at elevated temperatures.

IEC 62631-1: Dielectric and resistive properties of solid insulating materials - Part 1: General

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.

WG6: IEC 61857-31: Electrical insulation systems - Procedures for thermal evaluation - Applications with an expected operating life less than 5000-hours.

IEC 61857-32: Electrical insulation systems - Procedures for thermal evaluation - Multifactor evaluation by diagnostic procedures.

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.

WG7: IEC/TR 60493-3: Guide for the statistical analysis of aging test data - Minimum specimen numbers at different test conditions with given experimental data.

WG8: IEC/TR 62836: Measurement of internal electric field in insulating materials - Pressure wave propagation method.

IEC/TS 62758: Calibration of space charge measuring equipment based on the pulsed electro-acoustic (PEA) measurement principle.

Finally, JNC would like to express our deep regret for the loss of two distinguished experts, Prof. Noriyuki Shimizu and Mr. Tomiaki Sakano, in recent one year.

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

Chairperson: Tsuguhiro Takahashi (CRIEPI*)
Secretary: Toshio Shimizu (Toshiba Corporation)
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 4 categories: A (Equipment), B (Subsystems), C (Systems) and D (Horizontal). Among them, our SC D1 has a horizontal character and contributes to other CIGRE SC's. The activity of CIGRE SC's is principally research oriented one.

SC D1 has now following 7 Advisory Groups (AG): Strategic AG, Customer AG, Tutorial AG, AG D1.01 (Insulating Liquids), AG D1.02 (High Voltage Testing and Diagnostic), AG D1.03 (Insulating Gases) and AG D1.04 (Insulating Solids). SC D1 consists of these AGs and following 23 WGs.

[Liquids] JWG D1/A2.47 (New frontiers of DGA interpretation for transformers and their accessories), WG D1.52 (Moisture measurement in insulating fluids and transformer insulation), WG D1.53 (Ageing of upgraded cellulose and cellulose impregnated in ester liquids and other liquids), WG D1.65 (Mechanical properties of insulating materials and insulated conductors for oil immersed power transformers), JWG A2/D1.46 (Field experience with transformer solid insulating ageing markers), JWG A2/D1.51 (Improvement to partial discharge measurements for factory and site acceptance tests of power transformers).

[Testing & Diagnosis] WG D1.44 (Testing of naturally polluted insulators), WG D1.50 (Atmospheric and altitude correction factors for air gaps and clean insulators), WG D1.54 (Principles and methods to measure the AC and DC resistance of conductors of cables and overhead lines), WG D1.60 (Traceable measurement techniques for very fast transients), D1.61 (Optical corona detection and measurement), D1.63 (Partial discharge detection under DC stress).

[Gases] WG D1.51 (Dielectric performance of eco-friendly gas insulated systems), JWG D1/B3.57 (Dielectric testing of gas-insulated HVDC systems), WG D1.66 (Requirements for partial discharge monitoring systems for gas insulated systems), WG D1.67 (Dielectric performance of new non-SF6 gases and gas mixtures for gas-insulated systems).

[Solids] WG D1.48 (Properties of insulating materials under VLF voltages), JWG D1/B1.49 (Harmonized test for the measurement of residual inflammable gases in insulating materials by gas chromat), WG D1.56 (Field grading in electrical insulation systems), WG D1.58 (Evaluation of dynamic hydrophobicity of polymeric 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) .

The preferential subjects for the 2016 SC D1 Paris group meeting were PS1: Compact Insulation Systems (AC and DC) / High field strength phenomena, Field grading, Ageing and long-term performance, PS2: New Materials / Nano composites, Eco-friendly materials (liquids, gases, solids), and PS3: Non-standardized stresses and emerging test techniques / Offshore and subsea applications (high pressure, corrosion, etc.), Advanced diagnostic technologies, Impact of non-standardized stress on materials.

From Japan, following 3 papers were accepted: “ Various Characteristics of GIS Insulation Systems and Test Method of Insulating Spacers for Residual DC Voltage” by S. Okabe, S. Kaneko, T. Kobayashi, K. Nojima, M. Takei, M. Hikita (PS1), “Preparation of Thermal Conducive Insulating Composite Material Using Electrostatic Adsorption Method” by Y. Murakami, T. Kawashima, N. Hozumi, M. Nagao (PS2), and “Insulation Evaluation of High-voltage Insulation Systems for Actual Overvoltage Waveforms and Practical Field Conditions” by S. Okabe, G. Ueta, H. Hama, H. Koyama, T. Utsumi, H. Okubo (PS3).

The next meeting is scheduled to be held in Winnipeg, Canada on October 1-6, 2017, The Japanese National SC D1 will hold 2 or 3 meetings for its preparation.

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RESEARCH ACTIVITIES AND TECHNICAL EXCHANGES IN ASIAN COUNTRIES

Conference Records

International Conference on Electrical Engineering (ICEE2016 Okinawa)

1. Introduction

International Conference on Electrical Engineering 2016 (ICEE2016 Okinawa) was held from 3rd to 7th of July, 2016 at the Okinawa Jichikaikan in Naha City, Okinawa, Japan. ICEE is held annually in Japan, Korea, China and Hong Kong through collaborative work with the related academic institutions from these countries. ICEE2016 Okinawa was the twenty second annual conference, and the sixth one in Japan, followed by those in Kanazawa City (2012), Ginowan City, Okinawa (2008), Sapporo City (2004), Kita-Kyushu City (2000), and Matsue City (1997).

Institute of Electrical Engineers of Japan (IEEJ), being the main organizer, strongly supported this conference as one of its major international activities. This time, we set the theme of the conference as “Future Technology for Bridging Nations” in order to make bridges among the countries of this region by the scientific knowledge exchanges during the conference.

Fig. 1 Okinawa Jichikaikan

2. Opening session

At the opening ceremony, Dr. Koji Tanaka, President of IEEJ and Conference chairman, opened the conference and addressed a welcome speech, followed by addresses by President of Chinese Society for Electrical Engineering (CSEE), President of Korean Institute of Electrical Engineers (KIEE), and President of Hong Kong Institute of Engineers (HKIE).

Fig.2 Dr. Koji Tanaka at the opening ceremony

The following five keynote speeches were presented at the Keynote sessions followed by the opening ceremony.

- “Designing building service subsystems for future aging society” by Prof. Dr.-Ing. Thomas Bock (TU Munich, Germany)
- “Strategy and Practice of Smart Grids” by Dr. Yu Xinqiang (SGCC, China)
- “Research Status and Projects of Microgrid in Korea” by Prof. Park June Ho (Pusan National University, Korea)

Fig.3 Prof. Thomas Bock at the key note speech

- “Global Energy Challenges and Global Energy Interconnection” by Ir Prof. CHAN Ching Chuen (The Hong Kong Institution of Engineers)
- “DC-Based Open Energy System: Bottom-Up and Scalable Microgrid for Renewable Energy Power Systems” by Dr. Mario Tokoro (Founder and Executive Advisor, Sony Computer Science Laboratories, Inc.)

3. Sessions and papers

The total of 412 papers were presented in 37 oral sessions (242 papers) and 10 poster sessions (170 papers). Seven panel sessions and one special session were held during the conference. Details of these papers are shown in Table 1. Selected papers will be published in JICEE (Journal of International Council on Electrical Engineering) after special peer reviews.

Followings are the topics of the panel sessions and the special session.

Panel session 1: Engineering the future

Panel session 2: International standardization activities on transmission and distribution field by China, Korea and Japan

Panel session 3: Modeling and simulation techniques for power systems

Panel session 4: Microgrid – Toward smart society or grid -- Electrical traction system and control

Panel session 5: Deep learning and its industrial expectation

Panel session 6: Power electronics technology supporting distribution systems with high penetration of renewable energy sources

Panel session 7: Low voltage DC applications – What are the difficult issues?

Special session: Spread of wind turbines and lightning protections- High voltage, insulation and sensing technology

Table 1 The number of presented papers

Country of Residence	412
China	8
Hong Kong	15
Indonesia	1
Japan	283
Korea	90
Macao	1
Taiwan	1
Thailand	12
Viet Nam	1

620 participants from 15 countries attended as listed in Table 2.

Table 2 Participants

Country	Regular participant
Cambodia	1
China	28
Egypt	1
Hong Kong	12
India	2
Japan	425
Kenya	2
Korea	126
Macau	1
Malaysia	1
Myanmar	1
Taiwan	1
Thailand	14
United States	1
Viet Nam	4
Total	620

Fig.4 Paper presentation at the session room

Fig.5 Poster session

4. Conference Banquet

Conference Banquet was held at ANA Crown Plaza Harborview Hotel near by the conference venue. At the banquet, full-course French dinners were served, along with the performance of Okinawan classical palace dances. About four hundred participants attended the banquet.

Before the closing of the banquet, Professor Zheng Baosen, President of CSEE, made an announcement

about the next ICEE, which is scheduled to be held in China next year. He announced that ICEE2017 will be held in Weihai, China, from 4th to 7th July, 2017, displayed a video showing information about the city. The conference flag was handed over from Professor Kaneko to Professor Zheng Baosen.

Fig.6 Participants at the banquet

Fig. 7 Conference flag was handed over from Japan to China

5. Technical tours

After the conference, following four courses of post conference tours were scheduled.

A) Visit the counter measure equipment for frequency variation control in Okinawa main Island
B) Visit Okinawa Institute of Science and Technology, and Okinawa Tracking Communication Station in Okinawa main Island
C) Visit the ocean based technological facility in Kume Island
D) Visit the maga-solar demonstration research facility in Miyako Island

Unfortunately, Miyako Island tour was cancelled due to the typhoon attacking the island, but the other three tours were successfully conducted.

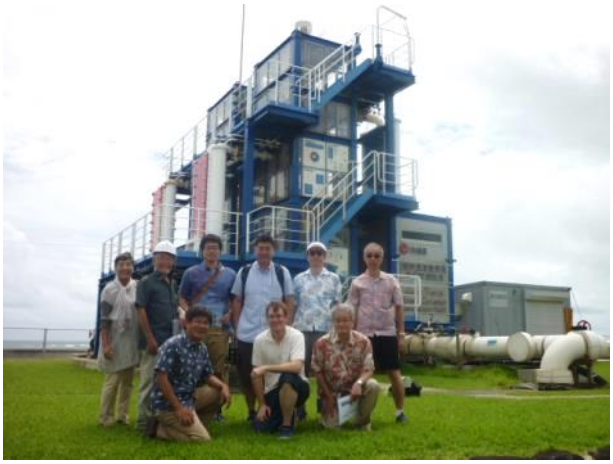

Fig.8 Kume Island tour, at the Okinawa prefectural deep sea water research center

6. Remarks

This conference was supported by Grant-in-Aid for Publication of Scientific Research Result (15HP0702) provided by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), as well as by many companies, universities, and Okinawa prefecture government. Great appreciation should be given to them. I would like to personally and sincerely thank the staff and students for their effort for the conference.

Next ICEE annual conference will be held in Weihai, China. We hope the conference will be a successful one with your participation.

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6th International Conference on Condition Monitoring and Diagnosis (CMD 2016)

The 6th International Conference on Condition Monitoring and Diagnosis (CMD 2016) was successfully held at Xi'an Jiaotong University, China from September 25th -28th, 2016. CMD is an IEEE DEIS-sponsored conference and serves as the main insulation conference for the field of condition monitoring and diagnosis around the world. The chairman of the Organizing Committee is Prof. Shengtao Li and the chairman of the International Steering Committee is Prof. Ja-Yoon KOO.

The aim of CMD2016 is to build a platform for scientists, researchers and engineers to share new ideas and promote closer cooperation. This year, 312 abstracts were submitted, of which 259 from 24 countries and regions were accepted, the distribution of the presented papers from different countries and regions is listed in Table.1. There were totally 308 delegates, among which 140 regular delegates, 143 student delegates, and 20 enterprise delegates attending the conference, the distribution of the participants from different countries and regions is listed in Table.2.

Table. 1 Distribution of papers from different countries and regions

No.	Country/Region	Number	No.	Country/Region	Number
1	Australia	6	13	Mongolia	1
2	Austria	5	14	Poland	1
3	Canada	1	15	Romania	1
4	Czech Republic	1	16	Russia	2
5	France	2	17	South Korea	12
6	Germany	3	18	Spain	1
7	Hong Kong	3	19	Sweden	1
8	India	3	20	Switzerland	1
9	Iran	1	21	Thailand	9
10	Italy	1	22	UK	11
11	Japan	7	23	USA	1
12	Malaysia	1	24	China	184

Table.2 Distribution of participants from different countries and regions

No.	Country/Region	Total	No.	Country/Region	Total
1	Australia	7	12	Pakistan	2
2	Austria	5	13	Russia	2
3	Canada	2	14	Singapore	1
4	Czech Republic	1	15	South Korea	17
5	Germany	3	16	Sweden	1
6	Hong Kong	3	17	Switzerland	2
7	India	1	18	Taiwan	1
8	Indonesia	2	19	Thailand	11
9	Italy	1	20	UK	11
10	Japan	13	21	USA	2
11	Malaysia	1	22	China	219

The technical program consists of 3 plenary lectures, 13 invited addresses, 84 oral presentations which were divided into 16 sessions and 175 poster presentation which were divides into 3 sessions. Topic areas of CMD 2016 were stated as follows and the details of the plenary lectures are listed in Table.3.

- Evaluation of failure and degradation of power equipment based on CMD
- Advanced sensors and diagnosis techniques for Smart Grid
- Strategy planning and asset management for power equipment
- Fusion of Big Data and Smart Grid Control with CMD techniques for power equipment
- Insulation structure design and lifetime assessment for HVDC system
- Degradation and lifetime assessment of new energy devices for power generation and storage

Table. 3 List of plenary lectures

Speaker	Affiliation	Title
Prof. Chengke Zhou	Glasgow Caledonian University	An Integrated Cable Condition Diagnosis and Fault Localization System via Sheath Current Monitoring
Prof. Masayuki HIKITA	Kyushu Institute of Technology University of Leicester	Recent Progress in Diagnosis of Electric Power Apparatus using Non-Conventional Partial Discharge Measurement
Prof. Jian Li	Chongqing University	Dynamic Risk Assessment of Wind Turbines

Some pictures from the opening ceremony, plenary lectures, oral presentation and poster presentation are shown in Fig.1-Fig.4, respectively. The conference also organized a technical tour to the XD Group on September 27th. Participants visited three manufacturing companies affiliated with the Group, XD TRANSFORMER CO., LTD, XD SWITCHGEAR ELECTRIC CO., LTD and HIGH VOLTAGE APPARATUS RESEARCH INSTITUTE CO. LTD. This tour had made the conference experience more interesting and impressive. A picture from the technical tour is shown in Fig. 5. The banquet of the conference was held in Qujiang YuejiangLou, which was the imperial garden of Sui and Tang Dynasties representing the top level of ancient Chinese garden and architecture. The attendances had a good time at this resort and enjoyed the beautiful scenery and great food. A pictures from the banquet is shown in Fig.6.

Fig.1 Picture at the opening ceremony

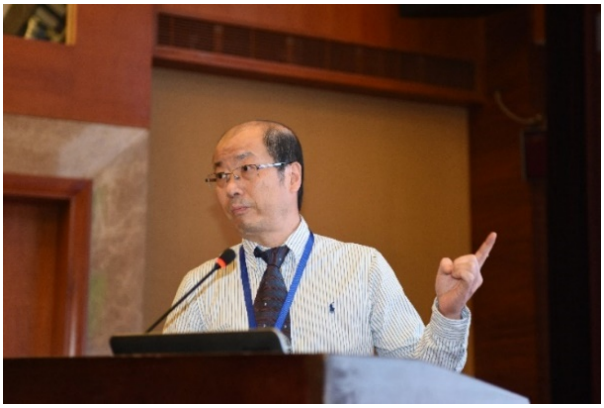

Fig.2 Picture at the plenary lectures

Fig.3 Picture at the oral presentations

Fig.4 Picture at the poster presentations

Fig.5 Picture at the technical tour

Fig.6 Picture at the banquet

During the conference, the International Advisory Committee convened to review the status of the conference and discussed some items about the organization of the committee. 14 IAC members attending the meeting and a consensus on some items was reached. At the conclusion of the conference, it was announced that the CMD 2020 will be held in Thailand in 2020. A picture from the IAC meeting is shown in Fig. 7.

Furthermore, a workshop on "Next generation Power Equipment" was held during the conference. Seven lectures were given from academic and industrial communities on the subjects of " GIS Incorporating Vacuum Circuit Breaker", "Fault Location Method for Polymer-Insulated Cables", "VSC-HVDC technology", "UHV transformer" and "HVDC Cable System". A picture from the workshop is shown in Fig. 8.

The 6th International Conference on Condition Monitoring and Diagnosis was a success, the plenary and the 7th CMD will be held at Perth, Australia from November 25th-28th, 2018. The group photo of the conference is shown in Fig.9.

Fig.7 Picture at the IAC meeting

Fig.8 Picture at the workshop

Fig.9 Group photo of CMD 2016

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Joint Conference of The 10th International Workshop on High Voltage Engineering (IWHV 2016), and 2016 Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering (JK2016 on ED&HVE)

From November 3rd to 4th 2016, Joint Conference of The 10th International Workshop on High Voltage Engineering (IWHV 2016), and 2016 Japan-Korea Joint Symposium on Electrical Discharge and High Voltage Engineering was held at University of Miyazaki, Miyazaki city, Japan. The Chairman of Steering Committee was Dr. Masafumi Yashima (Central Research Institute of Electric Power Industry). The co-Chairmen were Prof. H. Akahi (National Defense Academy) and Prof. Young - geum Kim (LSIS). The joint conference was organized by the Technical Committees on High Voltage Engineering, on Switchgear and Protection and on Electrical Discharge, Institute of Electrical Engineers of Japan, and was hosted by the Department of Electrical and Systems Engineering, University of Miyazaki.

Miyazaki Prefecture is located on the eastern coast of the island of Kyushu, surrounded by the Pacific Ocean to the south and east, Oita Prefecture to the north, and Kumamoto and Kagoshima Prefectures to the west. Miyazaki is the home of the hyuganatsu fruit, and Miyazaki's mango fruit is very famous in Japan. University of Miyazaki shown in Fig. 1 was founded in 1949 based up on the merger of Miyazaki Advanced Agriculture and Forestry School, Miyazaki Prefectural Normal School for Primary Education, and the Miyazaki Prefectural Advanced Technical School. Miyazaki Medical College was founded in 1974. Miyazaki University and Miyazaki Medical College, then, merged to form University of Miyazaki in October 2003. Currently University of Miyazaki has four faculties; Education and Culture, Medicine, Engineering, and Agriculture.

The IWHV 2016 in Miyazaki continued along the line of the previous workshops, which were held in Okinawa (1999), Tottori (2000), Fukuoka (2003), Sapporo (2004), Shizuoka (2007), Kyoto (2008), Kitakyushu (2010), Kanazawa (2012) and Okinawa (2014). The JK 2016 on ED & HVE in Miyazaki followed the line of the previous symposium in Mokpo, Korea, 2015, and also provided an opportunity for the specialists in the field of fundamentals and applications of electrical discharge and high voltage engineering, for exchanging and sharing their research achievements and experiences.

Fig. 1 Picture of University of Miyazaki

Technical subject areas of the joint conference were stated as follows:

1. Switchgear, Power apparatus and Industrial applications
2. Lightning, Over-voltages, Fast transients
3. High voltage measurements & testing
4. Insulation materials and systems (gas, liquid, solid, vacuum and combined materials)
5. Outdoor insulation
6. Fundamental phenomena of electrical discharges, partial discharges and corona discharges
7. Electrical discharges, plasma and their applications
8. Field calculation, measurement& EMC, EMF
9. Nano-dielectric application to HV Power apparatus
10. Environmental effects of HV system

The number of participants of the joint conference was 109, and a cumulative total of 181 were made by these participants over the same period. (1st day: 93, 2nd day: 88). They were from Republic of Korea, Republic of the Union of Myanmar, and Japan. The number of participants in each country was shown in Table 1. The host country Japan held the most participants. From these countries, there were lots of Master and Doctor Course students who participated in the conference.

Table 1 Number of Participants in Each Country

Country	No. of Participants
Korea	16
Myanmar	11
Japan	82
The total number: 109	

The number of articles per session was shown in Table 2. Every session gathered mostly equivalent number of articles. Because there was no poster session, only oral sessions were made all through 2 days. For

Fig. 2 Picture of participants of the joint conference.

presentation of high voltage and insulation, partial discharge, water tree, and remaining lifetime of power apparatus researches on various actual problems were reported. Additionally, there were lots of reports related to numerical electro - magnetic analysis.

Table 2 Number of Articles per Session

No.	Sessions	No. of papers
1	Lightning Phenomena	6
2	Arc measurement	5
3	Partial discharge, cable insulation	4
4	Lightning Protection	5
5	Transient voltage, VCB	5
6	Surface discharge	3
7	Diagnosis of cables and transformers	3
8	Arc analysis	6
9	Discharge application, liquid discharge	5
10	Numerical Electro- magnetic Analysis	8
11	Gaseous and vacuum discharges	5
	The total number: 55	

Fig. 3 Picture of opening ceremony

At the opening ceremony in the morning on the first day of the joint conference, Dr. Masafumi Yashima (The Chairman of Steering Committee, Central Research Institute of Electric Power Industry) made an opening declaration of the conference, as shown in Fig. 3. Prof. Young-geun Kim of the Steering Committee Member also made greeting.

Each presentation time was set within 20 min, and questions and answers time was set within 5 min. Most presentations were given by students and were active. Because students practiced many times for the presentation, most of the presentations were very well. However, for questions and answers, it seemed that a lot of students had troubles in understanding questions. Additionally, some students' times were greatly prolonged for discussion. Even during the coffee break time, the answer to the question about the presentation was still going on, and pleasant chats were also made.

The Steering Committee arranged two invited lectures. Prof. Jang seob Lim of Mokpo National Maritime University gave us a lecture on "Condition Indexing of HV System for Asset Management". Some approaches for estimating the remaining lifetime of electric power apparatus were introduced. In recent years, study on asset management and estimating the lifetime of electric power apparatus have drawn attention. Therefore, the lecture was fascinating content. Prof. Kazuhiro Toyoda of Kyushu Institute of Technology gave us a lecture on "High voltage on spacecraft". Behavior of charged particles and the surface discharge phenomenon on the solar cell surface of a spacecraft was extremely fascinating.

On the night of the first day, a banquet was held in a buffet styled restaurant of the center of Miyazaki town. The Local Committee Members prepared characteristic and local alcoholic spirit distilled from yams (Sho-chu) in Miyazaki Prefecture, as shown in Fig. 4. Prof. Yokota, a Dean of Engineering of University of Miyazaki, made a speech to welcome those present, as shown in Fig. 5. Prof. Jang seob Lim of Mokpo National Maritime University made a toast, as shown in Fig. 6. Then,

participants enjoyed meal, Sho-chu, and conversation. The research fellows renewed their friendships, and students tried to make friends with each other.

Fig. 4　Local alcoholic spirit distilled from yams

Fig. 5　Welcome speech from Prof. Yokota, a Dean of Engineering of University of Miyazaki

Fig. 6　Toast speech from Prof. Jang seob Lim of Mokpo National Maritime University

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The 47th Symposium on Electrical and Electronic Insulating Materials and Applications in Systems (47th SEEIMAS) and The 31st DEI Young Researchers' Seminar

The 47th SEEIMAS

This is a review of the 47th Symposium on Electrical and Electronic Insulating Materials and Applications in Systems (SEEIMAS), which is mainly hosted by Technical Committee on Dielectrics and Electrical Insulation (TC-DEI) in IEEJ. The 47th symposium was held at "Satellite Campus of Gifu University, Gifu City, Japan from 31st August to 2nd Sept., 2016. The SEEIMAS is an annual domestic symposium and the international one is supposed to be held in every three years as International Symposium on Electrical Insulating Materials (ISEIM). This domestic symposium, formerly called Symposium on Electrical Insulating Materials (SEIM), was started in 1968. The founders of this 1st symposium were Prof. Y. Inuishi, Prof. M. Ieda, Prof. K. Yahagi, Dr. T. Nakazima, and so on. Before the start, they attended the Pocono Conference (now it becomes CEIDP) in USA and they wanted to realize the similar conference in Japan to stimulate the activity in the field of dielectrics and electrical insulation technology in Japan through the intensive discussion among university, research institute and industry people. We hold this SEIM every year from 1968 and SEIM greatly contribute Japanese development in this field.

The 47th SEEIMAS was composed of following events:

(A) Functional and Newly Developed Materials (5 oral presentations)

(B) Properties of Dielectrics and Its Testing and Diagnostic method (5 oral presentations)

(K) Special Session for Application of Quantum Chemical Calculation for Analysis of Insulating Materials -Current and Future- (5 oral sessions)

(C) Evaluation of Insulating and Degradation Characteristics (4 oral presentations)

(D) Partial Discharge Phenomena

(MVP) Mutual visiting stile poster session (28 poster presentations)

(SS) Sun shine session (8 poster presentations)

(M) Memorial lectures (2 lectures)

As mentioned above, totally 61 papers including 2 invited papers were listed in the symposium proceedings. There were 25 oral and 36 poster presentations. During the conference, 113 participants working with industry, government, and research and academic institutions shared their experiences and discussed the latest developments and future challenges confronting the field.

Fig. 1 Ieda Memorial Lecture by Prof. M. Hikita

The conference commenced with opening remarks by Prof. Y. Tanaka of Tokyo City University and General Chair of the symposium. The second day, Prof. M. Hikita of Kyushu Institute of Technology delivered the 10th Ieda Memorial Lecture. (Fig. 1) This award is given to a person who have contributed to academic progress of this research field. His presentation consisted of his research carrier on measurement technologies for insulating materials using various advanced method. Dr. K. Soma, retired from Hitach Cable Ltd., also delivered the 13th Yahagi Memorial Lecture. This award is given to a person who have contributed to industrial progress of this research field. His presentation consisted of his research carrier on investigation of water trees in power cable insulating layer.

In this symposium, an application of quantum chemical calculation for analysis of insulating materials was a featuring theme. Having a successful experience of a workshop entitled APIANS (Analysis for Polymeric Insulating materials using Advanced Numerical Simulation) held in 2014 ISEIM, the general chair organized this attractive special session. After the workshop, number of research works published on

Fig. 2 Yahagi Memorial Lecture by Dr. K. Soma

journal or in conferences seems to be getting increase rapidly worldwide. In the oral session, five speakers introduced their recent research works, and many active discussions were carried out through the session. Furthermore, a practical seminar about the numerical simulation for quantum chemical calculation was held as an event of Young Researchers' Seminar held after the symposium, introduced later. In the practical seminar, more than 30 participants, students from universities and young researchers from industries, tried to use an advanced software temporary provided by a cooperative company.

A special poster session called "Mutual Visiting-Type Poster (MVP) Session" was organized to encourage young researchers to expand their activities. This is one of our most important missions. Young researchers were encouraged to showcase their presentation and research abilities through the poster sessions. Presenters from similar research fields were divided into small groups and were required to give their own poster presentation to the other members of the group. After the short presentations, the other group members questioned the presenter. All members of the group delivered their presentation in the same way; this allowed all participants to engage in meaningful and productive discussions (Fig. 3). Five outstanding presenters were presented awards during the symposium banquet. One of them, who got the top score, won "the most valuable presentation" award, which enabled the winner to partake in the Korea-Japan Young Researcher Exchange Program. This award winner is supposed to be invited to Korean domestic conference with financial aid. During this symposium, Mr. Suhun Kim of Kyungpook National University presented his study as part of this exchange program.

The other important mission of the symposium was to provide researches with the opportunity to generate links between researchers from industry and academia (including students). From this point of view, we planned another special session, named the "Sun-Shine Session," to introduce industry R&D topics to academics (Fig. 4). It is believed that the Sun-Shine Session was helpful as it fostered mutual understanding among researchers in industry and academia in the field of electrical insulation materials.

Fig.3 MVP session in the 47th SEEIMAS

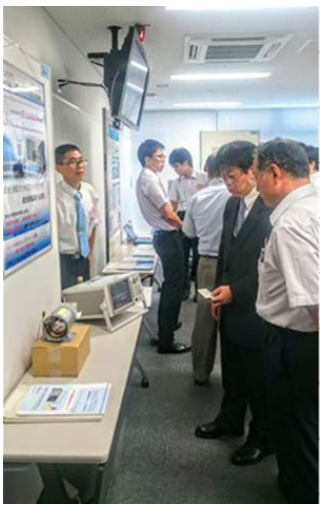

Fig.4 SS session in the 47th SEEIMAS

Finally, we would like to sincerely thank all of the participants and members of the organizing committee for their contribution to the symposium. We also would like to express our sincere appreciation to all the supporting members of the symposium for their contributions. Next year, the 48th SEEIMAS will be held as the 8th International Symposium on Electrical Insulating Materials (**2017 ISEIM**) at the building of Toyohashi chamber of commerce and industry, in Toyohashi, Japan, technically cosponsored by IEEE DEIS, in cooperation with IEEE DEIS Japan chapter.

The organized committee would like to participate you to this attractive symposium. Please visit the following URL or make a contact with the symposium secretary, Dr. N. Fuse, correspondence address below.

http://www2.iee.or.jp/~adei/ISEIM2017/index.html

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The 31st DEI Young Researchers' Seminar

Following the 47th SEEIMAS, the 31st Young Researchers' Seminar was started at the same site of the symposium, and followed by the seminars in a famous traditional hot spring area, "Nagaragawa" close to the symposium site.

The seminar also traditional events started in 1971, run by the TC-DEI. Members of TC-DEI had recognized the seminar was an important event and good opportunity to know each other. The members thought that the seminar enhanced growth of young talent and they have willing to continue this event. For example, Profs. N. Hozumi, Y. Tanaka and Dr. K. Fukunaga were typical frequent participants and

supporters of the seminar. While the seminar was held in every year at the beginning, once it had down period (2002-2008), close to a period so-called, “lost decade” in Japan (2000-2010). However in 2009, Prof. Hozumi, the chair of TC-DEI at that time, responded to requests from many researchers, and he reactivated the event in Matsue. After that, the seminar is usually held in every three years.

This event is basically organized by the committee members selected from students and researchers in industries. This time, the committee members were sent from Toyohashi Inst. Tech, Waseda Univ., Chubu Electric Power, Fuji Electric and VISCAS.

In this year, as mentioned above, the practical experience of the numerical simulation was carried out. In this practical seminar, more than 30 participants, students from universities and young researchers from industries, tried to use an advanced software temporary provided by a cooperative company. At first in this seminar, a professional coach gave a lecture about how to use the software (Fig. 5). After that, participants

Fig. 5 Practical experience of numerical calculation for energy band structure using an advanced software, in the 31st Young Researchers Seminar

operated the software by having the lecture and the support by Prof. T. Takada and his pupils in Tokyo City University, respectively. Thanks to their good coaching and supports, most of participants can achieve to calculate the energy band structure of a simple model of polymer molecular, while most of them were first-timers for such analysis. After above event, the participants enjoy the event of a program-based learning, a party and a lecture by Dr. Okazawa, a consultant engineer for high voltage equipment (Fig. 6). Participants seemed to be satisfied that they could have some new friends and knowledge through the seminar.

At this moment, the next DEI young researchers’ seminar has not been scheduled yet. However, it must be held, because the chair of the moment also had received favors from the seminar. Supposed year may be in 2019?

Fig. 6 Lecture by Dr. Okazawa

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International Conference to be held in Asia

ICEE 2017 (International Conference on Electrical Engineering)

Dates: July 3-7, 2017
Venue: Weihai, China
Organized by:
Shandong University
State Grid Shandong Electric Power Company
Sponsored by:
Chinese Society for Electrical Engineering (CSEE)
Co-organized by:
The Institute of Electrical Engineers of Japan (IEEJ)
The Korean Institute of Electrical Engineers (KIEE)
The Hong Kong Institution of Engineers (HKIE)
URL: www.icee2017.org.cn

ICEE is a major event that annually provides an international platform for electrical engineers and experts to highlight key issues and developments to the multifaceted field of electrical engineering systems. The 23rd in the series of the conference will be held in Weihai, China from July 3 to 7, 2017. It is a great pleasure for organizers to invite prospective authors initiating the discussion on challenges that need to be timely overcome and addressing key questions for achieving safe, reliable, sustainable and intelligent power system. Followings are to be the main topics of the conference:

- Fundamentals, materials
- Power systems
- Transmission and distribution
- HVDC and FACTS
- HV engineering
- Information and control systems
- Environment, renewable energy & energy efficiency
- Electrical machines and motor drives
- Sensors & micro-machines

All abstracts with contact details should be submitted via online abstract form available at the official web site. The abstract should be less than 500 words, and include the correspondence author, other authors, keywords, intended categorization of the paper as well as preference of presentation style. Accepted submissions will be announced to prepare their full paper accordance with the paper template. All submitted paper will be reviewed by the technical program committee. At least one author of each paper must complete the registration.

Important Dates:

Submission of abstract:	Feb. 1, 2017
Acceptance notification of abstract:	March. 1, 2017
Submission of full paper:	Apr. 1, 2017
Acceptance notification of paper:	May 1, 2017
Registration for paper publication & early bird registration:	Jun. 1, 2017

ISEIM 2017 (International Symposium on Electrical Insulating Materials)

Dates: September 12-15, 2017
Venue: Toyohashi Chamber of Commerce & Industry, Toyohashi City, Japan
Organized by: IEEJ Technical Committee on Dielectrics and Electrical Insulation
Technically co-sponsored by:
IEEE Dielectrics and Electrical Insulation Society
IEEE DEIS Japan Chapter
Supported by:
TBD
Honorary Chair
Prof. N. Hozumi (Toyohashi University of Technology)
General Chair
Prof. Y. Tanaka (Tokyo City University)
URL: http://www2.iee.or.jp/~adei/ISEIM2017/

ISEIM is positioned as the international version of the domestic symposium held every year by IEEJ TC-DEI. The 8th conference will take place in Toyohashi City. Followings are some events that organizing committee is newly preparing for.

1) The 2017 Inuishi lecture will be given by Christian Laurent, with the tentative entitle “Energetics of charge transport in insulating polymers.” This memorial award is named after Prof. Y. Inuishi who is one of great pioneers for our field in Japan.
2) Workshop for advanced nanodielectrics will be held to introduce the new book entitled “Advanced Nanodielectrics – Fundamentals and Applications –”. The editor group consist of the Investigating R&D Committee on Advanced Polymer Nanocomposite Dielectrics (Chair: Prof. T. Tanaka, 2010-2013) will present the fundamentals and applications of such advanced materials.
3) Round-robin test of repetitive partial discharge inception voltage measurements on complete winding of random-wound motor that relates to IEC 60034-18-41 has clarified the statistical properties and the significant impact of ambient humidity. Special sessions will be organized for digest report of such activity, and for demonstrating the measurement using test equipment.

Important Dates:

Abstract Submission:	Jan. 27, 2017
Acceptance/Rejection Notices:	Middle of Mar., 2017
Manuscript Submission:	May 27, 2017
Conference Dates:	Sept. 12-15, 2017

ISEIM 2017 Secretariat:
Dr. Norikazu Fuse: Central Research Institute of Electric Power Industry, 2-6-1 Nagasaka, Yokosuka, Kanagawa 240-0196, Japan
E-mail: iseim2017@freeml.com

Contribution to the Professor Kaneko's Preface

Collaborative Researches through Double Degree Programs (DDPs)

Sanong Ekgasit
Chulalongkorn University, Thailand

Thailand as a developing country trying to escape from the middle-income society to the high-income through innovation, nurturing and enhancing human capital via education is the essential task. For higher educations, especially those in science, technology, and engineering, research and development is part of the curricula. Collaborative research with Niigata University under the DDP is one of my systematic practice for training and transforming graduate students into professionals. Since Professor Baba and I were Alexander von Humboldt research fellows at Max-Planck Institute for Polymer Research at Mainz, Germany, the DDP makes our collaboration even stronger by conducting researches of mutual interests. We (my students and I) gained tremendous benefits from DDP collaboration. As a team of chemists at department of Chemistry, Faculty of Science, Chulalongkorn University specialized in synthesis and fabrication of functional nanostructures of noble metals (gold, silver, platinum and palladium), we would like to explore the potential applications of our materials in sensor, energy, and medical fields. Three of my students with three different synthetic skills of metal nanostructures have explored the potentials of their materials in SPR sensor and solar cell applications by performing in-depth researches at the department of Electrical and Electronic Engineering, Niigata University for 2 years under the supervision of the Niigata team. They have perfected the research skills necessary for good researchers as well as the arts of working with others. Two engineering undergraduate students from Niigata also had a three-months visit at my laboratory to learn how to synthesized silver and gold nanostructures. The fruitful collaboration resulted in 6 jointed publications, 2 symposiums in Thailand, and numbers of awards earned by the students as they presented their works in international conferences.

I really enjoy the virtue of DDP program and hope that this kind of activity is continued and supported.

Group photo of the 2nd Japan-Thailand Joint Symposium on Advanced Nanomaterials and Devices for Electronics and Photonics (JT-AND 2016) held from January 11 to 13, 2016 at Chulalongkorn University in Bangkok, Thailand. The symposium was organized by Profs. Kato and Baba of Niigata University and Prof. Ekgasit of Chulalongkorn University.

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China Corner

High-voltage Vacuum Circuit Breakers in China

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

1. Overall

Vacuum circuit breakers (VCBs) are widely used in medium voltage power distribution systems because of their excellent performance, compact size, and maintenance-free operation. In recent decades, VCBs in the transmission voltage class have been drawing increasing worldwide interest. However, there is still require large amount of research on the technology of the vacuum circuits breaker at transmission voltage (≥72 kV). Extensive efforts have been devoted to the development of transmission voltage class VCBs. The research topics include contact materials; internal and external electrical insulation of the vacuum interrupter (VI); vacuum arc control technologies and the optimization of the operating mechanisms.

VCBs have the advantage over the traditional gas and oil breaker. A vacuum interrupter is the most important part of the VCBs. The vacuum interrupter is self-contained. It requires no extra supply of gases or liquids, and it emits no flame or smoke. The ambient surrounding the vacuum interrupter neither affects nor is affected by its performance. Moreover, the vacuum interrupter can be used in adverse atmospheres. The vacuum interrupter can withstand quite high voltages with only a small contact gap.

2. Technology of the High-voltage Vacuum Circuits Breaker in China

2.1 Development of A Single-Break 126 kV/2500A/40kA Vacuum Circuit Breaker

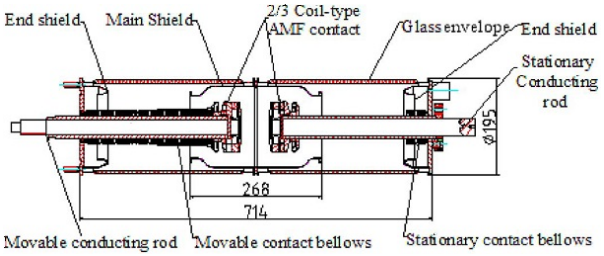
In China, the demand for the VCBs at transmission voltage is gradually increasing. Figure 1 shows a prototype of the 126 kV single-break VCB. Figure 1 also indicates the technical parameters of the VCB, which is designed by the Xi'an Jiaotong University, in China. The external insulation of 126 kV vacuum interrupter (VI) is provided by SF_6 gas at 0.1 MPa, which is a gauge pressure. The main technical parameters of the 126-kV VCB include: rated current of 2500 A, rated voltage of 126 kV, rated short-circuit breaking current of 40 kA, rated short-circuit making current of 100 kA, rated short-time witstand current of 40 kA, 4 s and peak withstand current of 100 kA. The 126-kV VCB passed type tests performed according to the IEC 62271-100 international standard and the Chinese standard GB 1984-2003.

The vacuum interrupter is the core of the VCBs. Figure 2(a) shows a sketch of the 126 kV VI. The distance between the two terminal flanges is 714 mm,

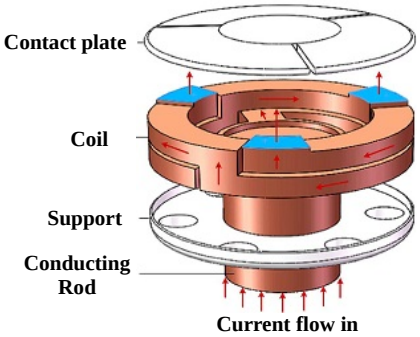
Voltage	kV	126
Normal current	kA	2.5
Number of poles		3
Frequency	Hz	50
Operating sequence		O-0.3s-CO-3min-CO
Short-time withstand current	kA	40
Peak withstand current	kA	100
Duration of short-circuit	s	4
Short-circuit making current	kA	100
Short-circuit breaking current	kA	40
First pole-to-clear factor		1.5
Capacitive voltage factor		1.4
Line-charging breaking current	A	31.5
Cable-charging breaking current	A	140
Pressure for insulation SF_6 at 20℃	MPa	0.1
Supply voltage of closing and opening device	V	220
Class		E2, C1, M1

Figure 1. Prototype of the 126 kV single-break VCB with its main technical parameters.

and the diameter of the glass envelope is 195 mm. The length of the main shield is 268 mm. The gap is 60 mm when the contacts are fully open. The contact spring provides a force of 4938 N when the contacts are fully closed. In the single-break 126 kV VI, a pair of 2/3 coil-type AMF contacts shown in Figure 2(b), with a diameter of 100 mm, was chosen. The 2/3 coil-type AMF contacts are defined as the current flows 2/3 circle in the contact.



(a)



(b)

Figure 2. The 126 kV single-break vacuum interrupter: (a) Sketch of the vacuum interrupter and (b) 2/3 coil-type AMF contact.

2.2 Application of High-voltage Vacuum Circuits Breaker in China

126 kV VCBs were in service for 11~13 years until 2016. Two ZW-126/T1600-40 VCBs were put into service in Jiangsu province, China, from December 15, 2005. Until February 28, 2010, one VCB operated 18 times and the other operated 32 times. There were no problems found. The two 126 kV VCBs were checked for

status in December 2006 and December 2008. The status of the VCBs were good. Moreover, two ZW-126/T1600-40 VCBs were put into service in Yunnan province, China, from April 21, 2006. Until February 22, 2010, one VCB operated 16 times and the other operated 20 times. There were no problems found. The two 126kV VCBs were checked for status in December 2007 and December 2009, and the status of these two VCBs were good.

Figure 3. The 126 kV single-break vacuum breakers serviced in China.

The ambient surrounding the vacuum interrupter neither affects nor is affected by its performance. They can be used in adverse atmospheres. The VCBs are unaffected by temperature, dust, humidity, or altitude. In the north of China and in Russia, the liquidification of SF_6 gas and other insulated medium caused by the cold temperature affect the insulating characteristics. And so far, the number of the 126 kV live type VCBs serviced is more than 200. The number of the 72.5 kV live type VCBs serviced is more than 400.

Figure 4. The 72.5 kV vacuum breakers serviced in the north of China.

3. Key Technologies of the High-voltage Vacuum Circuits Breaker

With the development of the power system and the industry, more high-voltage VCBs are in requested. Extensive efforts have been devoted to the key technologies of the high-voltage vacuum circuits breaker. There are many key technologies that support high-voltage (HV) VCBs, such as the following.

1) High-voltage insulation technology, which includes vacuum insulation and external insulation of vacuum interrupter.
2) Interrupting technology with long contact gaps. Generally, HV vacuum insulation requirements lead to long contact gaps where vacuum arcs are more difficult to be controlled by a magnetic field. To interrupt high short circuit current successfully with long contact gaps, axial magnetic field technology is preferred.
3) Nominal current increasing technology. High-voltage circuit breaker needs high nominal current level. Also, heat conduction path of HV VCBs is long that is an obstacle to increase the nominal current level.
4) Operating mechanism technology. The opening and closing characteristics provided by operating mechanism should cooperate with the vacuum arc characteristics in obtaining an optimum performance.
5) Contact bouncing damping technology. This phenomenon is particularly obvious in HV VCBs, because the closing velocity and contact stroke in HV VCBs are higher than that of medium voltage ones.

4. The Vision of the Vacuum Switching at Transmission Voltage

4.1 Ceramic vacuum interrupter with multiple shields

Two materials have been successfully used for the vacuum interrupter's body: a glass cylinder and a high alumina content porcelain ceramic, as shown in Figure 5. It has been proved that the 126 kV single-break vacuum interrupters with single floating shield and a glass cylinder can have the BIL voltages up to 550 kV. However, the BIL voltages of the single floating shield VI is hard to reach 600 kV and above. For the higher BIL voltages (600 kV and above) needed for 126 kV/145 kV and higher voltage circuits up to three floating shields with a porcelain ceramic have been successfully used. There are many advantage of the ceramic vacuum interrupter. The ceramic vacuum interrupter can improve the product quality of the VIs. It also can reduce the product costs.

(a) (b)

Figure 5. The 126 kV single-break vacuum interrupters.
(a) Single floating shield with a glass cylinder and
(b) Multi floating shields with a porcelain ceramic.

4.2 Gas Insulated "Vacuum" Switchgears

A new generation of GIS and/or circuit breakers may use vacuum interrupter technology instead. Meanwhile, environment-friendly insulating gas will be used instead of SF_6, as shown in Figure 6. There are many advantages of the gas insulated "Vacuum" switchgears. Environment-friendly can reduce the using of the strong greenhouse gas SF_6. This gas insulated "vacuum" switchgears have a low price and maintenance free. Moreover, it has a small size with low noise.

Figure 6. Environment-friendly insulating gas vacuum breaker.

4.3 Extreme-high Multi-breaks Vacuum Circuit Breakers

Using multiple vacuum breaks in series is a way to solve the saturation problem of the vacuum insulation capability. Therefore, the vacuum switchgears could be used in the extreme-high transmission system. Figure 7 shows the design of the 363 kV multi-breaks vacuum breaker. Two branches connects are in parallel. Each branch includes six VIs connected in series. Every VI is driven by a repulsion mechanism. The rated short circuit current is 63 kA. The rated power frequency withstanding voltage is 510 kV. The rated lightning impulse voltage withstanding voltage is 950 kV..

Some efforts need to be devoted to the key technologies of the extreme-high multi-breaks vacuum circuit breakers, including the dynamic recovery process of the multi-breaks, determination of grading capacitance and design of operating mechanism. The development of extreme-high-voltage vacuum circuit breaker can effectively reduce the using of the strong greenhouse gas SF_6.

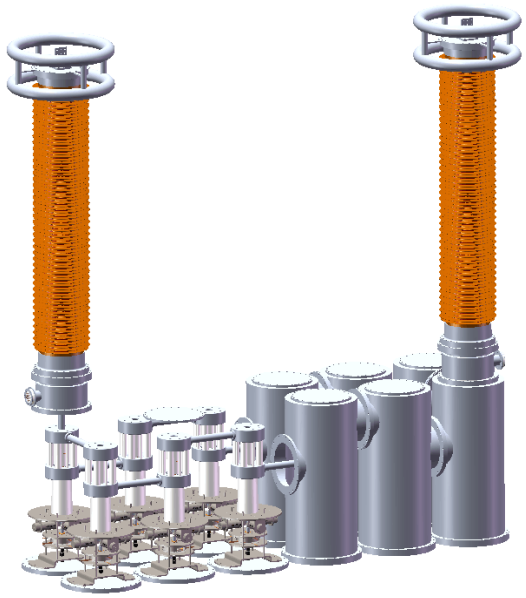


Figure 7. The design of 363 kV multi-break vacuum breaker.

5. Conclusion

High-voltage VCBs is a technology integration, including high-voltage vacuum insulation, long gap inter-ruption of high short circuit current, high nominal current, and mechanical technology.

The high-voltage VCBs, especially for 72.5 kV and 126 kV are developing rapidly in China. Much attention has been taken to the key technologies of the high-voltage vacuum circuit breakers, which has been intro-duced. The high-voltage vacuum circuits breakers have a bright potential application in the transmission voltage level.

Profs. Shengtao Li, Yingsan Geng and Zhiyuan Liu

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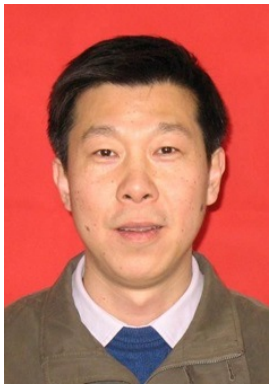

Prof. Zhiyuan Liu

Korea Corner

SIEFCON 2016

Prof. Yong Joo Kim
ASTU, Korea

1. Introduction

SIEFCON 2016 (Seoul International Electric Fair Conference) was held, for the first time, at COEX, Seoul, Republic of Korea, from Oct. 5 to Oct. 7, 2016. The first industry oriented international conference was jointly organized with SIEF (Seoul International Electric Fair). In addition HVDC (High Voltage Direct Current) workshop and CMD (Condition Monitoring and Diagnosis) Workshop were jointly accommodated at the same venue as well. SIEFCON 2016 (www.siefcon.org) hosted by KOEMA (Korea Electric Manufactures Association) was attempted to share the most updated information and state of the art technologies among the electric power industry and the research institutions. The main topics were the recently promoted technologies such as next generation of electric power equipment, renewable energy and electric vehicle.

2. Brief on SIEFCON 2016

One of the main issues emerged in SIEFCON 2016 was the evolution of Korean electric power industry, which adapts the IoT technology and the framework of Industry 4.0 (competition shifts from discrete products, to product systems consisting of closely related products, to systems of systems that link an array of product systems together) into electric power industry. Korean electric power industry has been seeking to restructure the business framework combining the emerging technologies and to be the total solution providers. Figure 1 shows the IoT application example in distribution system.

Photo 1, Opening Ceremony of SIEFCON 2016

Self-powered multifunctional smart sensors will be installed along the distribution power lines. And a portable wireless terminal collects the health status from the wireless smart sensors and it forwards the information to the corresponding substation.

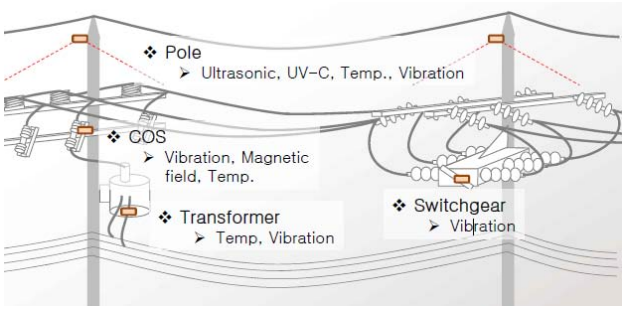

Figure 1, IoT Application in Distribution System

Based on the survey taken from the participants in SIEFCON 2016, the organization committee of SIEFCON was suggested to promote the conference to the annual event aiming to invite more technical staffs from China and Japan.

In June 23, 2016, KERI (Korea Electrotechnology Research Institute) officially announced the completion of #2 HPL (High Power Laboratory, 4,000 MVA) testing facility as shown in Figure 2. The total capacity including #1 HPL will be increased to 8,000 MVA. The commercial operation has already started since July 1. Korean electric industry believes that the upgraded test facility for high voltage power circuit breaker and high voltage power transformer will enhance the competitiveness of Korean heavy electric products in the global market.

In HVDC Workshop, Super Grid between Korea and China has been discussed again regarding the framework of the project between State Grid of China and KEPCO. The result of the feasibility study on

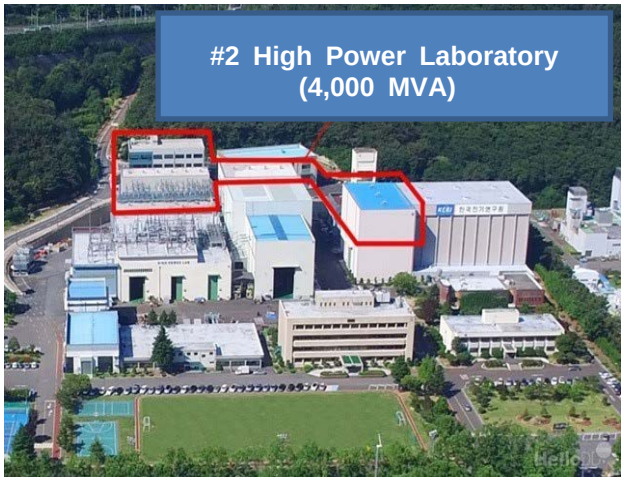

Figure 2, #2 HPL in KERI

Super Grid between two companies will be completed by the end of 2016.

KERI also announced R&D project to develop HVDC system (±200kV, 200 MVA, MMC converter) from 2017 and the commissioning test will be completed by the end of 2020.

KEPCO presented the on-going HVDC project from Bukdangjin to Godeok (LCC, Bipole, 3 GW, 500 kV MI PPLP Cable 34.2 km) as shown in Figure 3. The company also reveals the future project to construct the #3 Jeju HVDC line (LCC or VSC, 200 400 MW, MI PPLP Cable 100 km) by the end of 2021. And South-West-Sea wind farm project transmitting the power to the on-shore via HVDC submarine cable (VSC, 2 GW, MI PPLP Cable) is scheduled to complete the construction in 2019. Shinwuljin Plant - Seoul HVDC line (Figure 4) is also under the feasibility study changing the original plan (AC 765 kV) to 500 kV LCC HVDC line (265 km, 6.8 GW).

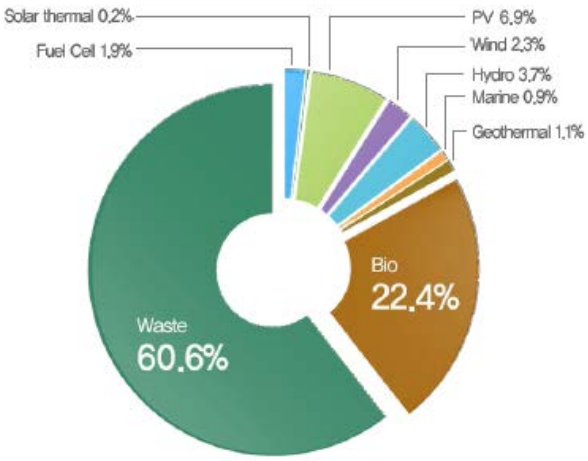

Figure 5, Current renewable energy shares in Korea

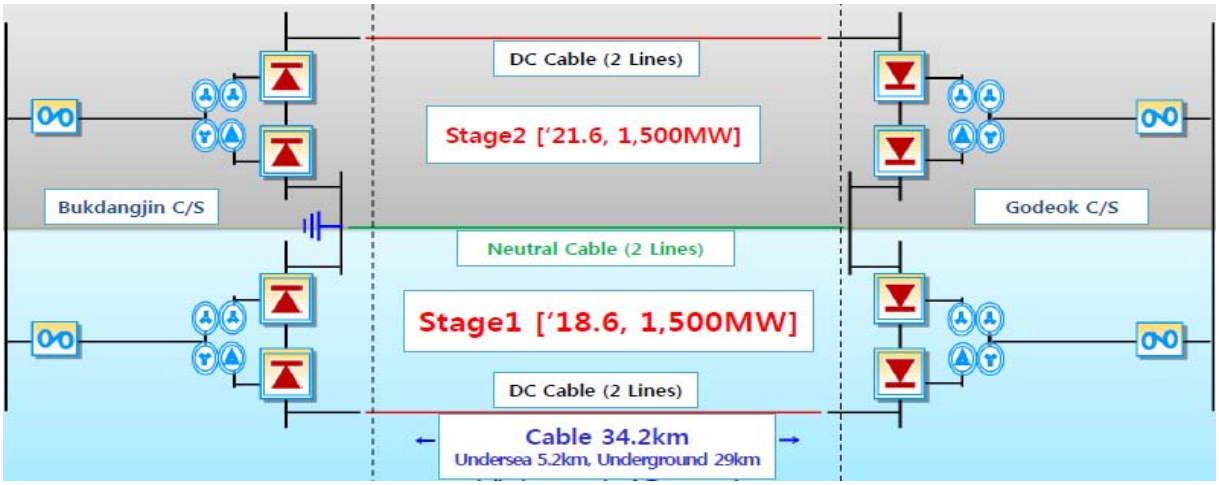

Figure 3, Bukdangjin-Godeok HVDC line (Middle-West region in Korea)

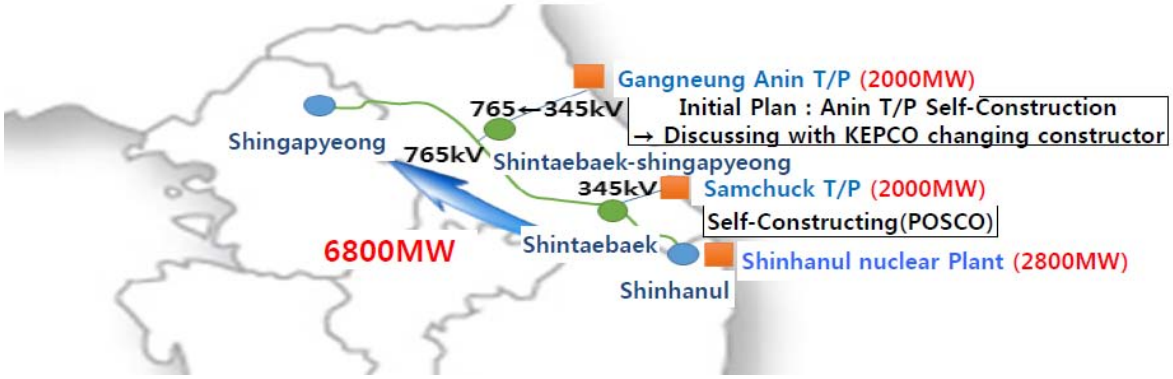

Figure 4, Bukdangjin-Godeok HVDC line (Middle-East region in Korea)

3. Renewable Energy Development

Korea Energy Agency confirms the development plan of renewable energy - 4.3 % shares in 2015 (Figure 5) – increasing its shares up to 11 % by 2035.

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India Corner

Lightning Research at the High Voltage Laboratory of Department of Electrical Engineering, Indian Institute of Science

Prof. Udaya Kumar
Indian Institute of Science
Bangalore, India

Abstract Since its inception at late 1960s, the high voltage lab of Indian Institute of Science (IISc) was actively involved in providing technical advice on lightning protection issues, for the power transmission lines and substations in particular. Extensive research and developmental activities have been carried out on surge absorbing elements during 1960 - 1980. At later part of 1990, a dedicated laboratory for testing of small aircrafts for lightning certification was built. Subsequently, development of suitable lightning protection system to Indian satellite launch pads was carried out by the laboratory in and around year 2000. During this period and thereafter, a detailed research spanning from modelling of lightning to various aspects of lightning protection and current measurements were pursued. A novel self-consistent model for the lightning return stroke was developed. The source of reflection at the top of the grounded object was identified. The fate of secondary reflected waves racing along the matured channel section towards the wavefront is theoretically determined. The nature of the current in unconnected upward leader has been determined. A special experimental facility for evaluating the surge response of protection system using reduced scale model has been built. The surge response of various lightning protection system has been evaluated both experimentally and theoretically, including the insulated mast design. The interception efficacy, as well as, the surge response of lightning protection system to Indian satellite launch pad has been evaluated. The induction to the cable mounted on tall towers for both isolated and regularly connected cases has been evaluated. The frequency response of Rogowski coil has been determined analytically by deriving a novel governing equation and its solution for salient cases. The salient features of the tower base currents for both intercepted and bypass strokes have been investigated for Indian satellite launch pads and algorithm was developed for both stroke classification and for estimation of current in the stroke. Presently, investigation on lightning-power-line interaction and development of software for assessment of lightning threat to small aircrafts are underway.

1. Introduction

The high voltage laboratory of Indian Institute of Science has been pursuing lightning related work for a long time. It was instrumental in designing or advising the lightning protective measures for power utilities, small aircrafts, satellite launch pads, etc., of India. In the last 18 years, the lightning research was augmented mainly by Prof. Udaya Kumar and his group and it can be categorised into following sections.

2. Modelling of the return stroke

2.1 Model for the return stroke current evolution

In order to better understand the electrical aspects of return stroke evolution, which is of prime interest to protection engineering, suitable model for the return stroke was investigated. A novel macroscopic physical model for the first return stroke was successfully developed. This is a self-consistent model in which the current or the velocity of propagation are not assumed, rather they are predicted. Sample simulation results are presented in figure 1.

It is evident from the results presented in figure 1 that, the model developed is capable of depicting most of the salient features of the return stroke currents and fields. The above powerful model is employed to investigate on many intricate aspects, which will be dealt next.

2.2 Source of reflection at the junction of channel and tall objects

Source of reflection for the return stroke current wave at the top of grounded object is of basic importance in evaluating the role of tall object in modifying the return stroke current amplitude, as well as, the remote fields. In order to throw some light on this, a detailed investigation is carried out to show that it is basically the change in radii at the junction, which is responsible for the reflection rather than any other thermal related aspects.

2.3 Dynamics at the wavefront for secondary waves

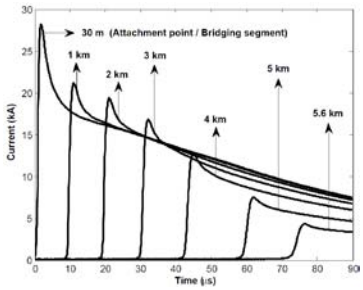
Dynamics at the wavefront for the waves reflected from the ground end of tall objects and transmitted on to the evolving return stroke channel has been investigated. This is necessary to get a clear picture of the phenomena and also to ascertain the resulting remote fields. It is rigorously shown that the secondary waves get totally absorbed at the wavefront, thereby clarifying on the problem, which had in the literature diverse opinions.

Further, considering a simplified model for Canadian National Tower, it is shown (refer to Figure 2) that the first ground end reflected wave is responsible for the early/first zero crossover in the remote fields.

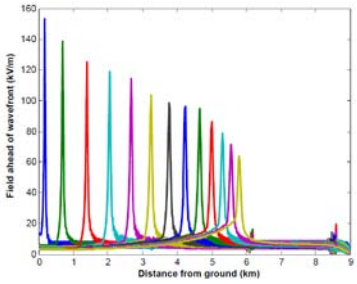
2.4 Currents in the unconnected upward leaders

During the cloud-to-ground lightning strike, there will be several upward leaders competing to meet with it. Generally, only one of them will be successful, leaving all the others unattended. The charge deposited in these unconnected leaders will have to come back to ground,

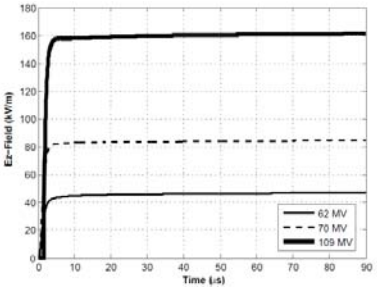
which is modulated by the conductance of the upward leader, field due to the charges deposited on the leader and the field due to the evolving return stroke. These aspects have been modelled and it is shown that the unlike the currents in the tall towers illuminated by the field due to return stroke, the resulting current will be unipolar and is of higher amplitude. Figure 3 presents a sample simulation result.



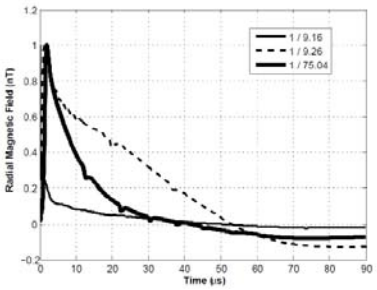
(a) Current at different heights



(b) Field due to ohmic drop at different times



(c) Vertical electric field at 50 m



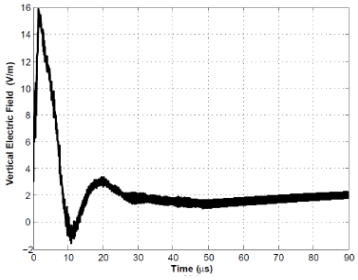
(d) Azimuthal magnetic field at 200 km

Fig.1 Sample simulation results for cloud base potential of 70 MV

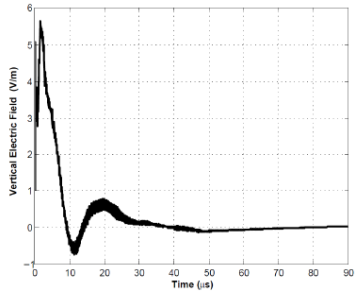
3. Protection

3.1 Investigation on lightning surge response of tall tower

It was inferred that in tall towers significant transverse magnetic mode of current propagation prevails during the initial critical time periods and hence the commonly employed transverse electromagnetic mode of propagation based approximation becomes questionable. Using the Numerical Electromagnetic Code (NEC2) based frequency domain full-wave solution, evaluation of lightning surge response of protection schemes involving isolated tower, tower with guy wires, etc. were carried out in time domain.



(a) At 16.8 km



(b) At 50.9 km

Fig.2 Vertical electric field at two different distances during a strike to 553 m tall tower

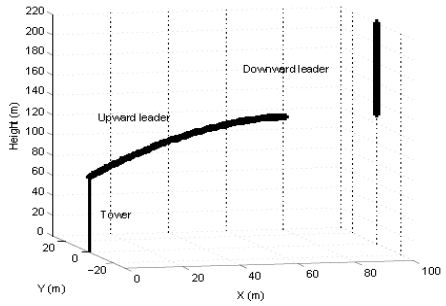
The insulated mast scheme, in which the down conductor and the air terminal is isolated from the support tower, is frequently suggested in the literature for the protection of critical systems. In order to quantitatively evaluate this scheme, theoretical evaluation of lightning surge response of insulated mast scheme with a single support tower is carried out, which is supported by the experiments on scaled models. It is shown that the supporting insulator cannot always provide isolation and further even when it can provide isolation, there is a significant induction to the supporting tower. These two aspects are not in the favour of insulated mast scheme.

3.2 Lightning protection of Indian Satellite Launch Pads

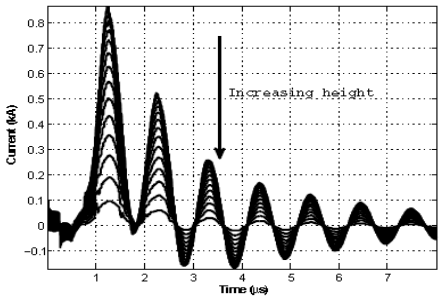
High voltage laboratory of IISc was responsible for the design of lightning protective measures for both of the Indian satellite launch pads. The initial design was with stringent time constraint and hence it was directly based on engineering practice at that time. Subsequently, different investigations were initiated to quantify various aspects of solitary and distributed lightning protection system with special emphasis on protection for launch pad.

The lightning stroke interception efficacy, potential rise after the stroke interception and comparison across different protection philosophies for protection system to two of Indian satellite Launch Pads were evaluated and sample simulation results, reduced scale model setup and image of launch pad-II are presented in figure 4. The

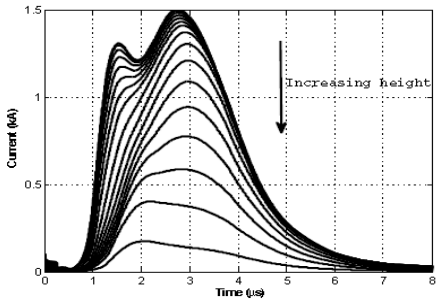
lightning surge response of the protection system was quantified by employing a unique experimental facility. These works were first of their kind.



(a) Just before strike to ground



(b) Induced currents in the absence of leader



(c) Induced currents with the leader

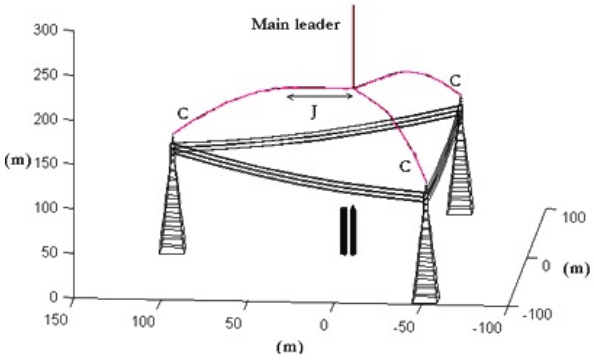
Fig.3 Simulation results for 75 m tall down conductor at 100 m from the channel

3.3 Induction to cables mounted on tall towers

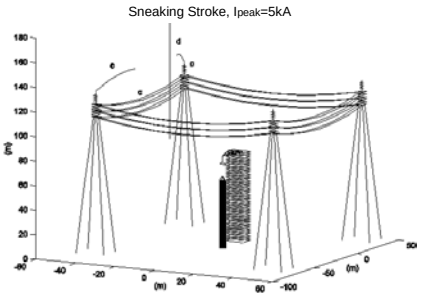
Protection of cables and systems mounted on tall towers is a serious issue. In order to ascertain the situation, theoretical investigation was carried out with newly developed thin-wire time-domain code, which correctly accounts for the proximity effects. This study was supported by tedious experiments with reduced scale models of the tower with cables. Many important inferences were brought out. Figure 5 shows sample results for a cable which is connected to the supporting tower at regular intervals.

3.4 Lightning attachment to UHV lines

As a part of the working group C4.26 of CIGRE, role of ground wires on upward leader launching efficacy of phase conductors and towers were investigated using a novel charge simulation based method specifically developed during the course of work. It is shown that the ground wires act as electric shield thereby curtailing the inception of upward leaders from the phase conductors.



(a) Stroke interception by protection system to pad-I



(b) A bypass stroke in pad-II

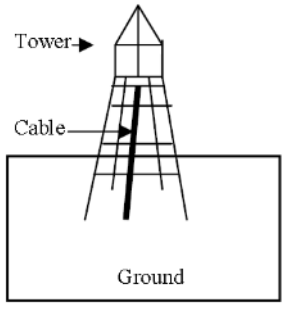
(c) 1:40 reduced scale model for evaluation of surge response

(d) Pad-II with protection system

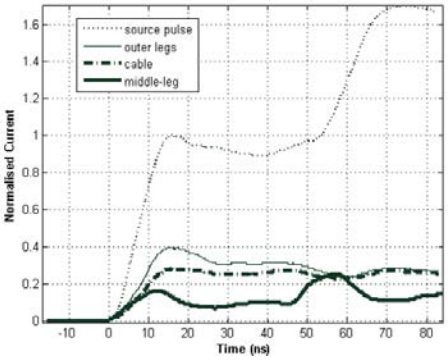
Fig.4 Protection system to Indian satellite launch pads along with sample simulation results and experimental set up

4. Measurement

Measurement of stroke current in tall interconnected towers impose several difficulties, including the demand on sensitivity and bandwidth on one side and identification of the type of strike and actual stroke current on the other side. In order address these issues, few activities were taken up.



(b) Schematic of 1:20 scaled tower model



(b) Injected and cable currents

Fig.5 Current shared by a cable running along the face of a 120 m tall tower with regular bonding

4.1 Work on Rogowski coil

In order to design high sensitivity large bandwidth Rogowski coils, a new governing equation was developed and solved analytically for canonical cases. Subsequently, simple novel measures to enhance coils bandwidth was suggested.

4.2 Work on stroke classification and estimation of current

Taking lightning protection system to Indian satellite launch pad as an example, a method for lightning stroke classification and evaluation of currents in the intercepted strokes from the measured tower base current has been proposed.

5 Work in progress and future plans

5.1 Lightning protection for aircrafts

Development of two software for aiding in the design of lightning protective measures to small aircrafts is under progress. This development will be supported by suitable laboratory experiments (refer to figure 6). Subsequently research work toward better quantification of the associated entities have also been planned.

5.2 Different field solution approach to delve into the buried conductors

Incidentally, in order to further enhance the modelling of physical process associated with lightning, including that in the soil, a domain based field computation approach is under consideration, which will replace the thin-wire formulation part of the modelling indicated in section 2.1.

5.3 Strokes to power lines

The lightning strikes to power lines is of prime interest to power engineers. Invariably, in the power system lightning related studies, a current source model with a shunt impedance is generally employed. There are uncertainties in both the value of the shunt impedance to be employed, as well as, the actual wave propagation characteristics close to the strike point. The work is under progress towards use of self-consistent return stroke model to reliably simulate the associated phenomena and some preliminary results in this direction have already been published in lightning conferences.

(a) Impulse voltage flashover test on small aircraft model

(b) Scaled model of another small aircraft

Fig.6 Laboratory models for evaluation

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Indonesia Corner

Application of Gas Insulated Sub Stations in Indonesian Electric Power System

Prof. Suwarno **Ibrahim, M.Sc.**

1. Introduction

Indonesia is the world's largest archipelago country. Indonesia is the largest archipelago country which is located at the earth's equator, between Asia and Australia as well as between Pacific and Hindi ocean.

It located in tropical area which is situated around the equator. Currently, the population number is 260 million with annual growth rate of 3.5 % and stand as 4th largest populated country after China, India and US.

Naturally, as the economic sector is growing, the electric demand will also grow with the percentage value higher than the economic growth. According to Indonesia's Central Bureau of Statistic press release, in the first quarter of 2016 the economic growth was reach 4.92%. With this value, the Indonesia's economic growth will reach 5% during 2016. This economic growth will expand the electrical energy demand within this year with greater value.

PLN as the state owned company has the obligation to fulfill all the electricity demand in all over Indonesia. According to the PLN's statistic, until December 2015, PLN's installed capacity already reach 40,256.26 MW generated from 5,218 power plants. In the same year, the Indonesia's peak load already reached 33,381.08 MW which increase 0.18% from previous year. During 2015 the electric energy production has reached 176,472.21 GW, which also increase 0.67%.

Among the total population of Indonesia today, 57.5% of them are residing in Java Island although Java Island is the 5th largest island after Kalimantan, Papua, Sumatra and Celebes islands. Hence the Java Island only has 6.8% of the total area of Indonesia, which make the Java Island as the most populated Island in the country.

According to these facts, the development in economic sector as well as in electrical system in Java takes the biggest part in Indonesia. In electrical energy sector, the capacity and the energy development are increase significantly which make the Java and Bali system as the biggest and the most important system in Indonesia. Until the end of 2015, 69.21% of Indonesia's installed capacity is located in Java and Bali system. The capacities will keep increase as its peak load increase 1.5% to 24,258 MW. In supporting the economy expansion, Indonesia is pursuing a 35 GW extra capacity within 5 years.

2. Gas Insulated Substation

As the biggest electric system which is placed in a narrow zone in Java and Bali, the area for substation development, especially in urban region is a big issue during the electric capacity expansion. The solution for this problem is by constructing substation in the form of Gas Insulated Substation (GIS). By erecting the GIS, PLN can save around 75% of land space utilization comparing with conventional Substation.

GIS as the solution for Substation building have become the choice for some decade. The first generation of GIS in Java and Bali system were built in early 1980's. Until 2016, there are 82 GIS have been built for Java and Bali system. These GIS were 75 and 7 units for 150 kV and 500 kV respectively.

In recent years, there are so many manufacturers which have appointed to build the substation. Figure 1 shows the portion of 500 kV GIS and Figure 2 shows the 150 kV portion.

Most of the GIS in Java Bali system were operated in 1990's era. The oldest GIS is the Gedung pola Substation which was operated in 1984 and the newest and already operated GIS are GIS Tanah Tinggi, PLTU Pelabuhan Ratu and Bandara Ngurah Rai Airport Denpasar Bali which were operated in 2013. Today,

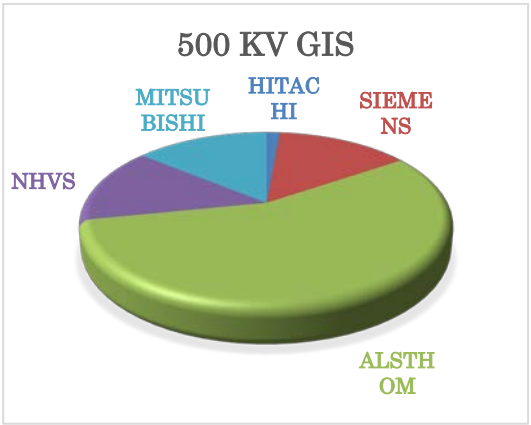

Figure 1 Installed 500kV GIS in Java-Bali system

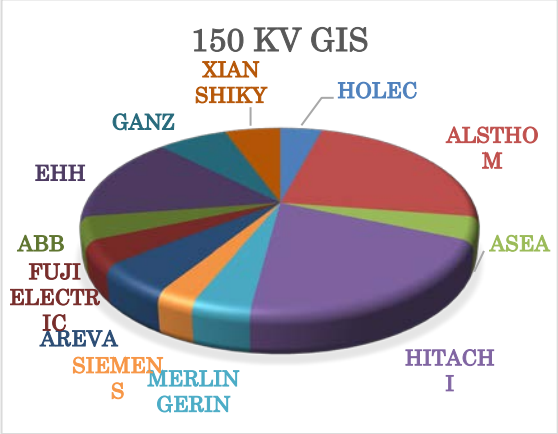

Figure 2 Installed GIS 150 kV GIS in Java- Bali system

there were some new substation using GIS type which still under construction. Figure 3 and 4 show typical the 500kV and 150kV GIS in Java and Bali system.

As most of the GIS are already operated around 20 years, the maintenance according to the lifecycle service has become the issue in recent years. This maintenance requires the scheduled shutdown of a substation, or every bay in a substation. To avoid or reduce the unserved load, this maintenance schedule should be calculated precisely as the shutdown of a bay can take up to two weeks.

Figure 3 500kV outdoor GIS at Java and Bali system.

Figure 4. 150kV indoor GIS at Java and Bali system.

In the other hand because the load are growing annually, the existing conventional substation need to be increased in the term of its capacity. During this period, there are some conventional Substations which will be combined with the GIS or will be turned off and replaced with the GIS to overcome the bay extension.

3. GIS Extension

In general, GIS is working under high current. This high current flowing in conductor will produce high magnetic field in SF6 gas and enclosure. Therefore, it is important to use non magnetic such as aluminum or very low magnetic materials such as low magnetic steel for GIS enclosure. In some cases, GIS extensions are necessary to be done. Since the beginning, the extension of GIS usually uses same manufacturers and enclosure materials. However, since recent years, GIS extension using different manufactures as well as enclosure materials is being common.

Figure 5 shows an extended 150 kV GIS with different manufacturer and enclosure material. The 150 kV GIS has continuous rated current of 2000 A and short circuit current of 40 kA. The enclosure materials are aluminum and low magnetic stainless steel.

Figure 6 shows an extended 500 kV GIS with different manufacturer and enclosure material. The GIS has continuous rated current of 3150 A and short circuit current of 31.5 kA. The enclosure materials are aluminum and low magnetic stainless steel. An illustration of materials used in the extension is shown in table 1. The permeability of the enclosure materials strongly affects the magnetic flux density and contribution of magnetic losses inside the enclosure. This will enhance the increase of the temperature of the GIS.

Figure 5 Typical extended 150 kV GIS with different manufacturer and enclosure material.

Figure 6 Typical extended 500 kV GIS with different manufacturer and enclosure material.

Table 1 Typical material parameters used in GIS

#	Part	Material	Relative Permittivity	Relative permeability	Thermal conductivity (W/(m.K))
1	Conductor	Aluminum	-	1.000022	250
2	Connector	Silver	-	-	429
3	Gas	SF_6	1.002026	1	0.012058
		Air	1.00058986	1.00000037	0.0285
5	*Spacer*	Epoxy Resin	4	-	0.21
6	*Gas Seal*	Rubber	7	-	0.13
7	Enclosure	Aluminum	-	1.000022	250
		Stainless SUS304	-	1.05	16

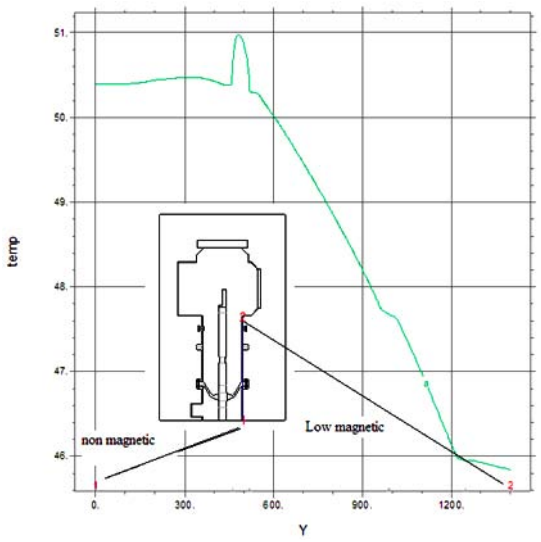

Figure 7 Temperature distribution at non magnetic and low magnetic enclosures

By using the material constants as indicated in table and rated current, the temperature distribution was calculated. Figure 7 shown distribution of temperature at enclosure with different materials. It is seen that enclosure with aluminum as a non magnetic material has slightly lower temperature than those of stainless steel as low magnetic material.

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BOOK REVIEW

Advanced Nanodielectrics - Fundamentals and Applications -

IEEJ Investigation Committee on Advanced Polymer Nanocomposite Dielectrics

Chairperson: Toshikatsu Tanaka, Waseda University

Pan Stanford Publishing Pte. Ltd., The book is planned to appear in December 2016.
Print ISBN 9789814745024, 300 pages, List price $149.45

The book is a translated version of the "Advanced Nanodielectrics - Fundamentals and Applications -" which was published by the Investigating R&D Committee on Advanced Polymer Nanocomposite Dielectrics in the Institute of Electrical Engineers of Japan (IEEJ). The Japanese version was a winner of the IEEJ Outstanding Technical Report Award in 2016. Its cover and contents are shown in Figures 1 and 2.

The book provides detailed coverage on processing, and the electrical, thermal and mechanical properties of nanocomposites. Special consideration concerning surface modification of inorganic particles with nano-metric dimensions, theoretical aspects of interface and computer simulation develops an understanding of the characteristics in nanocomposites. In particular, a large interface between the polymer and particles dominates properties in nanocomposite dielectrics, and that is illustrated in detail.

Moreover, potential applications in electric power and electronics sectors imply many advantages of nanocomposites.

The book is a definitive edition of a practical handbook for beginners as well as experts. Key features of the book are shown as follows:

- Provides sufficient knowledge of cutting edge technologies in polymer nanocomposites to be used in electrical and electronics engineering.
- Explains significant roles of "guest" nano-fillers in "host" polymer matrices.
- Explains computer simulations in organic and inorganic composite materials.
- Includes contributions from international leading academic and engineering experts.
- Strikes a good balance between fundamental production methods and applications.
- Includes many practical examples of polymer nanocomposites with many experimental results.

The book can be obtained from the following site.

http://www.panstanford.com/books/9789814745024.html

Dr. Takahiro Imai (Toshiba Corporation, Japan)

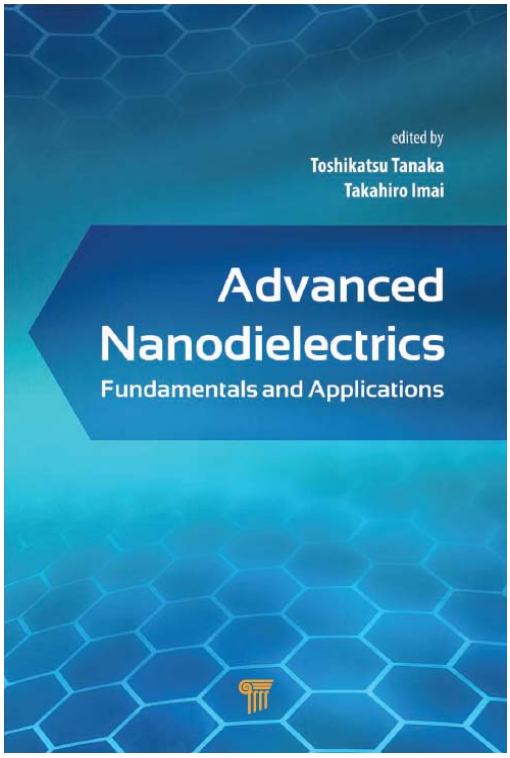


Figure 1. Book cover.

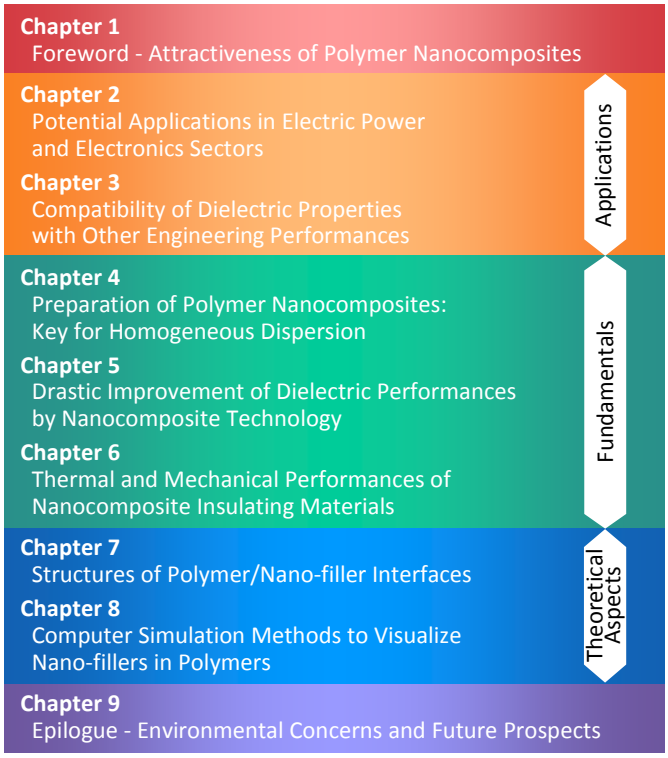


Figure 2. Contents of "Advanced Nanodielectrics".

Tailoring of Nanocomposite Dielectrics -From Fundamentals to Devices and Applications

Editors : Toshikatsu Tanaka (Waseda University, Japan), Alun S. Vaughan (University of Southampton, UK)

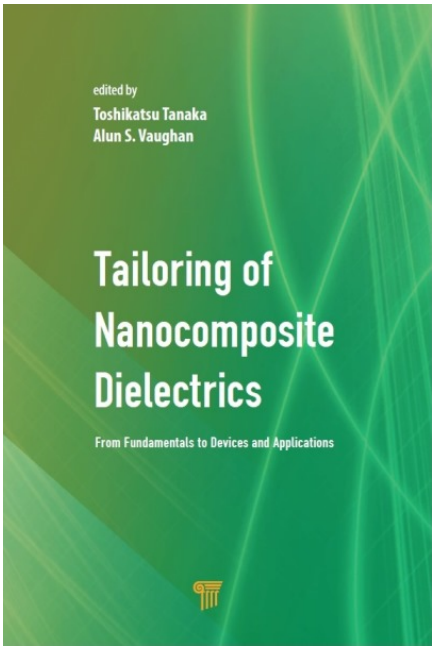
Pan Stanford Publishing Pte. Ltd.,
Print ISBN: 9789814669801, 422 pages, List price $149.95

The inclusion of nanoscale particulates within a host matrix has been exploited by mankind for millennia as a means of producing materials with unique properties. Notable examples of this include the Lycurgus Cup and Damascus steel, albeit that the origins of the effects were not understood at the time. More recently, the inclusion of nanometric carbon – carbon black – in rubber was found to be an effective means of producing improved automobile tyres. As such, the topic that we now know as nanocomposites has a long history. In the electrical area, such materials have a rather shorter history, with many authors citing John Lewis' 1994 paper, "*Nanometric Dielectrics*" as catalysing the current extensive and global interest in the field of so-called nanodielectrics, although it is clear that some pioneers had been researching this topic well before the 1990s. So what has caused the massive growth in interest in this class of materials over the last two decades? A reasonable answer to this is that experimental evidence emerged to demonstrate that introducing nanoparticles at a low loading level can be an effective means of improving a range of electrically-relevant properties of bulk commodity polymers. While the potential of the approach progressively evolved during the first decade or so of empirical study, understanding of the origins of the effects that were reported lagged behind and this, combined with issues of scale-up and reproducibility, have meant that the clear laboratory promise of nanodielectrics has not been transferred into extensive technological impact. However, recently, this has begun to change and, therefore, the publication of this book is most timely.

The aim of this book is to bring together contributions from leading researchers who are active in topics pertinent to the electrical applications of nanocomposite systems. While the topics addressed are covered in detail, it is never possible to provide an entirely comprehensive account in a concise manner and, therefore, extensive reference lists are provided within each chapter, in order to facilitate further inquiry. The book is divided into four sections that, address, in order: material preparation; experimental characterisation and techniques for computer simulation; properties, both bulk and surface, that are relevant to the use of nanocomposites in dielectric application; a range of potential devices and applications. In this way, the book aims to provide a multidisciplinary overview of nanodielectrics from a range of different perspectives.

The book can be obtained from the following site.
http://www.panstanford.com/books/9789814669801.html

Dr. Toshikatsu Tanaka (Waseda University, Japan)



Book cover

MISCELLANEOUS

Photos on Front and Rear Covers

Front Cover

Redox Flow Battery

The "Redox Flow Battery" is a rechargeable battery using the oxidation-reduction reactions of transition metals in their ionic complexes as electro-active materials. They have excellent characteristics such as a long service life with almost no degradation of electrodes and electrolytes, a high safety due to being free of combustible materials, and a high availability of operation under normal temperatures. These characteristics of the batteries will bring many advantages to power grid systems. Thus an application of the Redox Flow Batteries is expected to be a solution to stabilize the power grids when renewable energies such as solar and/or wind power generation are introduced into them.

Yasumitsu Tsutsui

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Rear Cover

Nanoimprinting Technique and AFM Images of Nanostructures for Plasmonic Organic Solar Cells

We demonstrated the fabrication of grating-coupled surface plasmon resonance (SPR) enhanced organic solar cells, that is, plasmonic organic solar cells. Blu-ray disk recordable (BD-R) substrates were used as the diffraction grating substrates on which silver films are deposited by vacuum evaporation. Grating structures were fabricated on poly(3-hexylthiophene-2,5-diyl) (P3HT) : phenyl-C61-butyric acid methyl ester (PCBM) thin films by nanoimprinting technique with a PDMS stamp as shown in Figure (a). Figures (b) and (c) show the AFM images of the 1- and 2-dimentional BD-R grating structures fabricated by the nanoimprinting technique, respectively. 1-dimensional grating-structured PDMS stamp was fabricated using a BD-R grating template with the grating pitch, Λ of 320 nm. The PDMS mold was placed on the P3HT:PCBM layer at 100 ºC for 1 hour to create 1-dimensional grating pattern. Then the fabricated P3HT:PCBM 1-dimensional patterned substrate was rotated 90º in the horizontal direction. 2-dimensional grating pattern was fabricated by imprinting the PDMS stamp on the 1-dimensional P3HT:PCBM pattern at 100 °C for 1 hour. Low conductivity poly(3,4-ethylene-dioxythiophene) (PEDOT) : poly(styrenesulfonate) (PSS) / poly(diallyl-dimethylammonium chloride) (PDADMAC) layer-by-layer ultrathin films deposited on P3HT:PCBM films act as the hole transport layer, whereas high conductivity PEDOT:PSS films deposited by spin-coating act as the anode. SPR excitations were observed in the fabricated cells upon irradiation with white light. The photoelectric conversion efficiency of the plasmonic solar cells was improved.

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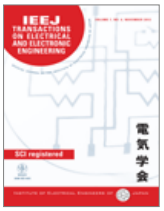
Journals of IEEJ

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 bimonthly 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 (http://www.iee.jp/?page_id=1544) › Journal & Paper > Journal (http://www.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
http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1942-9541, (SCI registered)

Left: Electrical Engineering in Japan
http://onlinelibrary.wiley.com/journal/10.1002/(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

Technical reports listed below were prepared by investigation committees in technical societies A to E in IEEJ and published from the end of October in 2015 to November in 2016. Their extended summaries can be browsed in English on the web site below but the texts of technical reports are described in Japanese except No. 1365 and No.1366.

No.	Title	Issue date
1350	Agricultural and Fisheries Applications Using Pulsed Power and Plasmas	2015/11/20
1351	Natural Disaster Cases and Protective Measures for Factory Electrical Facilities – Based on the lessons learned from the Great East Japan Earthquake –	2015/10/5
1352	Motion Control for Innovative Industrial Infrastructure	2015/11/30
1353	Risk Management Related to Low-Frequency,Large-Scale Disasters at Municipal Facilities	2015/11/30
1354	Lightning protection design of low-voltage distribution system	2015/12/15
1355	EMC problems of electromagnetic noise characteristics caused by the discharge	2015/12/15
1356	History of the nuclear power generation technology in Japan	2016/5/20
1357	Present Status of Researches on Ultra-High-Performance Permanent Magnets and Their Applications	2016/1/25
1358	Energy Measurement and Data Analysis	2016/1/25
1359	Application of Energy Storage Technologies to Railway Electrification Systems	2015/12/15
1360	Metrological traceability for smart grid	2016/1/25
1361	Small-motor Technologies for Service Robots	2016/1/25
1362	Security management system for water facility: A survey on the current situation of security practices for water facilities in Japan	2015/10/20

1363	Safety and security technology of electrical installations for future buildings	2016/2/15
1364	Present Status and Future Trend of Generating Systems based on Renewable Energies	2015/12/10
1365	The System Optimization and the Benchmark Problem for Industrial Application (English)	2016/2/25
1366	International Joint Study Programme on History of Technology Interaction (English)	2016/5/20
1368	Latest Situation of Linear Motor Application 2015	2016/3/15
1369	Recent trend of the advanced research on photonics and magnetics	2016/3/15
1370	Radiation and radioactivity measurement technology related to nuclear power plant accident	2016/8/30
1371	Fuel cell technology and application suitable for renewable energy society	2016/4/15
1372	Current state of Fukushima and trends in superconducting magnetic separation techniques for decontamination	2016/5/20
1373	Application of Machine Learning to Service-Oriented Systems	2016/5/20
1374	Technical Trends in New-Type Voltage Source AC/DC Converters for Power Systems ～with Special Focuses on Modular Multilevel Converter (MMC) ～	2016/4/25
1375	Investigating R&D Committee of Yttrium-Barium-Copper Oxide High Temperature Superconducting Magnet Technology	2016/3/10
1376	Switching phenomena and requirements for high voltage circuit breakers on power systems	2016/4/5
1377	Recent Advances in Real-World Haptics	2016/6/21
1378	Performance evaluation of new-generation actuators and suggestion of multi-degree-of-freedom structures exploiting their characteristics	2016/6/24
1379	Recent technology Trend of Overhead Transmission Line Conductors and Fittings	2016/8/15
1381	Technical Challenges for Wider Spread and Benefits in Applications of Matrix Converters	2016/9/5
1382	Generic Models for the Simulation of Power Electronics Systems:Smart-Grid, Motor-Drive and Automotive Applications	2016/9/30
1383	Evaluation of Properties and Improvement of Polymeric Insulating Materials for Outdoor Use	2016/10/20
1384	Application of Information and Communication Technology for Water Supply and Sewerage Facilities	2016/10/25
1385	Trends of AC motor drive application from the users sights	2016/10/20
1387	Electrostatic discharge as a failure source	2016/11/25

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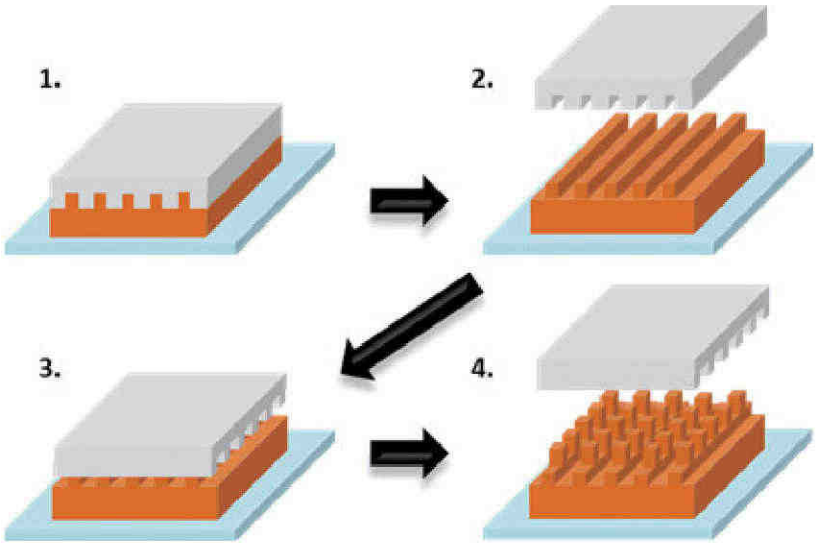
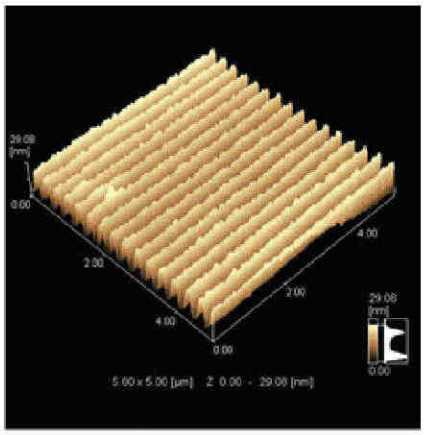
Nanoimprinting Technique and AFM Images of Nanostructures for Plasmonic Organic Solar Cells

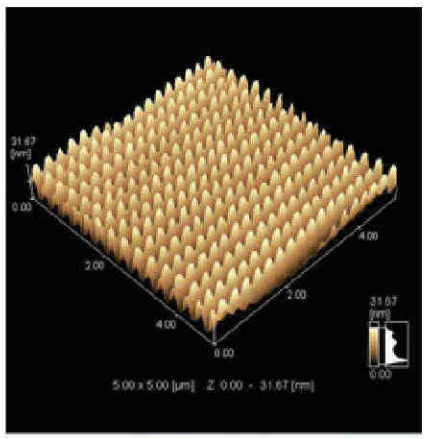


1. Imprint at 100℃ for 1 h.
2. After cooling, detach and 90° rotate the mold.
3. Imprint at 100℃ for 1 h.
4. After cooling, detach the mold.

(a) Nanoimprinting technique



(b) 1-dimentional BD-R grating structure



(c) 2-dimentional BD-R grating structure

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