

2017 1st International Conference on Electrical Materials and Power Equipment (ICEMPE 2017)

**Xi'an, China
14-17 May 2017**



**IEEE Catalog Number: CFP17J57-POD
ISBN: 978-1-5090-5737-5**

**Copyright © 2017 by the Institute of Electrical and Electronics Engineers, Inc
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP17J57-POD
ISBN (Print-On-Demand):	978-1-5090-5737-5
ISBN (Online):	978-1-5090-5736-8

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

Table of Contents

Plenary Lecture

- PL-1 [Space Charge Behavior under Temperature Gradient and Its Effects on Material Aging \(Chen Jidan Memorial Lecture\)](#) 1
Kai Wu, Rui Su, Xia Wang

Oral Session 1: Power Cable

- 1-1 [Ultrahigh Thermal Conductivity Enhancement in Polymer Insulating Materials by Constructing 3D BN Nanosheet Networks](#) 10
(Invited) Xingyi Huang, Jin Chen, Yingke Zhu, Pingkai Jiang
- 1-2 [Charge Accumulation Characteristics of XLPE under DC Stresses with Semi-conductive Electrodes](#) 14
Hiroki Kasuga, Tatsuya Kamikawa, Hiroaki Miyake, Yasuhiro Tanaka
- 1-3 [Insulation Reliability of Superconductive Cables](#) 20
Robert Ross, B. Gholizad, G. Koopmans, S. Mousavi Gargari, J. J. Smit, M. Ghaffarian Niasar, C. G. Meijer, A. M. Bucurenciu
- 1-4 [Low Frequency Dispersion in the Dielectric Response of HTV Silicone Rubber](#) 24
Yanfeng Gao, Xidong Liang

Oral Session 2: Transformer

- 2-1 [Correlation Between Dissolved Gases and Oil Spectral Response](#) 28
(Invited) Huize Cui, Ahmed Abu-siada, Shengtao Li, Syed Islam
- 2-2 [Magnetic Polarizability of the Metamaterials with Negative Permeability](#) 33
Quan Wang, Yewen Zhang, Kai Fang, Yunhui Li
- 2-3 [A Study of Hot-Spot Localization in Dis-tribution Transformers](#) 36
Thinh Dao and B.T. Phung
- 2-4 [Continuous Condition Monitoring of High Voltage Transformers by Direct Sensor Monitoring of Oil Aging for a Stable Power Grid](#) 41
Manfred Mauntz and Jörn Peuser

Oral Session 4: GIS and Electric Apparatus

- 4-1 [Decomposition Characteristics of By-products of SF₆ under Different Spark Energies](#) 45
X. G. Yue, X. Liu, Q. Yao, Y. L. Miao, J. Tang, F. P. Zeng
- 4-2 [FTIR Analysis of LDPE and XLPE Thin Samples Pressed between Different Protective Anti-Adhesive Films](#) 49
Roman Kochetov, Thomas Christen, F. Gullo
- 4-3 [Signal Separation and Identification of Partial Discharge in XLPE Insulation under DC Voltage](#) 53
Revi Aldrian, Gian Carlo Montanari, Andrea Cavallini, Suwarno
- 4-4 [Optimal Design of Shielding Structure in Ultra-high Voltage GIS Bushing Using Artificial Fish-Swarm Algorithm](#) 57
Siyu Zhang, Jiaqi Yan, Ding Li, Peng Liu, Zongren Peng, Shiling Zhang

Oral Session6: Capacitor and Energy Storage

- 6-1 [Roles of Quantum Dot like Multi-functional Traps in Electrical Conduction of Polymer Nanocomposites](#) 61
Toshikatsu Tanaka
- 6-2 [Surface Resistance to Erosion of Various Polymer Composites Containing Conductive Nanofillers](#) 65
Michel Fr échette, S.B. Ghafarizadeh, Sonia Vadeboncoeur, Eya Zribi, Christele Vanga-Bouanga , Eric David
- 6-3 [Characterisations of a Single Rod Electrode Earthing System under High Impulse Currents with Different Polarities](#) 70
N. Etobi A., N. Mohamad Nor, S. Abdullah, N. Eng Eng, M. Othman

Oral Session 7: Electric Motor

- 7-1 [Transmission Line Matrix \(TLM\) Simulation of the Propagation of Partial Discharge Phenomenon in Transmission Lines](#) 76
(Invited)Alistair Duffy, Hugh Sasse, Jianying Li

7-2	<u>Developing a Novel Environment Friendly Epoxy Solventless Impregnating Resin without Anhydride for High Voltage Motor</u>	80
	(Invited) <i>Yu Xia, Wen Wang, Cheng Zhou, Shengzhi Guo</i>	
7-3	<u>Artificial Intelligence for DGA Interpretation Methods Using Weighting Factor</u>	85
	<i>Cahyo Subroto, Harjo Suwarno, T Trianto, Guanjun Zhang</i>	
7-4	<u>Determining the Similarity between Observed and Expected Ageing Behavior</u>	89
	<i>Peter Ypma, R. Ross</i>	
7-5	<u>Progress of Long-Distance DC Electrical Power Transmission</u>	93
	(Invited) <i>Rongsheng Liu</i>	

Poster Part

Poster Session 1:

3-1	<u>Low Loss Design Study for HV AC Cable System</u>	97
	<i>Ying Wang, Jiankang Zhao</i>	
3-2	<u>Research on Simplified Equivalent Method of 3D Simulation Model for Temperature Distribution of HVDC Submarine Cables</u>	102
	<i>Yanpeng Hao, Yun Chen, Lin Yang, Weihao Qiu, Weiquan Huang, Jichao Huang</i>	
3-3	<u>Design of a Novel Rogowski Coil with Function of Overcurrent Protection</u>	109
	<i>Lu Zhang, Chen Mao, Lu Pu, Lei Sun, Wei Duan, Qiaogen Zhang</i>	
3-4	<u>Study on Characteristic Parameter Selection of Alternating Current Filter Sub-bank Circuit Breaker</u>	113
	<i>Weimin Chen, Jinwei Chu, Changhong Zhang, Xu Yang, Weiguo Li, Haibin Zhou</i>	
3-5	<u>Influence of Ambient Humidity on UV Imaging Detection of Polluted Plate Model Discharge</u>	117
	<i>Jianchun Wei, Ang Ren, Jiaxiang Sun, Ruinan Shi, Qingquan Li</i>	
3-6	<u>Study on the Influence of Core Material on the Performance of Nanosecond Pulse Power Supply</u>	122

Yaguang Tao, Simeng Li, Qingquan Li, Ye Tian, Zhaojun Wang, Famin Cheng

- 3-7 The Characteristics of Secondary Arc Current in UHV Transmission Line with Hybrid Reactive Power Compensation 128
Zhen Wang, Hongshun Liu, Bin Li, Runchang Li, Qingquan Li
- 3-8 Wide-Range High Voltage Input Auxiliary Power Supply for Modular Multi-level Converters 133
Dezhi Kong, Xuandong Liu, Zhixuan Ying, Wenjian Sun, Geqi Li, Ke Wang, Jing Peng, Qiaogen Zhang
- 3-9 Study on Turn-to-turn Insulation Detection Methods and Judgment of Dry-type Air-core Reactor 137
Shaowei Guo, Jixian Ma, Zheng Niu, Ting Mao, Haoyang Li
- 3-10 Research on Development and Performance of Small Capacitance UHV CVT with Damping Device Integrated 141
Xuan Li, Shuzhen Zhang, Shipu Wu, Ping Wang, Xiaoqi Wang
- 3-11 Investigation on Electrical Trees Propagation Characteristic in Polyethylene Based on Etching Method 147
Xiaohong Zhang, Zexiang Shi, Cheng Cheng, Lin Li
- 3-12 Simulation and Experiment Research of Fittings Power Loss in High Voltage Transmission Line 151
Tianwei Li, Tian Wu, Lei Liu, Bing Luo, Li Tang
- 3-13 Surface Discharge Detection Method of Contaminated Insulators Based on Ultraviolet Images' Parameters 155
Xuewen Li, Lijun Jin, Zhiyuan Xu, Tao Jiang, Haifeng Jin
- 3-14 Effect of the Epoxy Insulators Shed Structure on Pollution Flashover Performance 159
Zhiyuan Xu, Tao Jiang, Lijun Jin, Kun Liu
- 3-15 Gray Correlation Analysis and Chebyshev Prediction of Air Gap Discharge Voltage 163
Haiqing Niu, Jia Yu, Huang Zhang
- 3-16 Space Charge Measurement in Polyethylene under High Static Pressure 168
Penghao Zhang, Yewen Zhang, Stéphane Holé, Feihu Zheng, Zhenlian An

3-17	<u>Simulation Design and 3D-Printing Fabrication of Conductivity Graded Insulator</u>	.....171
	<i>Zhe Liu, Wendong Li, Liyuan Zhang, Xiaoran Li, Junbo Deng, Guanjun Zhang</i>	
3-18	<u>Study on the Surface Charge Accumulation of Post Insulators Considering Particle's Influences in DC GIL</u>	.....175
	<i>Hafiz Muhammad Azib Khan, Botao Li, Qingmin Li, Jian Wang, Zhiyuan Wang</i>	
3-19	<u>Study on Thermal Circuit Model of Typical Disconnector and Current Transformer</u>	.....179
	<i>Yuqin Ding, Qiaogen Zhang, Xuandong Liu, Meng Gao, Yuan Li, Yi Zhao, Hengchi Ma, Guangqi Liu, Ke Wang</i>	
3-20	<u>Influence of Epoxy Insulating Materials Parameters on Surface Charge Characteristics and Surface Flashover in Vacuum under DC</u>	.....184
	<i>Zhaoliang Xing, Chenpeng Li, Chong Zhang, Zhuo Zhang, Weikang Li, Jiasheng Ru, Yu Xiao, Yuan Zhou, Xin Chen</i>	
3-21	<u>Development of Simulation Models for Calculating Space Charge Accumulation around Defects in AThin Film Sample under HVDC</u>	.....188
	<i>A. A. Mulla, S. J. Dodd, N. Chalashkanov, L. A. Dissado</i>	
3-22	<u>Study on Generation of Electro-Chemical Migration in Layered Insulating Films for Flexible Printed Circuit</u>	.....192
	<i>Koki Sato, Yasuhiro Tanaka, Takashi Maeno</i>	
3-23	<u>The influence of DC component within combined AC and DC voltage on charge dynamics in polyethylene</u>	.....198
	<i>Churui Zhou, George Chen</i>	
3-24	<u>The Application of Transient Earth Voltage in the Partial Discharge of Power Transformers</u>	.....202
	<i>Ruinan Shi, Simeng Li, Qingquan Li, Bin Liu, Shuai Ma, Lijuan Wu</i>	
3-25	<u>LDPE Nanocomposites Containing Functionalized SiO₂ Molecular Structures: Properties Associated with A Ball-Milled Preparation</u>	.....207
	<i>M. F. Fréchette, S. B. Ghafarizadeh, T. Tran Ahn, S. Vadeboncoeur, M. Guo, E. David</i>	
3-26	<u>The Condition Diagnosis of XLPE Cable Insulation Based on Fuzzy Clustering Method</u>	.....211

Xu Zhang, Liang Zhang, Kangning Wu, Huan Li, Fusheng Zhou, Jianying Li

- 3-27 [Modal Analysis of Three-phase Cable Systems Based on A Modified High-frequency Model](#) 215
Xiaoxin Chen, Yong Qian, Yongpeng Xu, Gehao Sheng, Xiuchen Jiang
- 3-28 [Experimental Research on Space Charge of Linear / Nonlinear Double-layered Composites](#) 220
Changyou Suo, Zhonghua Li, Yunlong Sun, Tao Zhu and Huang Zheng
- 3-29 [Sandwich-structural PVDF Nanocomposites with High Thermal Conductivity and Excellent Dielectric Properties](#) 225
Dongli Zhang, Junwei Zha, Zhimin Dang
- 3-30 [Dielectric and Electrical Properties of \$\text{La}_x\text{Sr}_{1-3x/2}\text{Cu}_3\text{Ti}_4\text{O}_{12}\$ Ceramics](#) 229
Yuwei Huang, Liang Zhang, Zhuang Tang, Kangning Wu, Jianying Li
- 3-31 [Evaluation of Insulating Materials during DC Voltage Charging by DCIC Method](#) 233
Keita Sonoda, Koichi Ota, Shugo Yoshida, Tsuyoshi Tohmine, Hiroaki Miyake, Yasuhiro Tanaka, Tatsuo Takada, Yoitsu Sekiguchi
- 3-32 [Improving Dielectric Properties of PVDF Composites by Obtaining the BT-Ni Particles](#) 239
Y. Cui, X. Wang, Q.G. Chi, J.F. Dong, T. Ma, Q.Q. Lei
- 3-33 [Enhanced Energy Density of PVDF-HFP/CCTO Nanocomposites Induced by Aspect Ratio Fillers](#) 244
Q.G. Chi, T. Ma, J.F. Dong, Y. Zhang, X. Wang, Q.Q. Lei
- 3-34 [Trap and Polarization of Polyethylene Terephthalate Influenced by Electron Beam Irradiation](#) 250
Dongri Xie, Daomin Min, Yin Huang, Shaoming Pan, Shihu Yu, Shengtao Li
- 3-35 [Higher Electrical Conductivity of Carbon Black/Polystyrene Composites by Selective Localization of Carbon Black](#) 254
Yongliang Wang, Hu Shi, Zhidong Han
- 3-36 [Enhanced Dielectric Properties of Polyvinylidene Fluoride Nanocomposites via Calcium Copper Titanate nanofibers](#) 258
Chaohe Hu, Junwei Zha, Yu Yang, Mingsheng Zheng, Zhimin Dang

3-37	<u>Experimental Study on the Lifetime of the All-Film Pulse Capacitor in LTD Systems</u>	262
	<i>Jiangtao Li, Zheng Zhao, Jianhao Li, Chenjie Li</i>	
3-38	<u>Influence of Impulse Wave Front Time on Flashover Characteristics of Coaxial Bus line of 220kV GIS</u>	266
	<i>Lingli Zhang, Xuandong Liu, Can Guo, Ming Chen, Tao Wen, Qiaogen Zhang</i>	
3-39	<u>Design of Intelligent On-load Tap Changer Controlled by Permanent Magnetic Actuator</u>	270
	<i>Jinqiu Deng, Guogang Zhang, Yingsan Geng, Jianhua Wang</i>	
3-40	<u>An Image-Oriented Recognition Method for PD Development Stage in Oil-Pressboard Insulation with Needle-Plate Model under AC-DC Mixed Voltage</u>	275
	<i>Simeng Li, Qingquan Li, Wen Si, Junyan Yao</i>	
3-41	<u>Study on Gas Bubble Formation in Single-layer Paper Insulation</u>	283
	<i>Meng Gao, Qiaogen Zhang, Heli Ni, Yuqin Ding, Weixiong Yuan</i>	
3-42	<u>Simulation and Analysis of Temperature Field of the Discrete Cooling System Transformer Based on Fluent</u>	287
	<i>Ruochen Guo, Jie Lou, Zhen Wang, Hua Huang, Bengang Wei, Yuying Zhang</i>	
3-43	<u>The Forecasting Model for Time Series of Transformer DGA Data Based on WNN-GNN-SVM Combined Algorithm</u>	292
	<i>Shiling Zhang, Yunqing Bai, Gaolin Wu, Qiang Yao</i>	
3-44	<u>Study on Ventilation of Indoor Substation Main Transformer Room Based on COMSOL Software</u>	296
	<i>Yuanhe Liu, Yanpeng Hao, M.L. Fu, D.B. Wang, Lin Yang</i>	
3-45	<u>A Comparative Study of the Migration Behaviors of Cellulose Particles in Natural Ester and Mineral Oil under DC Electric Field</u>	301
	<i>Yanqing Li, Jian Hao, Min Dan, Ruijin Liao, Lijun Yang</i>	
3-46	<u>Study on PD Detection Method in GIS Under Oscillating Impulse Voltage Based on UHF Method</u>	305
	<i>Xutao Wu, Xutao Han, Liang Zhang, Xiuguang Li, Yunlong Ma, Junhao Li</i>	

Poster Session 5:

- 5-1 [The Interpretative Structural Model of Influencing Factors of the New-type Town Distribution System](#) 309
Yifan Zhang, Shuyong Song, Zhenguo Ma, Ruihao Sun, Wei Zhang
- 5-2 [Study on Large-tonnage Live Working Tools for ± 800 kV UHVDC Transmission Lines at High Altitudes](#) 315
Yong Peng, Zehua Huang, Bo Chen, Xinglie Lei, Zhonghua Qiu, Cimeng Zhang
- 5-3 [Research on Air Gap Discharge Induced by Axial Injection of Nanosecond Laser Light](#) 319
Wei Zhou, Dong Dang, Qinxiao Dong, Zhifang Liu, Zefeng Yang
- 5-4 [Simulation and Motion Analysis of Spherical Free Conducting Particle between Coaxial Electrodes](#) 324
Zhicheng Wu, Qiaogen Zhang, Jiajie Song, Jingtian Ma, Qiandong Du, Chao Gao, Guoli Wang, Yiwen Zhang
- 5-5 [Effects of 1.8GHz Electromagnetic Radiation on Dielectric Properties of SD Rat's Typical Tissues](#) 328
Minchen Qiu, Lisheng Zhong, Xiaoyuan Song, Jiaxi He, Jinghui Gao, Qinxue Yu
- 5-6 [Improved Algorithm of Surface Charge Density Distribution and Electric Field Distribution on Insulating Materials](#) 332
Han Wang, Jianyi Xue, Yibo Wang, Guoqiang Su, Junbo Deng, Haibao Mu, Guanjun Zhang
- 5-7 [Study of Surface Tracking on Epoxy/MgO Nanocomposite](#) 336
Ziyue Wang, Kangning Wu, Jianying Li
- 5-8 [Characteristics of Transient Electric Field induced by VFTO based on Field Measurement](#) 340
Xutao Wu, Xiuguang Li, Shitao Liu, Fei Guo, Junhao Li, Yanzhao Xie
- 5-9 [Vibration Distribution Characteristics on Oil-tank Surface of A Single-Phase Transformer](#) 344
Xiaowen Wu, Nianguang Zhou, Yuhang Shi, Shengchang Ji, Fan Zhang, Weifeng Lu, Sheng Hu
- 5-10 [In-situ Observation of Electrophoresis of Conductive and Semi-conductive Micro](#)

	<u>Particles in Epoxy Resin</u>	349
	<i>Siyu Chen, Zhengdong Wang, Mengmeng Yang, Qian Xie, Jingya Liu, Jiale Mao, Yonghong Cheng</i>	
5-11	<u>Study of Overvoltage and Insulation Coordination of UHV DC Transmission Line</u>	
	.....	354
	<i>Xiaolan Li, Peihong Zhou, Huiwen He, Lei Wang</i>	
5-12	<u>Detection of Composite Insulators Inner Defects Based on Flash Thermography</u>	359
	<i>Z. Qiao, L. Cheng, S. Zhang, L. Yang, C. Guo</i>	
5-13	<u>Applications of Support Vector Machine and Improved K-Nearest Neighbor Algorithm in Fault Diagnosis and Fault Degree Evaluation of Gas Insulated Switchgear</u>	364
	<i>Kai Zheng, Gangquan Si, Lijie Diao, Zhou Zhou, Jiaxi Chen, Wenmeng Yue</i>	
5-14	<u>A NOVEL METHOD of TRANSFORMER FAULT DIAGNOSIS BASED on K-MEDIODS and DECISION TREE ALGORITHM</u>	369
	<i>Zhou Zhou, Gangquan Si, Jiaxi Chen, Kai Zheng, Wenmeng Yue</i>	
5-15	<u>Research on Anti-interferences Methods in the PD Detection on Power Transformer</u>	374
	<i>Jing Liu, Jingfeng Wu, Yanhua Han, Shuangzan Ren, Yang Liu, Xuefeng Zhao, Ting Ren, Yuanjing Lu</i>	
5-16	<u>Location Mechanism for Wireless Sensor Networks in Mine</u>	378
	<i>Jie Li, Tianzheng Wang, Hua Yu, Fan Hu</i>	
5-17	<u>Research on Simultaneous Measurement of Space Charge and Conduction Current for Thermally Aged Cross-linked Polyethylene</u>	383
	<i>Yalin Wang, Jiandong Wu, Shuhui Yi, Yi Yin</i>	
5-18	<u>Correlation Characteristics Between DC Partial Discharge Quantity and SF₆ Decomposition Components Under the Needle-plate Electrode</u>	388
	<i>Nian Tang, Xin She, Li Li, Xiaodian Li, Ju Tang, Fuping Zeng</i>	
5-19	<u>AC Flashover Performance and Polarization Current of Ethylene Propylene Rubber under Different Temperature</u>	393
	<i>Shaofei Wang, Jiancheng Song, Zhipeng Lei, Bingni Qu, Muqin Tian, Yuanyuan Li</i>	
5-20	<u>Research on Electrical Properties of Natural Ester-paper Insulation After</u>	

	<u>Accelerated Thermal Aging</u>	397
	<i>Shengwei Cai, Cheng Chen, Hui Li, Minfeng Shao, Jiangbo Chen, Jin Yin, Huihao Guo</i>	
5-21	<u>Small-angle X-ray Scattering Study on Nanostructures of MgO/LDPE Nanocomposites</u>	402
	<i>Yani Wang, Jiandong Wu, Yi Yin</i>	
5-22	<u>High Voltage Circuit Breaker Dynamics Simulation and Mechanical State Recognition</u>	406
	<i>Jinggang Yang, Bin Wu, Yue Wu, Ke Zhao, Hongtao Li, Guogang Zhang</i>	
5-23	<u>Experimental Study on Sound Level Calculation of Dry Transformer Via Vibration Velocity Method</u>	410
	<i>Haoyang Tian, Wei Peng, Hua Huang, Min Hu</i>	
5-24	<u>Moisture Characteristic Parameter Extraction and Quantitive Analysis of Oil-paper Insulation Based on New Explanation Model of FDS</u>	414
	<i>Jiacheng Xie, Ming Dong, Li Wang, Ao Ma</i>	
5-25	<u>Effect of the β-crystal Formation in Isotactic Polypropylene Used for Eco-Friendly Insulating Material</u>	419
	<i>Wei Zhang, Man Xu, Mingxuan He, George Chen, Shuai Hou, Mingli Fu, Hao Zheng, Qingtao Chen</i>	
5-26	<u>Surface Charge Dynamic Characteristics of EVA/CB Nanocomposite under Mechanical Stretching</u>	424
	<i>Xiaoxiao Kong, Boxue Du, Jin Li, Zhonglei Li, Jing Mu</i>	
5-27	<u>Surface Charge Behaviors of SiR/SiC Composites with Nonlinear Conductivity</u> 428	
	<i>Z.L. Li, B.X. Du, Z.R. Yang, Z.Y. Ran</i>	
5-28	<u>The Influence of surface modifier on structural morphology and Dielectric Property of XLPE/SiO₂ Nanocomposites</u>	432
	<i>Donghe Di, Xiufeng Li, Jin Shen, Peijie Yang, Youfu Chen</i>	
5-29	<u>Novel Time Synchronization Method based on Duo-Satellite Triggering for Double-Ended PD Location in MV Cables</u>	436
	<i>Baojie Li, Hongjie Li, Xiangfeng Zeng, Weisheng He, Xiaoming Zeng</i>	
5-30	<u>Study on Crystalline Morphology and Breakdown Property of Micro-, Nano-,</u>	

	<u>Micro-/Nano-Composites</u>	440
	<i>Xiaohong Zhang, Meng Wang, Ruru Cheng, Kun Wang, Junguo Gao, Qi Zhang</i>	
5-31	<u>Effect of Magnetic Field Induction on Crystallization of BiFeO₃/LDPE Nanocomposite</u>	444
	<i>Wei Song, Dong Zhang, Bai Han, Zhi Sun, Xuan Wang, Qingquan Lei</i>	
5-32	<u>Supersmooth Semiconductive Shielding Materials use for XLPE HVDC Cables</u>	447
	<i>Weikang Li, Hongda Yan, Yuan Zhou, Chong Zhang, Xin Chen</i>	
5-33	<u>Research on Conversion of Polarization/Depolarization Current and Frequency Domain Spectroscopy for XLPE Cable</u>	452
	<i>Xing Zhang, Long Xu, Aixuan Zhao, Yanbo Wang, Xuefeng Zhao, Lu Pu, Junbo Deng, Guanjun Zhang</i>	
5-34	<u>Research on the Defect Development of Cable Accessories under AC Voltage</u> ...	457
	<i>Xuefeng Zhao, Lu Pu, Long Xu, Xing Zhang, Baohong Guo, Aixuan Zhao, Junbo Deng, Guanjun Zhang, Ni Hui, Minghao Fan</i>	
5-35	<u>Comparison of Space Charge Distribution Measurements among Planar Sample, HVDC Cable on External Layer and from Inner Conductor by Laser PWP Method</u>	461
	<i>Cong Guo, Yewen Zhang, Feihu Zheng, Zhenlian An, Zhien Zhu, Liming Yang, Jian Zhang, Enke Yu</i>	
5-36	<u>Study on Conduction Current and Space Charge Accumulation Simultaneously in Ethylene Propylene Diene Monomer Film</u>	464
	<i>Weiwang Wang, Yasuhiro Tanaka, Toshiyuki Fujitomi, Tatsuo Takada, Shengtao Li</i>	
5-37	<u>A Study on Stray Loss Analysis Involving Fuel Tank and Clip Part in Power Transformer using FLUX 3D</u>	468
	<i>Junqiu Fan, Song Han</i>	
5-38	<u>Modified Thermal Circuit Model for Distribution Transformers in Three-phase Unbalanced Operation</u>	473
	<i>Yuqin Ding, Qiaogen Zhang, Xuandong Liu, Meng Gao, Tonglei Wang, Heli Ni, Weixiong Yuan, Guangqi Liu, Ke Wang</i>	
5-39	<u>AC Breakdown and Frequency Dielectric Response Characteristics of the Mixed Oil-Paper Insulation with Different Moisture Content</u>	478
	<i>Gang Li, Jian Hao, Shuai Li, Ruijin Liao, Xuetong Zhao, Lijun Yang</i>	

- 5-40 [Research on Impulse Withstand Test Effectiveness from Insulation Characteristics of SF₆ Gas Gap with Highly Inhomogeneous Electric Field](#)482
Tao Wen, Qiaogen Zhang, Lingli Zhang, Jiangtan Ma, Min Chen, Naoyuki Shimomura, Zhibing Li
- 5-41 [DC Flashover Performance and Surface Discharge Resistance of the Fluorinated Epoxy Insulator in Nitrogen Gas](#)486
Y. Ma, Z. An, L. Que, F. Shan, Y. Zhang, F. Zheng, Y. Zhang
- 5-42 [Effects of Surface-modification on Properties of Graphene/Epoxy Composites](#) ..490
Shihu Yu, Shengtao Li
- 5-43 [Slow Moving Charges in the Oil Impregnated Insulation Paper with Different Aging Condition Oil](#)494
Jian Hao, Ruijin Liao, George Chen, Runhao Zou, Qiang Liao
- 5-44 [Numerical Investigation of Acoustic Emissions Distribution from Partial Discharge in Transformer](#)498
Weichao Zhang, Qichao Chen, Hong Zhao
- 5-45 [Improvement of DGA Interpretation using Scoring Index Method](#)502
Norazhar Abu Bakar, Ahmed Abu-Siada, Huize Cui, Shengtao Li
- 5-46 [High Dielectric Permittivity in BaTiO₃-xBaSnO₃ Ceramics](#).....507
Y. Wang, Y.B. Liu, X.H. Hu, Y.T. He, J.H. Gao, L.S. Zhong

Poster Session 8:

- 8-1 [Comparison of Electrical Tree Propagation in Epoxy Composite Insulation for WTG under Repetitive Impulse and AC Stresses](#)511
Rui Zhang, Xuezhong Liu, Meng Wang, Changzhi Xue, Hongsheng Chen, Yanqin Li
- 8-2 [Network Tearing Interface for FPGA Simulation](#)515
Qian Sun, Qing Mu, Xiangxu Wang, Sijia Lao
- 8-3 [SST Experimental Research on the Discharge Characteristics in c-C₄F₈/N₂](#)521
Liuchun Zhang, Dengming Xiao
- 8-4 [The Breakdown Time Delay and Jitter of Different Cathode Materials under Nanosecond Pulse in N₂](#)525

8-5	<u>Indication of Initial Degradation of ZnO varistor ceramics</u>	529
	<i>Jinqiang He, Jiajun Lin, Lei Zhang, Wenfeng Liu, Shengtao Li</i>	
8-6	<u>A Hybrid Type Valve Arrester for the Protection of Substation Overvoltage</u>	533
	<i>Shuo Chen, Hongjie Li, Baojie Li, Xiangfeng Zeng, Yufei Chen</i>	
8-7	<u>Non-invasive Energy Harvesting for Wireless Sensors from Electromagnetic Fields around 10kV Three-core Power Cables</u>	536
	<i>Xiangfeng Zeng, Baojie Li, Hongjie Li, Shuo Chen, Yufei Chen</i>	
8-8	<u>Thermal and Electrical Properties of BNNPs/TiO₂-Epoxy Three-phase Nanocomposites</u>	540
	<i>Mengmeng Yang, Zhengdong Wang, Siyu Chen, Qian Xie, Jiale Mao, Jingya Liu, Yonghong Cheng</i>	
8-9	<u>Three Dimensional Simulating and Experimental Study on the Influential Factors of the Effectiveness of the DC-GIL Particle Trap</u>	544
	<i>Zhiyuan Wang, Jian Wang, Qingmin Li, Xiaoru Ni, Botao Li</i>	
8-10	<u>The Electric and Temperature Field Computations of Resin Impregnated Paper Bushing</u>	548
	<i>Shiling Zhang, Yin Hua, Gaolin Wu, Qian Wang</i>	
8-11	<u>Influence of Surface Modification by Direct Fluorination on Dielectric Flashover Characteristics in Vacuum</u>	552
	<i>Baohong Guo, Yibo Wang, Guoqiang Su, Wendong Li, Junbo Deng, Guanjun Zhang</i>	
8-12	<u>Influence of Embedded Electrode Structure and Sputtered Gold Coating on Surface Flashover Characteristics of PMMA in Vacuum</u>	556
	<i>Baohong Guo, Yibo Wang, Guoqiang Su, Rundong Zhou, Junbo Deng, Guanjun Zhang</i>	
8-13	<u>The Study of Voltage Stability Comprehensive Controls for Large City Receiving-end Grid</u>	560
	<i>Yong Cui, Yuyao Feng, Hong Fan, Yanbin Jiang</i>	
8-14	<u>Gaseous Characteristics of Impulse Breakdown Initiation Process in Transformer Oil</u>	564
	<i>Tonglei Wang, Heli Ni, Weixiong Yuan, Yuqin Ding, Ning Guo, Meng Guo, Yuan Li,</i>	

Qiaogen Zhang

- 8-15 [A Reduced-Scale Experimental Study of Tower Impulse Grounding Impedance](#) 568
Jiangtao Li, Hui Cao, Xing Liu, Kefu He, Zheng Zhao, Minjun Zheng
- 8-16 [Research on Electrical Properties of New Polymer Cement Concrete Used for Pipeline Transmission](#)572
Hui Li, Jisi Sun, Shengwei Cai, An Su, Jing Yin, Jiangbo Chen, Jianyuan Xu
- 8-17 [Study of Removal of Sulfur Dioxide by Gas - Liquid Two - Phase Gliding Arc Plasma Combined with Photocatalyst](#)577
Guoqing Yang, Mengyao Yan, Zhao Yang, Deyi Wang
- 8-18 [Dynamic and Flexible Effectivity Evaluation System of Live Test Approaches for Power Equipment](#)581
Yang Liu, Xu Li, Weidong Qi, Jingfeng Wu, Shuangzan Ren, Chuankai Yang, Jing Liu
- 8-19 [Effects of Plasma Modified Micro-Al₂O₃ on Surface Partial Discharge and Insulation Aging of Micro-Al₂O₃/Epoxy Resin Composites](#)586
Guoqing Yang, Yang Li, Dongxu Ji, Deyi Wang, Yue Yang
- 8-20 [Effect of Charge Accumulation on the Surface Discharge Evolution for Polyimide under High Frequency Sinusoidal Voltage](#)590
Yangfei Lu , Tao Liu, Xuwei Huang, Yi Xiao, Hanwen Ren, Qingmin Li, Zhongdong Wang
- 8-21 [A Risk Assessment Method of Transformer Considering the Economy and Reliability of Power Network](#)594
Dun Lin, Yaoyu Xu, Yu Liang, Yuan Li, Ning Liu, Guanjun Zhang
- 8-22 [Feature Extraction of the Transformer Core Loosening Based on Variational Mode Decomposition](#)598
Haoyang Tian, Wei Peng, Min Hu, Guogang Yuan, Yuhui Chen
- 8-23 [Comparative AC Tracking and Erosion Resistance of Micro-AlN and BN Filled Silicone Rubber Composites](#)603
M.Tariq Nazir, B.T. Phung, Shengtao Li, Shihu Yu
- 8-24 [UHV AC Y-type Insulator String Pollution Withstand Voltage Characteristics](#) ..607

Jing Nan, Feng Huo, Jian Li, Xiaodong Wan, Tao Xu, Jin Li, Ru Jia, Qin Liu, Yaoqin Li

- 8-25 [Mechanical Fault Diagnosis System Based on Acoustic Feature Analysis in Gas Insulated Switchgear](#).....610
Yu Shang, Qiang Liu, Bo Niu, Mohan Zhang, Weidong Qi, Jingfeng Wu
- 8-26 [Temperature Rise Characteristics Simulation of 40.5kV High Current Cubicle Type Gas Insulated Switchgear](#).....616
Min Li, Xiaolin Li, Jing Lin, Lijun Wang
- 8-27 [Discharge Characteristics of SF₆ Gas with and without Insulators under VFTO and Lightning Impulse Voltage](#).....620
Lu Zhang, Chen Mao, Sun Lei, Jingfeng Wu, Xiaolan Zhang, Qiaogen Zhang
- 8-28 [Research on Dynamic Modeling and Transient Characteristics of Hybrid DC Switch](#).....625
Jingcun Liu, Guogang Zhang, Qian Chen, Lu Qi, Zheng Qin, Jianhua Wang
- 8-29 [Experimental Study on Suppressing VFTO in 550 kV GIS by Great and Small Magnetic Rings](#).....630
Fanfu Gao, Xueqin Xu, Xiangyu Tan, Wenjian Sun, Zhirui Liang
- 8-30 [Effect of BN Size on AC Breakdown Characteristics of PTFE/BN Composites](#)..635
Yongjie Nie, Liuqing Yang, Yongsen Han, Shengtao Li
- 8-31 [Multispectral Light Pulse Detection on Partial Discharges Initiated by Metal Particle on Insulator in SF₆ Gas](#).....639
Jierui Zhou, Ming Ren, Ming Dong, Chongxing Zhang, Wenguang Huang, Yang Li
- 8-32 [Influence of Trace SF₆ on Discharge Characteristics of SF₆/N₂ Gas Mixture under Lightning Impulse](#)643
Can Guo, Qiaogen Zhang, Lingli Zhang, Jingtian Ma, Zhicheng Wu, Ming Chen
- 8-33 [Research on Partial Discharge Monitoring System of Switchgear Based on Wireless Distributed TEV Sensors](#)647
Wenguang Huang, Chongqing Zhang, Ming Dong, Jierui Zhou
- 8-34 [The Design of Automatic Test System Used for PDIV Measurement of Inverter-fed Motor](#)651
Kejing Wang, Guodong Meng, Chengye Dong, Dujiao Zhang, Chong Gao,

Yonghong Cheng

- 8-35 [Influence of Metallic Contamination on Surface Charge Distribution of a 200kV Cone-Type Insulator](#) 655
Qiandong Du, Haoyu Liu, Zhicheng Wu, Zhihao Zhu, Junping Zhao, Boyuan Cui, Jie He, Yun Chen
- 8-36 [Design of Passive Wireless Temperature Measurement System for High Voltage Power Equipment](#) 659
Qian Chen, Guogang Zhang, Jingcun Liu, Yingsan Geng, Jianhua Wang
- 8-37 [Analysis of Green Algae Contamination on 500kV Silicone Rubber Composite Insulators](#) 664
Congzhen Xie, Chaohong Li, Wen Zhu, Yongye Gan
- 8-38 [Effects of Algae Contamination on Composite Insulator Hydrophobic Property](#) 667
S.F. Yang, Z.D. Jia, X.G. Ouyang, H. Bai, X.H. Zhang
- 8-39 [Dielectric Properties of Mn-doped ZnO-Bi₂O₃ Varistors below Liquid Nitrogen Temperature](#) 671
Jiajun Lin, Shengtao Li, Jinqiang He, Wenfeng Liu
- 8-40 [Defect Diagnosis of HVDC Bushings Based on SF₆ Decomposition and Partial Discharge Characteristics](#) 675
Ming Chen, Xuandong Liu, Jingtian Ma, Lingli Zhang, Tao Wen, Zhihao Zhu
- 8-41 [Research on Leakage Current Characteristic of the Metal Oxide Varistor](#) 680
Xuni Rao, Jie Guo, Yue Zhou, Qi Wei, Xing Liu
- 8-42 [Research on Security Distance of Live Working on Distribution Line at High Altitudes](#) 686
Ziming Su, Kai Liu, Ting Liu, Bin Xiao, Xi Zha, Bingqiang Wang
- 8-43 [Live Working on Electrode Line of ±800kV DC Transmission Project](#) 691
Pan Tang, Yuquan Fang, Kai Liu, Ting Liu
- 8-44 [Influence of the High-Speed Sand Dust Environment on Breakdown Characteristics of Needle-Plate Air Gap](#) 695
S.X Bai, K. Liu, L. Song, Y. Peng, Z.Y. Lei, Y. Du, X.B Yin, X.Q Zhang
- 8-45 [Performance Evaluation of ABS \(Acrylo-Nitrile-Butadiene Styrene\) as High Voltage Insulator in the Outdoor Environment](#) 700

*Muhammad Ali Mehmood, Jian Li, Zainul Abidin Jaffri, M. Arshad Shehzad
Hassan*

- 8-46 Some Possibilities to Analyze of the Relationship between Several Partial Discharges 703

N.V. Kinsht, N. N. Petrunko