

2023 INSUCON - 14th International Electrical Insulation Conference (INSUCON 2023)

**Birmingham, United Kingdom
18 – 20 April 2023**



**IEEE Catalog Number: CFP23INU-POD
ISBN: 979-8-3503-3460-9**

**Copyright © 2023, Electrical Insulation Association (EIA)
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:	CFP23INU-POD
ISBN (Print-On-Demand):	979-8-3503-3460-9
ISBN (Online):	978-1-915787-65-1

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

INSUCON 2023 TECHNICAL PROGRAMME

TUESDAY 19TH APRIL 2023

INSUCON 2023 Conference Chairman

Welcome & Introduction

09:00 - 09:10

Mr. Andrew Keefe- ELANTAS Europe GmbH

SESSION 1 - ROTATING MACHINES

09:10 - 10:50

Impact of heating rate combinations on thermal index estimation from decomposition kinetics of slot insulators...1

R. G. Andrzejewski WEG Brazil

Variability of dielectric measurements of stator bars performed at different manufacturing plants...7

M. J. da Silva, M. Wiesenhofer, G. Lemesch, F. Ramsauer and W. Ladstatter Andritz Hydro GmbH Germany

Ex 'ec' Ignition Testing of an Electrical Machine - Lessons Learned...13

V. I. Patel, K. J. Dickens, GE Power Conversion, UK

Assessment of Stator Winding Insulation Condition Based on Absolute Partial Discharge Magnitude...19

H.G. Sedding, C. Chan M. Sasic Iris Power, Canada, **G.C. Stone** Consultant, Canada

Qualification of a HV-insulation system acc. IEC 60034-18-42 for a hydro generator operating with inverter technology...N/A

C. Staubach HS Hannover, Germany T. **Hildinger** Voith Hydro, Brazil

SESSION 2 - INSULATION CHALLENGES - APPLICATIONS

INCLUDING E TRANSPORTATION

11:10-12:50

The challenges of insulation materials in EV Drivetrains; A comparison of electrical testing and thermal cycling of PEEK and enamel coated wires...N/A

D. Simkin Consultant, UK **J. Bonnett & C. Rimmer** VICTREX Manufacturing Ltd, UK

Risk assessment of PD appearance in aeronautic cables & connectors in view of the voltage increase in Aviation applications...33

R. Acheen Th. **Lebey** Safran Tech, France **G. Belijar** IRT,France **Yannick Pelletier**
Ophelie Petit Daphne Berthier Safran Electrical Components, France

Investigating the effect of space charge accumulation on partial discharges activity for new and thermally aged Glass fibre insulated wire...39

H. Naderiallaf Power Electronics, Machine and Control Group, University of Nottingham UK
P. Giangrande Department of Engineering and Applied Sciences, University of Bergamo, Italy
M. Galea Department of Industrial Electrical Power Conversion, University of Malta, Malta

Analysis of insulation degradation in low voltage motors driven by Si IGBT and SiC Mosfet frequency converters...44

D. Tedesco W. L. Pires Research and Development of Product Department-WEG, Brazil.

Some experience of voltage endurance testing of twisted pairs acc. to IEC 60851 under sinusoidal and inverter stresses...49

C. Staubach B. Sahan HS Hannover, Germany **A. Litinsky** Axalta Coating Systems, Germany

SESSION 3 - TRANSFORMERS, TRANSFORMER FLUIDS

AND IMPREGNATION

13:50-15:30

Sensitivity analysis of transformer frequency responses...54

L. Nilsson M. Ambrosetti G. Zwahlen M. Scholz L. Eggimann O. Krone D. Riesen BKW Energia AG, Switzerland **M. Gatti D. Rolle** Engineering School, Switzerland

Comparison of the penetration speed of mineral oils vs esters in different types of soils...60

Anabela Peixoto Monica Fialho Rui Martins EDP Labelec, Portugal; **Roberto Fernandez** Cargill Bioindustrial, Spain **Luis Pires Silvia Monteiro** E-REDES, Portugal

Amorphous VPI Transformer for Low Carbon Emission...65

Kacey.C.Lee DuPont, Korea **Radoslaw Szewczyk** DuPont, Poland **Zhongdong Bai, Ning Li, Chengxiang Jin** CEEG China

Condition Monitoring to Detect Insulation Deterioration in Bushings...70

J. Beardsall Drax Power, UK **P. Boreham, T. McGrail** Doble Engineering, UK

Load Capability of Ester-filled Hermetically Sealed Distribution Transformers...76

Gyula Hipszki Siemens Energy, Hungary **Dr Attila Gyore** M&I, UK

SESSION 4 - SUB MARINE CABLES AND

MATERIAL DEVELOPMENTS

15:50-17:10

Self-repairing and water blocking protection for subsea power cables...80

Rhys Rhodes, Ian German, Kate Rejek, Amy Pye, Gary C. Stevens Kinectrics UK **Chris Ebden, David Hoyle** Offshore Renewable Energy Catapult (OREG), UK

Development of self-healing dielectric fluids for autonomous repair of fluid filled cables...86

Rhys Rhodes, Ian German, Maggie Svensson, Amy Pye, Gary C. Stevens Kinectrics, UK **Christopher Miners** Energi Cable Engineering, UK

Field experience with resonant test systems for testing offshore array cables...91

Uwe Kaltenborn, Olaf Schacht HIGHVOLT Pruftechnik, Germany **Richard Gardner** HVUK Limited, UK

A study on insulation fatigue due to increased thermal load in dynamic HV cables for floating offshore wind...97

D. Hoyle, W. Brindley, A. Ebrahim, I. Hudson, K. Leigh Offshore Renewable Energy Catapult (OREG), UK **K. Grivas** Hellenic Cables, Greece

WEDNESDAY 19TH APRIL 2023

**KEYNOTE SPEAKER - Robert Madarasz Business Development Manager
09:00 - 09:20**

Megger Grid Performance Solutions

SESSION 5 - MATERIALS - TESTING AND EVALUATION 09:20 - 11 :00

Small scale testing methods for electro-insulating resins...103

M. Duracka, A. Kozakova, Z. Filova, M. Siitik, T. DererVUKI a.s, Slovakia

Experimental comparative investigation on alternative and commercially available wire insulations based on partial discharges activity...107

H. Naderiallaf Power Electronics, Machine and Control Group, University of Nottingham, UK
P. Giangrande Engineering and Applied Sciences, University of Bergamo, Italy
M. Galea Department of Industrial Electrical Power Conversion, University of Malta, Malta

DC conduction of epoxy composites under coupled temperature and water uptake effects...113

I. **Silva** Univ. Grenoble Alpes, CNRS & Schneider Electric, France, F. **Gentils** Schneider Electric, France
P. Rain Univ. Grenoble Alpes, France

Characterization of classic insulated wires and extruded enamelled wires...119

G. Pereira dos Santos Lima S. Ait-Amar, G. Velu Univ. Artois, Laboratoire Systemes Electrotechniques et Environment, France, **P. Frezel Green** Isolight International, France

High Thermal Conductivity Insulation of Synchronous Wound Field Rotors...125

V. I. Patel, J.P. Fobbester, M. Drogan GE Power Conversion, UK

SESSION 6 - DEIS YOUNG PROFESSIONALS 11:20-12:20

M. Tefferi, S. Hegde DEIS

**SESSION 7 - MATERIALS, SUSTAINABILITY AND
CONSERVATION**

13:10-14:50

Automatic Pressure Gelation process: New materials development for high production efficiency...130

E. Fazio, F. Campanini ELANTAS Europe srl, Italy

A study on the parameters influencing insulation coating on copper based electrical windings fabricated via additive manufacturing...134

SP. Munagala, N. Simpson Department of Electrical and Electronic Engineering, University of Bristol, UK **Y. Pang, S. Hodgson** School of Science, Engineering and Design, Teesside University, UK

Anhydride-free epoxy material for HV insulation...140

S. Iglesias, S. Haller, A. Perez, F. Jacquier, T. Vu-Cong, A. Girodet, M. Henriksen SuperGrid Institute, France

Modern Impregnation materials for sustainable rotating machines...145

K. A. Fernandes S. Rost ELANTAS Europe GmbH, Germany

Material and manufacturing trends in high-voltage electrical insulation...N/A

Robert Sekula, Hitachi Energy Research, Poland

SESSION 8 - CABLES AND TESTING

15:10 -16:50

A practical approach to benchmark the relationships between on-line HFCT PD measurement versus off-line IEC60270 PD measurement for Singapore Distribution Network Switchgear...157

K. X. Lai, C. S. Yiong, N. F. Affandi, C. X. Wong, K. K. Wong, T. Ranjan SP Group, Singapore

Thermally stimulated depolarization of space charges accumulated in polyethylene under temperature gradient condition...163

N. Fuse, S. Morita, T. Takahashi, Grid Innovation Research Lab, Central Research Institute of Electric Power Industry, Japan **Y. Tanaka, H. Miyake** Department of Mechanical System Engineering, Tokyo City University, Japan

Effect of asymmetric electrodes on DC current in silicone rubber...168

I. Silva Univ. Grenoble Alpes, CNRS & Schneider Electric, France **F. Gentils** Schneider Electric, France **P. Rain** Univ. Grenoble Alpes, France

The growing necessity for representative scales and geometries in electrical treeing tests...173

H.Mcdonald, S.Rowland Manchester University, UK

Frequency domain spectroscopy analysis of EPR/CSPE insulated nuclear power plant cable samples subjected to irradiation ageing and combined irradiation and mechanical ageing...179

Z. A. Tamus, O. Nouini Department of Electric Power Engineering, Budapest University of Technology and Economics, Hungary

THURSDAY 20^{1H} APRIL 2023

SESSION 9 - CABLES - CONDITION MONITORING

09:00 - 10:40

Propagation of Acoustic pulse due to PD in Polymeric Insulating Material...185

A Samad, W H Siew, M J Given, I Timoshkin Department of Electronic and Electrical Engineering, University of Strathclyde, UK **J. Liggat** Department of Pure and Applied Chemistry, University of Strathclyde, UK

Innovative Quality Measurements for Long HV Cables...191

Uwe Kaltenborn, Dan Keller HIGHVOLT Pruftechnik GmbH, Germany **Richard Gardner** HVUK Limited, UK

Degradation of TPE Insulation of Low Voltage Cabling...197

M.G Krieg-Wezelenburg Electrical Insulation Consultancy High Energy B.V, The Netherlands

Application of online PD monitoring to 400 -kV transmission underground cable systems: experiences and outcomes...203

A. Caprara, G. Ciotti, L. Paschini, S. Sutton Altanova group, Italy/ UK , **Zuhair Abdulla, Al Shaiba Ali, Rashid Ali, Al Marri Jabir, Ali Karimbanackal**, Qatar

Analysing the effect of thermal ageing on low voltage distribution cables in relation to their structure...209

S.Bal, A.G.N.A.Jasim, Z.A.Tamus Department of Electric Power Engineering Faculty of Electrical Engineering and Informatics, Budapest University of Technology and Economics, Hungary

SESSION 10 - PARTIAL DISCHARGE

11 :00 - 12:40

Partial Discharge Detection in High-Voltage Gas Insulated Systems Using Fiber Optic Based Acoustic Sensors...215

A R Zadeh Optics 11, The Netherlands, **LC Heredia** Delft University of Technology, The Netherlands

Partial discharge measurements on 220kV and 400kV GIS substations with embedded UHF sensors experience in detection, acquisition, and data analysis...221

A. Caprara, P. Pieron, L. Paschini, G. Ciotti Altanova Group, Italy

Localization of Partial Discharge events in HV-Windings of Rotating Machines...227

F. Oetti OMICRON Technologies, Italy **C. Engelen** Omicron Electronics, Germany **C. Staubach** Hannover University of Applied Science, Department of High Voltage Insulation and Diagnostics, Germany

On-line PD monitoring of coils subjected to electric/thermal combined ageing...232

M. Ferraris ELANTAS Europe srl, Italy **F. Guastavino** University of Genova, Italy

Impact of unipolar repetitive square wave voltage rise time and frequency on (RPDIV-PDIV) and (PDIV-PDEV)...236

H. Naderiallaf Power Electronics, Machine and Control Group, University of Nottingham, UK
P. Giangrande Engineering and Applied Sciences, University of Bergamo, Italy **M. Galea** Department of Industrial Electrical Power Conversion, University of Malta, Malta

INSUCON 2023 CONCLUDING REMARKS

12:40-12.50

Mr Malcolm Hems - Conference Secretary