

20th Nordic Insulation Symposium 2007

(NORD-IS 2007)

**Kongens Lyngby, Denmark
11 – 13 June 2007**

ISBN: 978-1-61738-895-8

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2007) by Tapir Academic Press
All rights reserved.

Printed by Curran Associates, Inc. (2010)

For permission requests, please contact Tapir Academic Press
at the address below.

Tapir Academic Press
Nardoveien 12
NO-7005 Trondheim
Norway

Phone: + 47 73 59 32 10
Fax: + 47 73 59 32 04

forlag@tapir.no

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

PROGRAM

Sunday, June 10, 2007

18:00-20:00 Registration at DTU and mounting of posters.

Monday, June 11, 2007

08:00-09:00 Registration at DTU and mounting of posters

09:00-09:10 Symposium opening by the chairman: Mogens Henriksen

09:10-10:00 **Invited lecture:**
Power Electronics and Electrical Apparatus: a Threat?
given by Prof. Gian Carlo Montanari, Italy.

10:00-10:30 Coffee Break / Completion of mounting of posters

10:30-12:00 **Session 1 – Transients 1**
Chairman: Jarmo Elovaara

Aging Mechanisms of Solid Insulation Subjected to Short Risetime Voltage Surges

I. M. Culbert, G. C. Stone
Iris Power, Canada

A novel technique to infer PWM inverter-fed induction motor insulation state

A. Cavallini¹, S. Chandrasekar², D. Fabiani¹, G. C. Montanari¹

¹*DIE, University of Bologna, Bologna, Italy*

²*DEEE, Sona College of Technology, Tamilnadu, India*

Partial Discharge Measurements on Components Energized by Power Electronic Frequency Converters

Florian Martin, Thomas Leibfried
University of Karlsruhe, Institute of Electric Energy Systems and High Voltage Technologies, Karlsruhe, Germany

Investigations on High Voltage Machine Insulation Systems subjected to Repetitive Pulsed Voltage

Fredrik Sahlén¹, Li Ming¹, Kenneth Johansson¹, Eva Mårtensson,² Hans-Åke Eriksson², Osmo Koponen³, Saija Pääkkönen³

¹*ABB Corporate research, Västerås, Sweden*

²*ABB Automation Technologies, Västerås, Sweden*

³*ABB Electrical Machines, Helsinki, Finland*

12:00-13:00 Lunch

13:00-14:00 Session 2 – Transients 2

Chairman: Hans Edin

Detection of Surface Partial Discharges at Semi-Square Voltages 000000000000043

*Elisabeth Lindell, Tord Bengtsson¹, Jörgen Blennow, Stanislaw M. Gubanski
High Voltage Engineering, Department of Materials and Manufacturing
Technology, Chalmers University of Technology, Göteborg, Sweden
¹also with ABB Corporate Research, Sweden*

Effect of Imbedded Particles on DC Breakdown of XLPE Cable Insulation 000007

*Erling Ildstad, Frank Mauseth, NTNU, Trondheim, Norway
Rolf Hegerberg, Mildred Selsjord, SINTEF Energy Research, Trondheim,
Norway
Bjørn Sanden, Nexans Norway, Halden, Norway
Marc Jeroense, ABB Power Systems, High Voltage Cables, Karlskrona,
Sweden
Jan Erik Larsen, Statnett SF, Oslo, Norway*

**Critical Voltage Distributions in Dry Type Transformers: From Voltage 0000053
Distribution to Actual Electrical fields**

*Kenneth Pedersen, Joachim Holbøll, Mogens Henriksen
Technical University of Denmark, Denmark*

14:00-14:10 Introduction to the poster session by Petri Hyvönen

14:10-15:00 Poster Session and Coffee

15:00-16:20 Session 3 - Cables

Chairman: Georg Balog

**Medium Voltage Power Cable Diagnostics- Review of International 00059
Standards and Practices**

*John Densley
ArborLec Solutions Inc, Toronto, Canada*

After laying test of medium voltage cables including PD measurements 00000063

*Petri Hyvönen
Helsinki University of Technology, Power Systems and High Voltage
Engineering, Finland*

**Some Electrical Features of Standard XLPE and Water Tree Retardant 000067
Cables**

*Gunnar Vegge, Hallvard Faremo
SINTEF Energy Research, Trondheim, Norway*

**Recent Experiences with Commissioning Testing of Transmission Class 000006;
Cables**

*Howard Sedding, Mark Fenger
Kinetrics Inc., Toronto, Canada*

17:00 Guided tour at “The Open air Museum”

19:00 Symposium Dinner at “The Open Air Museum” in Lyngby

Tuesday, June 12, 2007

09:00-10:20 Session 4 – Measurement and testing techniques 1

Chairman: Rolf Hegerberg

Development of a Data Acquisition System for On-site Partial Discharge Measurements

*Vesa Latva-Pukkila, Pekka Nevalainen, Tiila Kangas, Pertti Pakonen
Tampere University of Technology, Institute of Power Engineering, Finland
Pekka Verho
ABB Distribution Automation, Tampere, Finland*

Measured Partial Discharge Inception Voltage for a Cavity at Different Applied Frequencies

*Cecilia Forssén, Hans Edin
KTH Electrical Engineering, Sweden*

Web-based PD monitoring of a Generator in Loforsen

*Sonja Berlijn, STRI, Sweden
Tommy Hjort, VB Kraft, Sweden
Sacha Markalous, LDIC, Germany*

A Novel Wide Band Transient Detection and Recording System

*Morten Erlandsson Lunow, Jens Laulund, DONG Energy, Denmark
Joachim Holbøll, Mogens Henriksen, Ørsted•DTU*

10:20-10:40 Coffee Break

10:40-12:00 Session 5 – Measurement and testing techniques 2

Chairman: Anders Jensen

Utilizing High Voltage Containing High Frequency Components for Continuous Dielectric Response Measurements during Aging

*Björn Sonnerud¹, Tord Bengtsson^{1,2}, Jörgen Blennow¹, Stanislaw M. Gubanski¹
¹Chalmers University of Technology, Göteborg, Sweden
²ABB Corporate Research, Västerås, Sweden*

On-line Partial Discharge Monitoring of Substations

*Pekka Nevalainen, Tiila Kangas, Vesa Latva-Pukkila, Pertti Pakone
Tampere University of Technology, Finland
Pekka Verho
ABB Oy Distribution Automation, Tampere, Finland*

Sensitivity Assessment for Partial Discharge Measurements on Distribution and Transmission Class Cables

*Mark Fenger, Howard Sedding
Kinetrics Inc., Canada*

Onsite Tests on Power Transformers

*Peter Werle
ABB AG, Transformers, Halle, Germany*

12:00-13:00 Lunch

13:00-14:00 Poster Session and Coffee

14:00-15:10 **Session 6 – Insulation materials and systems including emerging Technologies**

Chairman: Jesper Hjerrild

The Enlargement Law as a Tool for Comparing the Breakdown Performance of Power Cables: the Role Played by Conductor Radius and Insulation Thickness

Massimo Marzinotto¹, C. Mazzetti¹, G. Mazzanti²

¹*Electrical Engineering Depart. "Sapienza", University of Roma, Italy*

²*Electrical Engineering Depart., University of Bologna, Italy*

Space Charge Formation in Two-layered HDPE-objects during Long Term DC-voltage Application

Sidsel Trøttestad, Erling Ildstad

Department of Electrical Power Engineering, NTNU, Trondheim, Norway

Performance of a Hybrid Insulation System in Inhomogeneous Electric Field

Frank Mauseth, Arne Nysveen

Norwegian University of Science and Technology(NTNU), Trondheim, Norway

15:10 **Closing of Symposium** by the new Danish OC member J. T. Holbøll and invitation to Nord IS09 by the Swedish OC member Stanislaw Gubanski.

Wednesday, June 13, 2007

Technical Tour – full day tour.

Departure (by bus) from Scandic Eremitage Hotel at 09:00.

POSTER SESSION

Chemical changes and remaining voltage withstand of field aged XPLE-cables (XXXXXXXXXXXXXXXXXXXX)B29

Petri Hyvönen, Helsinki University of Technology, Power Systems and High Voltage Engineering, Finland

Anna-Stiina Jääskeläinen, Helsinki University of Technology, Laboratory of Forest Products Chemistry, Finland

**Relationship between Electroluminescence and Dissipation Current (XXXXXXXXXXXXXXXXXXXX)B33
in Polyethylene under AC Field of Various Frequencies**

A. Fujita, S. Bamji, M. Abou-Dakka, A. T. Bulinski

National Research Council of Canada, Ottawa, Ontario, Canada

**Experimental Validation of the Volume Effect in the Statistical Enlargement Law (XXXXXXXXXXXXXXXXXXXX)B37
for Cable Lines**

M. Marzinotto

Electrical Engineering Depart., “Sapienza”, University of Roma, Italy

Partial Discharge Propagation through Cable Systems with Cross-bonding Joints (XXXXXXXXXXXXXXXXXXXX)B3;

*Paul Wagenaars, I. J. Tigchelaar, P. A. A. F. Wouters
Eindhoven University of Technology, The Netherlands*

*P. C. J. M. Van der Wielen, E. F. Steennis
KEMA, The Netherlands*

AC Breakdown Strength of Polypropylene-Calcium Carbonate Compounds (XXXXXXXXXXXXXXXXXXXX)B45

M. Takala, P. Salovaara, K. Kannus

Tampere University of Technology, High Voltage Laboratory, Tampere, Finland

M. Karttunen, S. Kortet

Technical Research Centre of Finland, Tampere, Finland

**Reproducible on-site measurements of transfer function on power transformers (XXXXXXXXXXXXXXXXXXXX)B49
in frequency domain**

Christian Homagk, Kai Mössner, Thomas Leibfried

Institute of Electric Energy Systems and High-Voltage Technology, University of Karlsruhe, Germany

**Design and Testing of a Steam-Resistant Insulation System for the Stator of Low- (XXXXXXXXXXXXXXXXXXXX)B53
Voltage Machine**

V. Sihvo, J. Pyrhönen

Lappeenranta University of Technology, Department of Electrical Engineering, Finland

**Effects of Polyhedral Oligomeric Silsesquioxanes on Partial Discharge (XXXXXXXXXXXXXXXXXXXX)B57
Endurance and Electrical properties of XLPE**

Lasse Linnamaa, Kari Kannus

Tampere University of Technology, Institute of Power Engineering, Tampere, Finland

High-Voltage, High- Frequency dielectric properties of mineral transformer oil

*Mischa Nagel, Thomas Leibfried
University of Karlsruhe, Karlsruhe, Germany*

Improving PD detection in long cable routes through advanced analysis techniques

*A. Cavallini, M. Tozzi, G. C. Montanari
DIE, Universitu of Bologna, Bologna, Italy.*

Inductive Sensors in On-line Partial Discharge Measurements

*Tiila Kangas, Vesa Latva-Pukkila, Pekka Nevalainen, Pertti Pakonen
Tampere University of Technology, Finland
Pekka Verho
ABB Oy Distribution Automation, Tampere, Finland*

A Partial Discharge Pattern Classification Algorithm for Generator Insulation Systems – Verification based on Test Data and Simulations

*Wolfgang Hribernik, Gusztáv Újvári, Gert Pascoli
Arsenal Research, Monitoring, Energy and Drive Technologies, Austria*

Repeatability of FRA Measurements and New Connection Technique

*J. Szczechowski, H. Borsi, E. Gockenbach
Institute of Electric Power Systems, High Voltage Engineering Section (Schering-Institut),
Leibniz Universität Hannover, Germany*

New Possibilities of the Oil-paper Insulating Systems

*Mentic, V., Prosr P., Pihera, J., Polanský, R.
University of West Bohemia, Czech Republic*

The Evaluation of the Insulation Resource According to the Integral Characteristics Of the Overvoltages Effect Duration

*Saulius Gudzius, Audrius Jonaitis, Linas Andronis Markevicius, Alfonsas Morkvenas, Renata Stanioniene
Kaunas University of Technology, Faculty of Electrical and Control Engineering, Department of Electric Power Systems, Lithuania*

Partial Discharge Behavior of Insulating Systems for High Voltage Rotating Machine under Electrical Stress

*M. Farahani, E. Gockenbach, H. Borsi
Institute of Electric Power Systems (Schering-Institute), Leibniz Universität Hannover,
Germany*

Condition Evaluation of Oil-Pressboard Insulation by Fourier Transform Of Time Domain Dielectric Response

*Setayeshmehr, A., Eicler, C., Akbari, A., Borsi, H., Gockenbach, E.
Institute of Electric Power Systems, High Voltage Engineering Section (Schering – Institute),
Leibniz Universität Hannover, Germany*

Global Experience with TR-XLPE Insulation for Long Life MV Utility Cables

Jerker Kjellqvist¹, Sunderesan Ramachandran²

¹Dow Europe GmbH., Switzerland, ²The Dow Chemical Company, USA

Reproducibility of the FRA-Measurements as an effective method for diagnostic of power transformers

Oleg Kouzmine, Peter Werle, Janusz Szczechowski

ABB AG, Power Technologies, Business Unit Transformers, Halle, Germany

Return Voltage Measurements - how to Overcome the Length Dependence of the Diagnostic Results

Rainer Patsch¹, Dieter Kamenka², Johannes Menzel¹

¹Institute of Materials & Diagnostics in Electrical Engineering, University of Siegen, Germany

²SebaKMT, Radeburg, Germany

Partial discharge measurements at varied low frequency, and some results from thermally aged stator insulation

N. Taylor, H. Edin

KTH, Stockholm, Sweden.

A Method to Characterize Wind Turbine Power Fluctuations

Stephane Eisen¹, Esben Larsen¹, Asger Jensen²

¹Technical University of Denmark, ²DONG Energy, Copenhagen, DK