

**Report to CIGRE-Canada on Activities of Study Committee – D1  
Materials and Emerging Test Techniques  
Presented at the CIGRE Canada Meeting at Toronto Oct 4-7 2009**

Chairman: Prof. E. Gockenbach, Germany  
Secretary: Prof. Joachim Hoelboell, Denmark  
Canadian Representative: Dr. Sudhakar Cherukupalli

**Mission of D1:**

Facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of materials and emerging test and diagnostic techniques. This Study Committee was formerly know as Materials and Emerging Technologies

**Scope of D1:**

The activities within this Study Committee is to investigate, monitor and evaluate

- new and existing materials for electro-technology
- emerging test and diagnosis techniques, and
- support other study committees in their analysis of recently introduced and developing materials and emerging test and diagnostic techniques

**Membership of the SC**

The membership has currently 24 Regular members, 9 Observer members including all conveners of the Working Groups as well as the Advisory Groups.

**Advisory Groups**

The Advisory Groups are standing groups of experts who provide advice to the WGs and liaise with their counterparts in the other Study Committee. They do not produce Technical brochures.

The Advisory Groups are:

Strategic and Customer Related Advisory Group

- AG D1.01      Liquids and Liquid Impregnated Systems
- AG D1.02      High Voltage and Current Test and Measuring Technique
- AG D1.03      Insulating Gases
- AG D1.04      Solid Materials

Comment: The other advisory groups have been disbanded

**Composition of Working Groups**

There are a total of 14 WGs. The Working Groups report to Study Committee and are arranged under a particular subject Advisory Group. They comprise of experts that examine the technology needs examine issues, and develop Technical Brochures published by CIGRE. The summary of the contents of this Technical brochure is normally published in the Electra magazine and quite often Tutorials are also prepared for dissemination to the general membership/industry at large. The WGs that are currently active are:

- 01 Liquid Impregnated Systems (split into 5 WGs)
- 07 Solid Insulating Materials for Rotating Machines
- 14 Material Properties for Non-Ceramic Outdoor Insulation (will be replaced by D1.27)
- 15 Superconducting and Insulating Materials for HTS Power Applications
- 17 HV Asset Condition Assessment Tools, Data Quality - Expert Systems
- 19 Solid insulation endurance stressed by repetitive transient voltages caused by power electronics
- 20 Non-destructive Water treeing detection in MV XLPE cables
- 23 Diagnostics and accelerated life endurance testing of polymeric materials for HVDC application
- 24 Potential of Polymer Nano-composites as electrical insulation for highly stressed insulation material in AC and DC application
- 25 Application guide for PD detection in GIS using UHF or acoustic methods
- 26 Basic principles to determinate methane content of cross-linked solid extruded insulation of MV and HV cables
- 27 Material Properties of new and non-ceramic insulations
- 28. Optimized Gas-insulated Systems by Advanced Dielectric Coatings and Functionally Graded Materials
- 29 Partial Discharges in Transformers
- 30 Oxidation Stability of Transformer Insulating Oils
- 31 Dielectric Performance of insulating liquids for transformers
- 32 Progress in DGA techniques and diagnoses
- 33 High Voltage and Current Test Standard Recommendations (to be split into 3 WGs)
- 34 DGA for condition assessment of oil-impregnated insulation used in ac cables S. Cherukupalli
- 35 Performance of high-voltage and high-current measurement systems for high voltage testing
- 36 Special requirements for dielectric testing of ultra high voltage (UHV) equipment
- 37 Maintenance and evaluation of measuring procedures for conventional and unconventional partial discharge testing

### **Liaisons Activities:**

This Study Committee liaises within CIGRE with other Study Committees such as A1 Rotating Machines, A2-Transformers, B1 Insulated Cables, and C4-System Technical Performance. Members of this Study Committee also liaise with the IEC bodies.

### **Recent Meetings**

In August 2008 the committee met at Paris during Aug 25-29, 2008. There was Study Committee Meeting in Budapest during Sept 2009

### **Highlights of the Meeting in September 2009 at Budapest, Hungary**

At this Study Committee meeting several WG had their meeting. Only some are mentioned for brevity.

### **WG D1-24 Potential of Polymer Nano-composites as electrical insulation for highly stressed insulation material in AC and DC application**

*This WG is developing a Guide titled “Potential of Polymer Nano-composites in Electrical Insulation Systems”. It is expected to be about 100-150 page long and the WG will have a final draft sometime by April 2010. Some members of this WG are planning to make short presentation*

*at other Study Committee Meetings during the Central Session in Paris in Aug 2010. Presentations were made at a Workshop on Sep 20, 2009 and the topics presented are listed below:*

- Back to the future on nanodielectrics - – M.F. Fréchette
- Techniques for imaging the structure of polymeric nanocomposites - – A. Vaughan
- What can we learn from dielectric spectroscopy on nanocomposites? - – P. Morhuis
- Polypropylene matrix with silica nanofillers as enhanced high-voltage insulation materials Mika Paajanen
- Various characteristics of LDPE/MgO nanocomposites together with application of XLPE/MgO nanocomposite to EHV DC power cables - - M. Nagao
- Similarity between Treeing Lifetime and PD Resistance in Aging Mechanisms for Epoxy Nanocomposites - T.Tanaka
- Resistance to High-Voltage Arcing and to Tracking and Erosion of Silicone/SiO2 Nanocomposites kinder J Kindersberger
- Space charge characterization of epoxy nanocomposites - - J. Castellon
- Influence of corona treatment on dielectric properties of epoxy based micro-nano-composites" - S. Gubanski
- Microscopic Observation of Surfaces of Epoxy/Silica Nanocomposites Subjected to Partial Discharges using the IEC (b) Electrode System P. Groppel

#### **WG D1-20: Non-destructive Water treeing detection in MV XLPE cables**

*The purpose of this group was to prepare a Technical Brochure on the diagnostic methods for water treed XLPE insulation. The intent of the work was to provide information to utilities so that they can ask the right questions to technology providers that detect water trees, help decide on the equipment to buy/use for their own diagnostics, and survey relevant diagnostic methods for detection of water trees. The document is almost complete and is expected to be sent to CIGRE HQ before the end of the year.*

Technical visits were also arranged to visit the GANZ transformer/synchronous motor and SF6 GIS factory on Friday Sept 18, 2009 as well as the MAVIRA (Hungarian Transmission Authority)'s brand new control centre on Sept 17, 2009. .

#### **WG D1.01 – Liquid Impregnated Insulation Systems**

*The WGs in this Section are addressing the following topics:*

*Low molecular acids and other markers,  
Ageing properties of cellulosic insulation, moisture assessment of cellulosic materials by using relative moisture measurements,  
Electrical and thermal properties of vegetable oils*

*Furans for Diagnostics,  
Dielectric response methods for diagnostics of power transformers,  
New application of DGA,  
Dechlorination and oil reclamation (A Technical brochure has been prepared and sent to the CIGRE Technical Office)*

*Dielectric properties and performance of liquids in impregnated insulating systems (A technical brochure has been issued to the CIGRE Central Office)*

*From the work undertaken by this Committee several Technical Brochures have been prepared and submitted to CIGRE Central Office for formatting and final issue. Efforts are also underway to form several new WG to address the partial discharge measurements issues in power transformers and the DGA interpretation as applied to insulation systems in fluid-filled transmission cable systems.*

**WG D1-26 Basic principles to determinate methane content of cross-linked solid extruded insulation of MV and HV cables**

*This WG had their second meeting at this session. Approximately four presentations were made and currently the membership has cable manufacturers, XLPE suppliers, utility representatives, and one University representative in the WG.*

The preferential subjects for the CIGRE Session in 2010 were reconfirmed to be:

PS1: New Insulating Materials

PS2: Applications of High Temperature Superconductors

PS3: Monitoring and Diagnostic Techniques

A special Poster session is also planned for the CIGRE Session in Paris. The details shall be announced once the formal approval from CIGRE HQ is received.

## LIST OF WORKING GROUPS WITHIN D1 (DRAFT)

CSAG	Customer and strategic advisory group	J. Smit
AG D1.01	Liquid and Liquid Impregnated Insulation Systems	L. Lundgaard
AG D1.02	High Voltage and Current Testing and Diagnostic	M. Muhr
AG D1.03	Insulating gases	U. Schichler
AG D1.04	Solid materials	J. Densley
WG D1.01	Liquid impregnated systems for transformers	L. Lundgaard
WG D1.05	Capacitors	M. Rinaldi
WG D1.07	Solid Insulating Materials for Rotating Machines	H. Sedding
WG D1.12	Materials for DC applications (inactive)	J. Densley
WG D1.14	Material Properties for Nonceramic Outdoor Insulation	J. Kindersberger
WG D1.15	Superconducting and insulating materials for HTS power applications	H. Okubo
WG D1.16	High Field Phenomena in Solid Insulation and Interfaces (inactive)	T. Tanaka
WG D1.17	HV asset condition assessment tools, data quality, and expert systems	E. Gulski
WG D1.18	Emerging Technologies (inactive)	D. Agoris
WG D1.19	Solid insulation endurance under transient voltages	J. Holboell
WG D1.20	Non destructive water-tree detection in XLPE insulation	J. Densley
WG D1.23	HVDC ageing, diagnostics and accelerated life testing of polymeric materials	G.C. Montanari
WG D1.24	Potential of Polymer Nanocomposites as Electrical Insulation	T. Tanaka
WG D1.25	Application Guide for PD Detection in GIS using UHF or Acoustic Method	U. Schichler
WG D1. 26	Basic principles to determine methane content of cross-linked solid extruded insulation of MV and HV cables	S. Pelissou
WG D1.27	Material Properties for New and Non-ceramic Insulation	J. Kindersberger
WG D1.28	Optimized Gas-insulated Systems by Advanced Dielectric Coatings and Functionally Graded Materials	H. Hama
WG D1.29	Partial Discharges in Transformers	J. Fuhr
WG D1.30	Oxidation Stability of Transformer Insulating Oils	I. H�hlein
WG D1.31	Dielectric Performance of insulating liquids for transformers	L. Lundgaard
WG D1.32	Progress in DGA techniques and diagnoses	M. Duval
WG D1.33	High Voltage and Current Test Standard Recommendations	M. Muhr
WG D1.34	DGA for condition assessment of oil-impregnated insulation used in ac cables	S. Cherukupalli
WG D1.35	Performance of high-voltage and high-current measurement systems for high voltage testing	Y. Li
WG D1.36	Special requirements for dielectric testing of ultra high voltage (UHV) equipment	U. Riechert

WG D1.37 Gulski	Maintenance and evaluation of measuring procedures for conventional and unconventional partial discharge testing	E.
WG D1.xx	Functional Nanomaterials for the Electrical Power Industry	M. Frechette
WG D1.xx	Methods for Diagnostic/Failure Data Collection and Analysis	P. Morshuis
WG D1.xx	Rotating machine insulation voltage endurance under fast repetitive voltage transients	C. Hudon
WG D1.xx	Transformers scrapping protocol	?
WG D1.xx	Radiation Ageing of Polymeric Insulating Materials	T. Okamoto
WG D1.xx	"Emerging Test Techniques Common to High Temperature Superconducting (HTS) Power Applications"	H. Okubo
JWG A2/D1	HVDC Transformer polarity reversal: Role of oil conductivity	?

### **Future Meetings:**

CIGRE Session – Paris in August 2010

Joint A2+D1 Colloquium – Kyoto Oct-Nov 2011

Study Committee Meeting – (tentative) Australia – Oct 2012

Further information on activities of this Study Committee may be found on the website

[www.cigre-d1.org](http://www.cigre-d1.org)

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