

# Take away Paris 2024, D1 materials and emerging test techniques

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**cigre**

For power system expertise



# Inhoudsopgave

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  - PS1: Testing, monitoring and diagnostics
  - PS2: Materials for electrotechnical purposes and modelling
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  - Tutorial: Functional Properties of modern insulating liquids
  - Workshop: Driving T&D substations and equipment towards ZERO emissions
  - Postersessie
- Preferred Subjects voor 2026

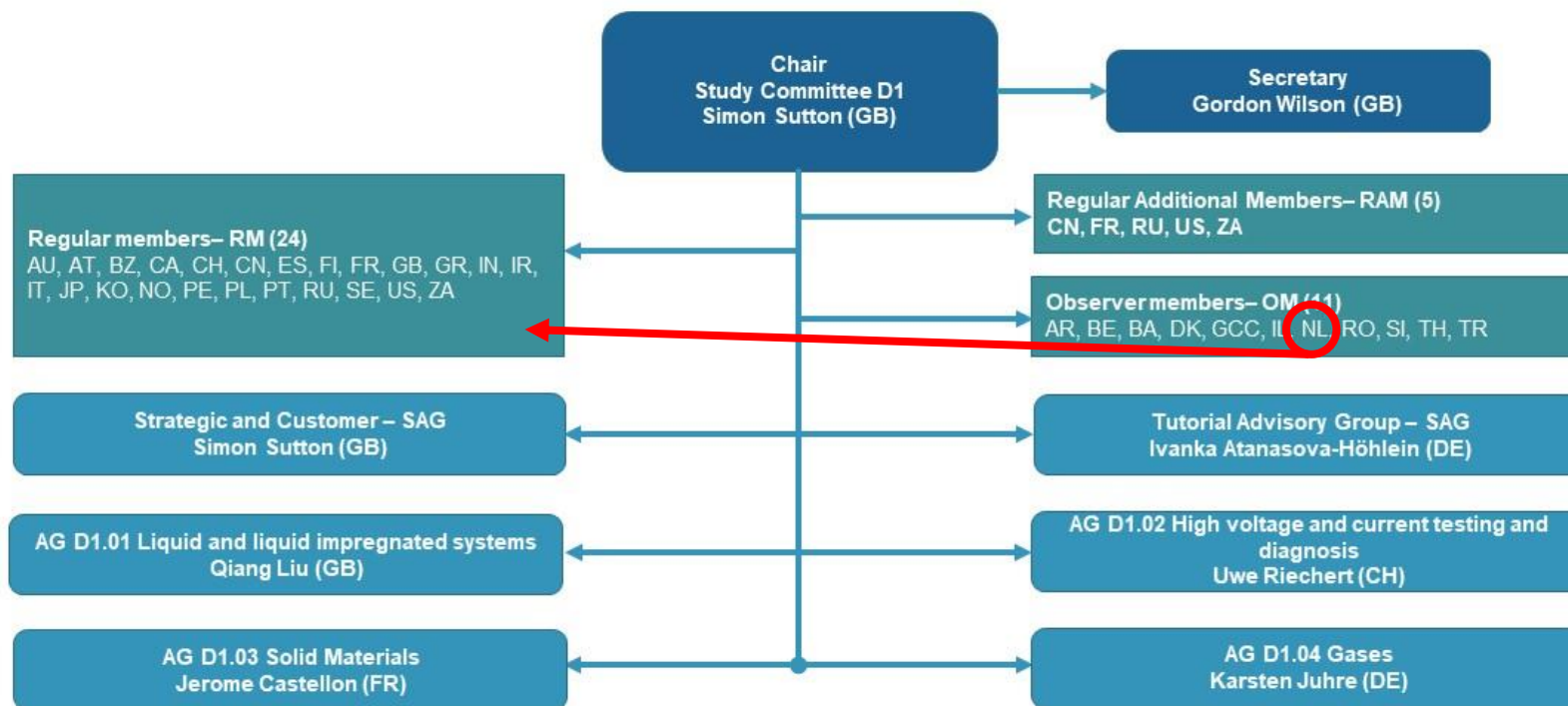
# Study Committee D1 – Meeting Parijs



# SC D1 - Organisatie

## SC D1 Organisation

August 2024



# D1 Advisory Groups met Working Groups

## SC D1 Working Groups

Study Committee D1

August 2024

### Liquid and liquid impregnated systems (AG D1.01)

WG D1.68 Natural and synthetic esters - Evaluation of the performance under fire and the impact on environment - M.Pompili (IT)

WG D1.76 Tests for verification of quality and ageing performance of cellulose insulation for power transformers - J.Lukic (RS)

JWG D1/A2.77 Liquid Tests for Electrical Equipment - F.Scatiggio (IT)

JWG D1/A2.79 Improved understanding of dynamic behaviour of winding insulating materials in liquid insulated power transformers - O.Girlanda (SE)

*JWG A2/D1.66 Breathing systems of liquid filled transformers and reactors - R. Kurte (DE)*

*JWG A2/D1.71 Modern Insulating Liquids Qualification for OLTC, Bushings and other Accessories - L.Liden (SE)*

*JWG A2/D1.72 Retrofill of Mineral Oil in Transformers - Motivations, Considerations and Guidance - R.Asano Jr (BZ)*

### High voltage and current testing and diagnosis (AG D1.02)

WG D1.60 Traceable measurement techniques for very fast transients - Y.Li (AU)

WG D1.61 Optical corona detection and measurement - N.Mahatho (ZA)

WG D1.63 Partial Discharge Detection under DC voltage stress R.Plath (DE)

WG D1.69 Guidelines for test techniques of High Temperature Superconducting (HTS) systems - R.Taylor (AU)

WG D1.72 Test of material resistance against surface arcing under DC - C.Bär (DE)

WG D1.74 PD measurement on insulation systems stressed from HV power electronics - A.Cavallini (IT)

WG D1.81 Methods and common data file format for Time-Domain Reflectometry - A.Barclay (GB)

*JWG B1/B3/D1.75 Recommendations for dielectric testing of HVDC gas insulated system cable sealing ends C.Plet (NL)*

*JWG A2/D1.67 Guideline for online dissolved gas analysis monitoring - T.Macarthur (AU)*

*JWG B3/A2/A3/C3/D1.66 Guidelines for Life Cycle Assessment in Substations considering the carbon footprint evaluation - A.Prabakar (IN)*

### Solid Materials (AG D1.03)

WG D1.62 Surface degradation of polymeric insulating materials - B.Komanschek (DE)

WG D1.73 Nanostructured dielectrics: Multifunctionality at the service of the electric power industry - J.Castellon (FR)

JWG D1/B1.75 Strategies and tools for corrosion prevention for cable systems - J.Tusek (AU)

JWG D1/A2.80 Functional properties of non-metallic solid materials for liquid filled transformers and reactors and their compatibility with insulating liquids - D.Vukovic (DE)

WG D1.82 Additive Manufacturing/3D Printing in Service of the Electrical Power Industry

*JWG B1/D1.75 Interaction between cable and accessory materials in HVAC and HVDC applications - A.Gustafsson (SE)*

### Gases (AG D1.04)

WG D1.66 Requirements for partial discharge monitoring systems for gas insulated systems W.Koltunowicz (DE)

WG D1.78 Partial discharge properties of non-SF6 insulating gases and gas mixtures M.Walter (CH)

*WG B3/D1.63 Guideline for assessing the toxicity of used SF6 gas onsite and in the lab of T&D equipment above 1 kV in substations R.Kurte (DE)*



# Nieuwe werkgroepen sinds Parijs 2022

WG	TITEL
D1.82	Additive Manufacturing/3D Printing in Service of the Electrical Power Industry (t.andritsch@soton.ac.uk)
D1.81	Methods and Common Data File Format for Time-Domain Reflectometry
D1/A2.80	Functional Properties of Non-metallic Solid Materials for Liquid Filled Transformers and Reactors and Their Compatibility With Insulating Liquids
D1.79	Improved Understanding of Dynamic Behaviour of Winding Insulating Materials in Liquid Insulated Power Transformers
D1.78	Partial Discharge Properties of Non-SF6 Insulating Gases and Gas Mixtures
JWG	
B3/A2/A3/ C3/D1.66	Guidelines for Life Cycle Assessment in Substations Considering the Carbon Footprint Evaluation
A2/D1.72	Retrofill of Mineral Oil in Transformers – Motivations, Considerations and Guidance
A2/D1.71	Modern Insulating Liquids Qualification for OLTC, Bushings and Other Accessories
A2/D1.74	Online moisture monitoring of transformers for ageing assessment (senja.leivo@vaisala.com)

# Technische Brochures uitgegeven sinds Parijs 2022



Nummer/Titel		Werkgroep	Gepubliceerd
933	Requirements and application of UHF PD systems for gas insulated systems	WG D1.66	2024-05
927	New Laboratory Methodologies for Investigating Liquids, Further Developments in Key Functional Properties	WG D1.70	2024-05
894	Basic principles and practical methods to measure the AC and DC resistance of conductors of power cables	WG D1.54	2023-03
888	Atmospheric and altitude correction factors for air gaps and clean insulators	WG D1.50	2023-03



# Papers, 65 in 3 preferred subjects (PS)

PS1: Testing, monitoring and diagnostics (36)

- *Testing and condition monitoring for reliability in conventional high voltage systems and power electronics applications.*
- *Assessment of diagnostics for equipment in remote or inaccessible locations.*
- *PD measurement under DC, rectifier, and impulse stress.*

PS2: Materials for electrotechnical purposes and modelling (23)

- *Ageing of materials under electrical, mechanical or thermal stresses and ageing markers.*
- *Modelling materials and field simulations for AC and DC applications.*
- *Assessment of compatibility of aged and new materials resulting from refurbishment or life extending activities.*

PS3: Materials to enable the energy transition (6)

- *Alternative electrotechnical materials or manufacturing processes which reduce environmental footprint.*
- *Materials and systems for energy storage; batteries, charging devices, capacitors etc.*
- *Materials to enable a hydrogen economy*





## D1 GDM – PS1 Testing, monitoring and diagnostics

- *Testing and condition monitoring for reliability in conventional high voltage systems and power electronics applications.*
- *Assessment of diagnostics for equipment in remote or inaccessible locations.*
- *PD measurement under DC, rectifier, and impulse stress.*

*36 Papers met de volgende inhoud:*

- *Voortgang in PD detectie (Akoestisch, UHF, HFCT, etc.)*
- *Vergelijkende PD-metingen conventioneel en UHF*
- *Toepassingen van DFR*
- *Diagnostieken voor conditiebepaling van transformatorolie*
- *Overige diagnostieken (Röntgen, Space Charge, DGA...)*
- *Prestaties, doorslag en PD-gedrag van verscheidene gassen, materialen en componenten*



# D1 GDM – PS2 Materials for Electrotechnical Purposes and Modelling



- *Ageing of materials under electrical, mechanical or thermal stresses and ageing markers.*
- *Modelling materials and field simulations for AC and DC applications.*
- *Assessment of compatibility of aged and new materials resulting from refurbishment or life extending activities.*

*23 Papers met de volgende inhoud:*

- *Voortgang in modellering van gedrag van isolatiematerialen*
- *Dielektrische eigenschappen en veroudering van alternatieve gassen, vloeistoffen, kunstharsen, siliconenrubbers, vloeibaar stikstof etc.*
- *Gedrag van isolatiematerialen onder HVDC*
- *Overige onderwerpen (ontgassing van XLPE, verwerken van gebruikt SF6...)*



# D1 GDM – PS3 Materials to enable the energy transition



- *Alternative electrotechnical materials or manufacturing processes which reduce environmental footprint.*
- *Materials and systems for energy storage; batteries, charging devices, capacitors etc.*
- *Materials to enable a hydrogen economy*

*6 Papers met de volgende inhoud:*

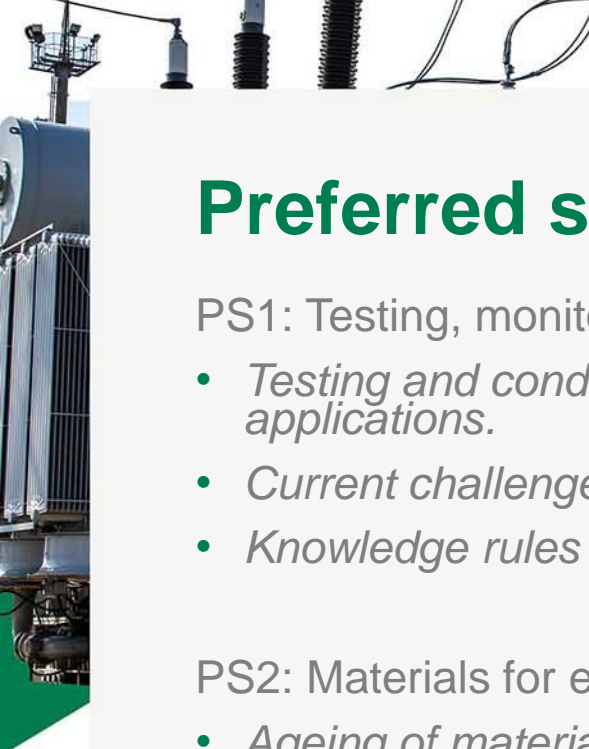
- *Toepassing en modellering van C4-FN gasmengsels*
- *Milieuvriendelijke coatings voor HS-componenten*
- *Nanomaterialen voor batterijen en condensatoren*
- *Invloed van vocht op papier-olie isolatie (minerale en plantaardige olie)*





## Workshops, tutorials, postersessie

- Joint workshop: “Driving T&D substations and equipment towards ZERO emissions”
  - Sprekers van A2, A3, B3 en D1
- Tutorial: “Functional properties of insulating liquids for transformers: laboratory methodologies and dielectric performance”
  - Verbonden aan WG D1.70: “Functional Properties of modern insulating liquids”
  - Twee technische brochures:
    - TB 856, “Dielectric performance of insulating liquids for transformers”
    - TB 927, “New laboratory methodologies for investigating of insulating liquids. Further developments in key functional properties”
  - Door Ivanka Atanasova-Hoehlein en Lars Lundgaard
- Postersessie, druk bezocht, meer wetenschappelijke inhoud maar met behoud van verbinding met de praktijk



# Preferred subjects voor Parijs 2026

## PS1: Testing, monitoring and diagnostics

- *Testing and condition monitoring for reliability in conventional high voltage systems and power electronics applications.*
- *Current challenges and understanding of PD behaviour under AC, DC, rectifier, and impulse stress.*
- *Knowledge rules and tools for improved diagnostics.*

## PS2: Materials for electrotechnical purposes and modelling

- *Ageing of materials under electrical, mechanical or thermal stresses and associated ageing markers.*
- *Advances in the application of novel materials and processes; superconductors, nano-composites, energy storage, additive manufacturing etc.*
- *Modelling materials and field simulations for AC and DC applications.*

## PS3: Measurements and modelling of interfaces

- *Understanding interfacial behaviour through experiments from nano- to macro-scale.*
- *Modelling field and charge dynamics at interfaces.*
- *Assessing material compatibility of aged and new materials.*