

Inside DuPont's European Technical Center: Pioneering Innovation in Transformer Insulation

by **Ante Prlic**
for **APC Media**

*Insulation system
based on Nomex® paper
and pressboard for
liquid-filled wind turbine
transformer*



DUPONT'S EUROPEAN TECHNICAL CENTER IN MEYRIN SERVES AS A HUB FOR INNOVATION, COLLABORATION, AND RIGOROUS TESTING. THE CENTER'S GLOBAL NETWORK, ADVANCED TESTING CAPABILITIES, AND FOCUS ON REAL-WORLD APPLICATIONS ENABLE DUPONT TO LEAD THE WAY IN DEVELOPING RELIABLE INSULATION SYSTEMS FOR THE POWER INDUSTRY.

In September 2024, Transformer Technology visited DuPont's European Technical Center (ETC) in Meyrin, Switzerland, just outside Geneva and next to the world-renowned CERN research facility. The ETC plays a crucial role in DuPont's development of advanced insulation systems for transformers and motors. This visit highlighted the sophisticated testing capabilities and collaborative work driving innovation at the ETC.

Our visit provided a comprehensive view of DuPont's approach to developing reliable, efficient insulation solutions through state-of-the-art testing methods. DuPont's team, including Jean-Claude Duart, Technical Expert; Radoslaw (Radek) Szewczyk, Application Development Leader for Transformers, EMEA; Bérénice Remy, Application Development Leader for Nomex®; Yannick Ittner, Application Development Engineer; Sébastien Tindillière, Technical & Laboratory Support for Nomex® Energy Solutions, and shared their insights and expertise as they led us through the center.

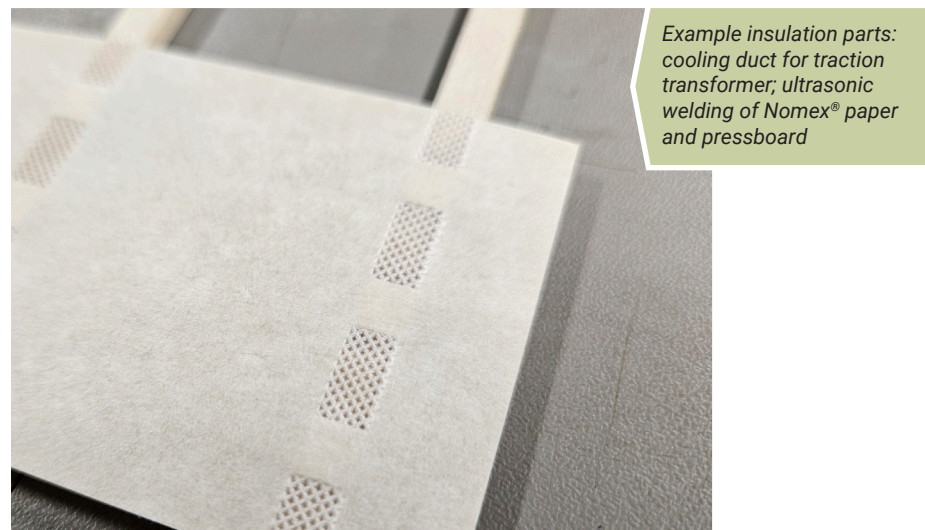
Global Collaboration and the Role of the ETC

DuPont's ETC is part of a global network of 22 technical centers that collaborate to push forward insulation technology. **"The ETC operates under a uniform system across our labs in Europe, China, and the US,"** explained Radek Szewczyk, during the introductory presentation. **"This allows us to assign work based on specific lab capabilities, ensuring that we use the right resources for every test."**

This network enables DuPont to leverage a broad range of expertise. **"We don't just test materials—we share knowledge and experiences across our labs worldwide,"** added Jean-Claude Duart. **"Whether we are validating a new insulation system or assessing the lifetime of materials, we benefit from a global pool of talent and technical resources."**



Radoslaw Szewczyk explaining the test for Comparative Tracking Index (CTI)



Example insulation parts: cooling duct for traction transformer; ultrasonic welding of Nomex® paper and pressboard



Example insulation parts:
lead cable for power
transformer with thick
insulation build made of
Nomex® crepe paper

Comprehensive Testing Capabilities for Advanced Insulation Systems

At the core of DuPont's approach is rigorous testing across the entire value chain, from base materials to finished windings of motors or transformers. **"We test materials at every stage of their lifecycle,"** noted Yannick Ittner. **"From plain Nomex® paper to laminated products and finished conductors or coils, our goal is to ensure performance consistency throughout the product's lifespan."**

An important technology on display was the **pulse endurance machine**, used to apply high-frequency electrical stress on insulation materials. **"This machine simulates the electrical stress caused by modern power electronics, such as silicon carbide (SiC) components,"** said Yannick. **"We subject materials like Nomex® to high-voltage pulses at up to 28 kHz, combined with thermal stress. This allows us to evaluate how these materials degrade under real-world conditions, which is crucial for ensuring long-term reliability."**

In addition to electrical stress tests, Yannick emphasized the importance of combining multiple stress factors in testing. **"The ability to simulate real operational conditions by combining electrical, thermal, and mechanical stresses is key to understanding how our insulation materials will perform in the field,"** he explained.

Tomography and Mechanical Stress Testing: Ensuring Material Integrity

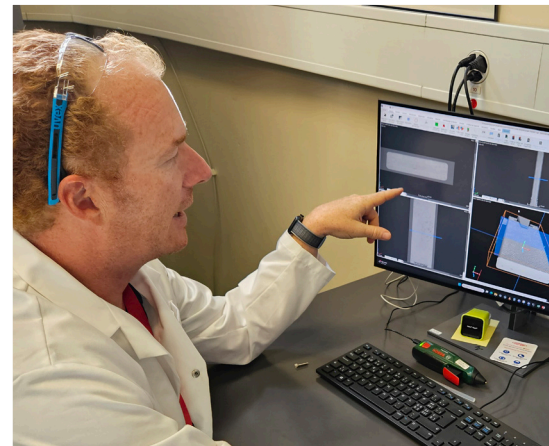
The non-destructive tomography equipment at the ETC provides an in-depth analysis of material integrity without cutting into samples.

"Tomography allows us to see inside materials like pressboard or composite laminates without damaging them,"

explained Sébastien Tindillière.

"This is critical for detecting internal issues such as voids, improper glue distribution, or contamination that could compromise mechanical strength or dielectric properties."

This level of precision, down to five microns, ensures that DuPont's materials meet the stringent quality standards required for critical applications. Sébastien demonstrated the tomography machine's ability to generate 3D models of materials, enabling detailed analysis of internal structures. **"We can see exactly where the material might have air pockets or inadequate glue coverage, allowing us to correct these issues before the materials are put into use,"** he said.



Following the tomography demonstration, Sébastien led us through the mechanical stress testing process. **"We evaluate the flexural strength of materials by applying significant pressure to both laminated pressboard samples and solid Nomex® sheets,"** he explained. **"This helps us assess whether the materials can withstand the physical stresses they'll encounter in transformers, such as during short circuits or heavy operational loads."**

These mechanical stress tests simulate real-world forces, ensuring that materials like Nomex® maintain their structural integrity even under extreme conditions. The tests are conducted according to standardized methods to ensure consistent and reliable results.

But customized test programs can be developed, too, to address novel approaches to insulation system evaluations or to answer specific customer questions.



Berenice Remy is material expert focusing on mechanical performance of electrical insulation and composites (in the photo together with Nomex® Energy Solutions team: Yannick Ittner, Karim Dirani and Radoslaw Szewczyk)



Sebastien Tindilliere mastered tomography analysis for non-destructive material evaluation

BY COMBINING CUTTING-EDGE TECHNOLOGY WITH A COMMITMENT TO COLLABORATION AND INDUSTRY LEADERSHIP, DUPONT'S ETC CONTINUES TO PUSH THE BOUNDARIES OF TRANSFORMER INSULATION, ENSURING THAT THE MATERIALS POWERING THE FUTURE ARE BUILT TO LAST.

Expanding Testing Expertise and Insights

During the demonstrations, additional insights were shared by Bérénice Remy, who emphasized the importance of maintaining consistency across testing and materials. **"We ensure that all tests follow standardized procedures to provide data that is comparable across different projects and different labs,"** she said. **"This consistency is crucial for our customers, who rely on our materials to meet the highest performance standards, especially in demanding environments."**

Bérénice also highlighted DuPont's involvement in industry working groups, such as CIGRE, where their expertise helps shape future standards. **"We contribute to standardization efforts through industry groups, helping to ensure that the materials we develop meet the evolving needs of the power industry,"** she said. **"This collaborative approach is vital to ensuring the highest level of reliability for transformers and other equipment."**

Practical Innovations in Transformer Design for Renewable Energy

One of the key focuses of DuPont's work at the ETC is developing insulation systems for transformers used in renewable energy applications, such as wind turbines. **"Nomex® allows us to design more compact and efficient transformers,"** explained Radek. **"By using Nomex® insulation, we can significantly reduce the size and weight of transformers, which is essential for applications where space is limited, like inside a wind turbine tower or nacelle."**

A model on display compared traditional cellulose-based transformer designs with those utilizing Nomex®, illustrating how the latter allows for smaller, compact designs. **"With Nomex®, we can reduce the cooling ducts inside transformers, which not only saves space but also allows for more copper windings, improving efficiency,"** added Radek. **"This means we can design transformers that are more compact, easier to transport, and more cost-effective to operate. They also need less raw materials, which has direct impact on environmental footprint of the equipment."**

Supporting Industry with Comprehensive Testing and Collaboration

The ETC's role goes beyond just material testing. DuPont works closely with industry partners, helping them optimize insulation systems for specific applications. **"We collaborate with manufacturers and utilities to ensure that our materials perform as expected in the field,"** said Jean-Claude. **"Our testing capabilities, from electrical stress simulations to material integrity assessments, provide the data needed to improve the reliability of transformers, motors, and other critical equipment."**

Radek also emphasized the importance of supporting customers through the entire product lifecycle. **"We don't just provide the materials; we help our customers understand how these materials will behave under different conditions,"** he said. **"For instance, in the development of compact transformers for renewable energy applications, we work closely with manufacturers to ensure that our insulation systems meet the specific requirements of their designs. We also encourage testing of materials at the end of transformer life, or after equipment failures. Information on material condition may be very valuable for future designs and for better understanding of actual stresses in operating equipment."**

This collaborative approach extends to DuPont's partnerships with other companies, such as fluid and resin manufacturers. **"Most of our materials are used in combination with other insulation products, so we work closely with our partners to ensure compatibility and optimized performance,"** explained Bérénice. **"This is particularly important in complex systems like liquid-filled transformers, where solid and fluid insulation must work together seamlessly."**

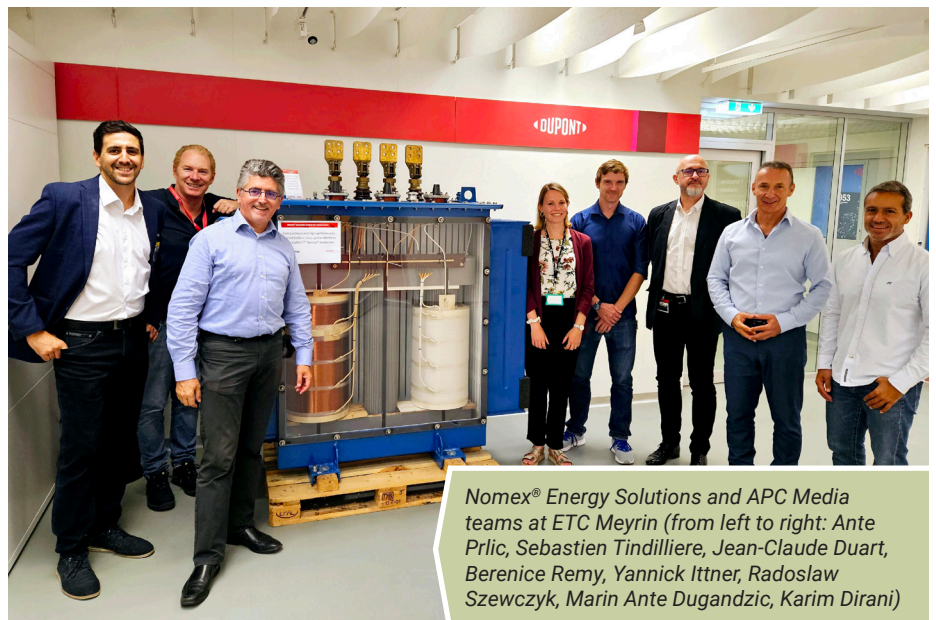
Conclusion: Advancing the Future of Transformer Insulation

DuPont's European Technical Center in Meyrin serves as a hub for innovation, collaboration, and rigorous testing. The center's global network, advanced testing capabilities, and focus on real-world applications enable DuPont to lead the way in developing reliable insulation systems for the power industry.

As Radek summarized, **"Our goal here at the ETC is to ensure that materials like Nomex® not only meet today's standards but exceed tomorrow's demands. Our goal here at the ETC is to ensure that materials like Nomex® not only meet today's standards but exceed tomorrow's demands. We are continuously working to provide solutions that empower the future with Nomex."**

By combining cutting-edge technology with a commitment to collaboration and industry leadership, DuPont's ETC continues to push the boundaries of transformer insulation, ensuring that the materials powering the future are built to last. For more information please visit ES.NOMEX.com.

Ply-bond test on key spacer for power transformers (Nomex® pressboard)



Nomex® Energy Solutions and APC Media teams at ETC Meyrin (from left to right: Ante Prlc, Sebastien Tindilliere, Jean-Claude Duart, Berenice Remy, Yannick Ittner, Radoslaw Szewczyk, Marin Ante Dugandzic, Karim Dirani)