

**More reliable transformer thanks to phenolic-glued pressboard**

## **Röchling improves the electrical properties of Trafoboard® – How reliable is the material?**

Since 2010, Röchling has been offering an insulation material made of high-quality laminated pressboard for the highest demands on electrical properties in the form of Trafoboard®. Trafoboard® HD-PH consists of high-density pressboard layers, made from pure cellulose according to IEC 60641, bonded together using a phenol-based resin matrix.

Röchling has several decades of experience with the phenolic resin for use in oil-filled transformers, thanks to the high-voltage insulation material Lignostone® Transformerwood®, which is also part of the company's product range. The properties of phenolic resin remain constant in oil-filled transformers even over a very long period of time and thus offer very good conditions for the construction of transformers. Against this background, Röchling developed the phenolic-glued pressboard, Trafoboard® HD-PH.

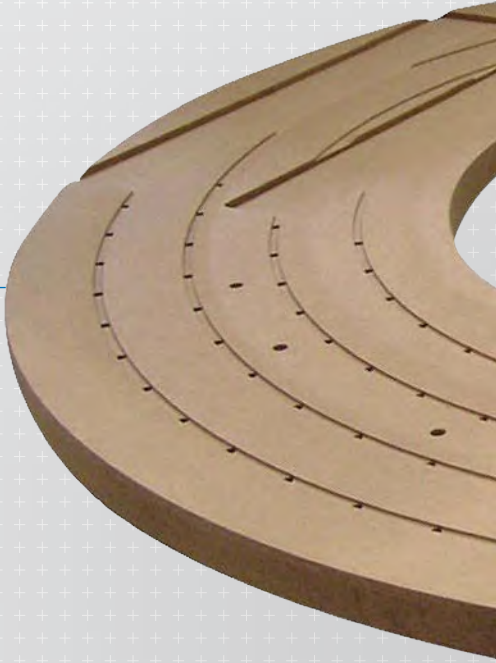
The very low moisture content and the very good drying behaviour characterise the material. Trafoboard® HD-PH meets the mechanical and electrical requirements for laminated pressboard according to IEC 60763-3 type 3.1 A.2 and in part clearly exceeds them. Unlike polyester-glued laminated pressboard, this material does not release styrene during machining. This avoids an unpleasant smell and a possible health hazard for the employees.

Röchling has been cooperating closely with the University of Applied Sciences in Osnabrück for years in the development of insulating materials for transformer construction. This also applies to Trafoboard® HD-PH, which has been approved for many years by renowned manufacturers of oil-filled transformers after thorough examinations of the properties and has been successfully used worldwide as insulating parts, such as rings, platform and fasteners.

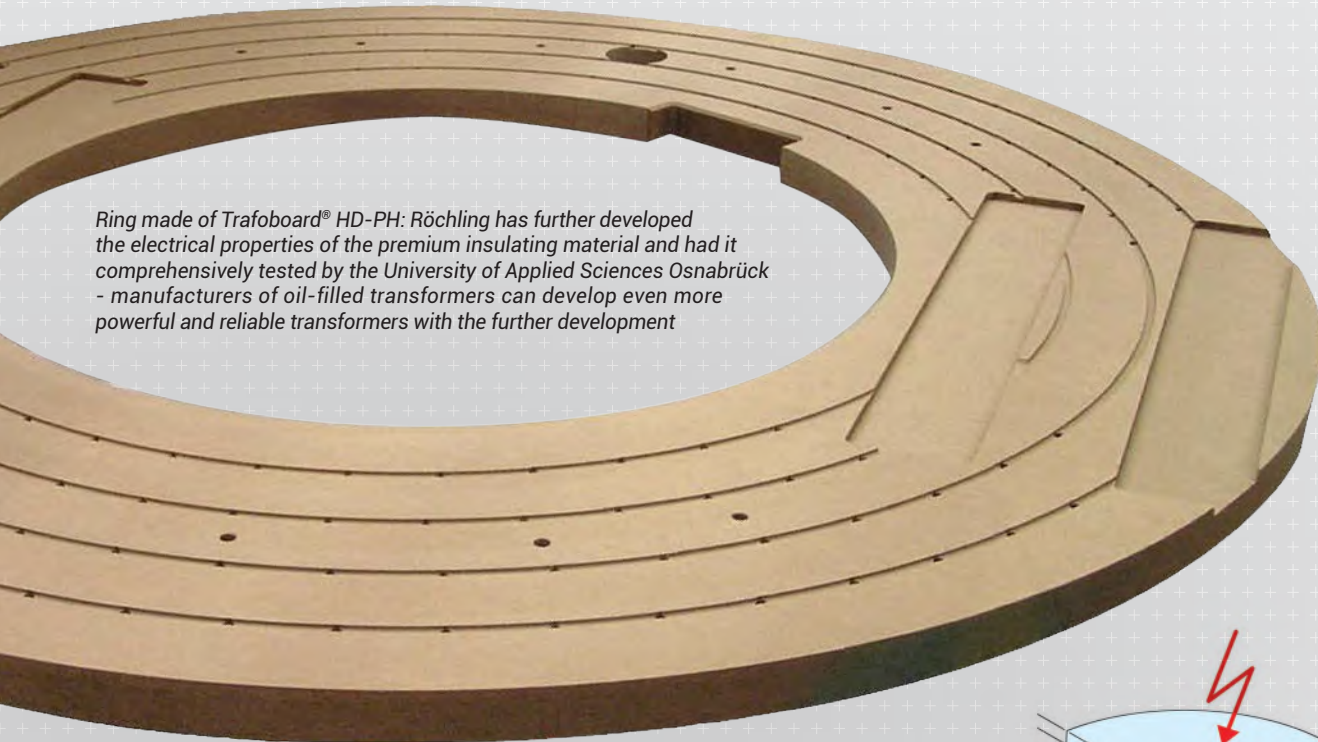
To enable transformer manufacturers to make allowance for the requirements for increasingly powerful transformers, Röchling has now further optimised the electrical properties of the material and had them tested in the modern high voltage laboratory of the University of Applied Sciences in Osnabrück. A high partial discharge inception field strength in the bonded seam between the laminated pressboard layers is the greatest challenge for the electrical properties. Consequently, Röchling has further optimised the manufacturing process of Trafoboard® and once again improved the bonded seam of the premium insulating material.

### **No partial discharge**

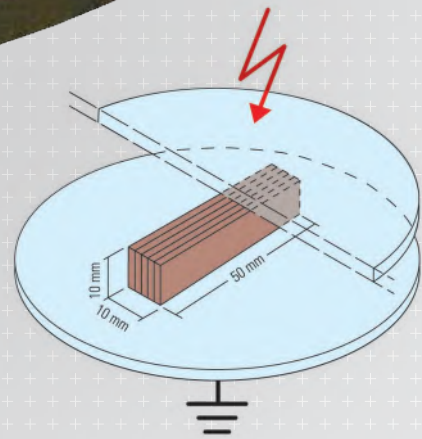
The University of Applied Sciences in Osnabrück tested 40 samples parallel to the lamination in mineral oil for partial discharge with a measurement precision of <1 pC. The results on Trafoboard® show no continuous partial and only two samples broke down. All the other tested samples were stopped due to a flash-over at the sample surface or a breakdown of the test sample. These events occur mainly by the surrounding mineral oil rather than by the sample, since the average event voltage corresponds to the electric strength of the oil. The samples did not show any partial discharge within the material at an average maximum field strength of 10 kV/mm (see the diagram).



**The demands placed on oil-filled transformers are constantly increasing. Ever greater efficiency and operational reliability are desired, even at high operating temperatures and heavy electrical load. Especially for the construction of modern transformers, Röchling Industrial has further developed the properties of its premium insulating material, Trafoboard®. Trafoboard® has been subjected to comprehensive testing by the University of Applied Sciences Osnabrück.**



Ring made of Trafoboard® HD-PH: Röchling has further developed the electrical properties of the premium insulating material and had it comprehensively tested by the University of Applied Sciences Osnabrück - manufacturers of oil-filled transformers can develop even more powerful and reliable transformers with the further development



Test result: The University of Applied Sciences Osnabrück tested 40 samples of Trafoboard®. None showed any partial discharge within the material at an average value of 10 kV/mm.

Test set-up: Arrangement of the sample between the electrodes

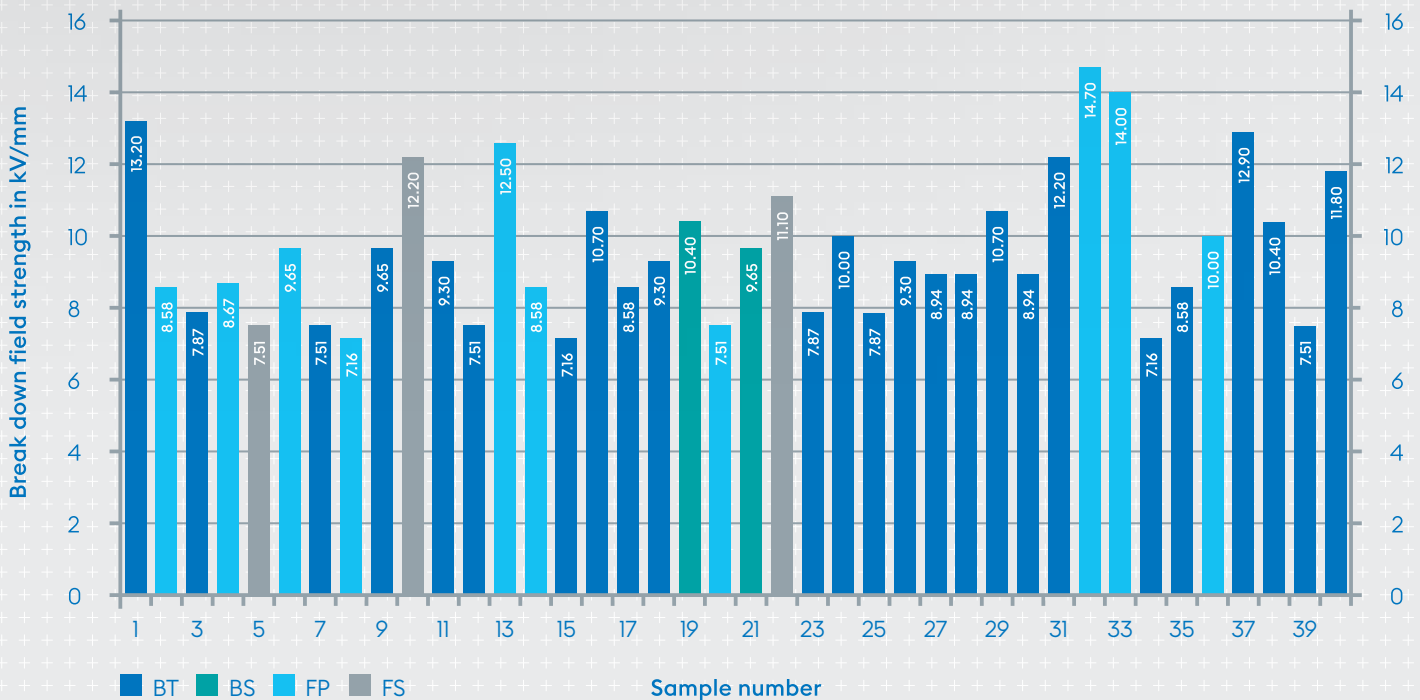
- BT = breakdown of test setup
- BS = breakdown of sample
- FP = flashover of sample on the pressed side
- FS = flashover of sample on the sawn side
- PD = onset of partial discharge – did not occur

TEST SETUP

Test direction: Parallel to the lamination

Voltage increase: Incremental

Measurement precision: <1.0 pC





*Trafoboard® HD-PH platform  
(size 3150 x 3100 mm) manufactured  
and machined by Röchling*

Hans-Jürgen Geers, General Manager Marketing & Technology, explained, "The results confirmed the very good electrical values of our material. The phenolic resin we use results in extraordinarily high breakdown resistance without partial discharge. We are very pleased with this result. We can provide our customers in transformer construction with more advantages for the construction and dimensioning of their transformers."

#### **Greater efficiency and more compact designs**

The very good electrical properties make it possible to design even more efficient transformers and contribute to operational safety and reliability. Thanks to the further improved bonding with phenol-based resin matrix, the premium insulation material can be used in higher electrical field areas, permitting even more compact transformer design. Furthermore, the mechanical properties remain at an excellent level even at elevated temperatures, which means that the Trafoboard® HD-PH also ensures increased operational safety in overload operation.

#### **Premium materials for the transformer industry**

Röchling insulating materials have been used in transformers for over 60 years and meet the highest dielectric and thermal requirements. Apart from Trafoboard® HD-PH, Röchling provides the laminated densified wood Lignostone® Transformerwood® for use in oil-filled power transformers. Both materials support transformer manufacturers in the development of powerful and safe transformers.

#### **Lignostone® Transformerwood® - Proven for over 60 years**

Lignostone® Transformerwood® is a laminated densified wood according to IEC 61061 for the construction of transformers made of selected red beech veneers (*Fagus sylvatica*), which are joined together with thermosetting synthetic resins under pressure and heat.

*Ring made of Lignostone®  
Transformerwood®: Apart from  
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Lignostone® Transformerwood® for use  
in oil-filled power transformers  
– a laminated densified wood according  
to IEC 61061 that consists of beech  
veneers (*Fagus sylvatica*), which are  
densified and glued together with  
specialized phenolic resins under high  
pressure and heat.*

## Röchling

The Röchling Group has been shaping industry worldwide. For nearly 200 years. The company transforms the lives of people every day with customized plastics: they reduce the weight of cars, make medication packaging more secure and improve industrial applications. The workforce of around 11,500 people is located in the places where the customers are – in 90 locations in 25 countries.

The Group's three divisions Industrial, Automotive and Medical generated joint annual sales of 2.352 billion euro in 2019.

The Industrial division, to which Röchling Engineering Plastics SE & Co. KG in Haren belongs, is the expert for optimal materials for every use.

Röchling Industrial develops and supplies individual products made of plastic for all industrial areas.

This is why Röchling Industrial has the broadest product range of thermoplastics and composite materials. The division supplies customers with semi-finished products or machined components.

Lignostone® Transformerwood® has an excellent reputation in the international transformer industry. The material combines outstanding electrical and thermal insulation properties with a very good oil intake, low weight and high resilience. Typical components include pressure rings, platforms, pressing beams, pitch rings, pressure segments and connection elements.

Röchling as the inventor of laminated densified wood has a unique know-how of the application of the material in transformer construction. Besides the patent from 1916, Röchling is a pioneer in the utilization of Lignostone® Transformerwood® in transformers. This started in the 1950s with the first oil-filled transformers built by Siemens.

## Durostone® CR - for higher temperatures

With the challenge of increasing power density, higher temperatures are required. This results in the need for high temperature insulation materials, which is Durostone® CR with a temperature class of up to 180°C.

Durostone® CR is a new product range of fiber-reinforced plastics especially for the transformer industry. Due to technical know-how with different manufacturing processes, resin systems and glass reinforcements Röchling can offer tailor-made fiber-reinforced plastics even for highest electrical insulation requirements. The extremely high mechanical strength makes steel replacement also possible, since Durostone® CR is available in big dimension. Chemical resistance and dimension stability are further advantages the materials offer.

## TRANSFORM network

As a member of the TRANSFORM network, the partner network of European premium suppliers for the transformer industry, Röchling has set itself the task of helping to configure the standards of tomorrow's transformers.

