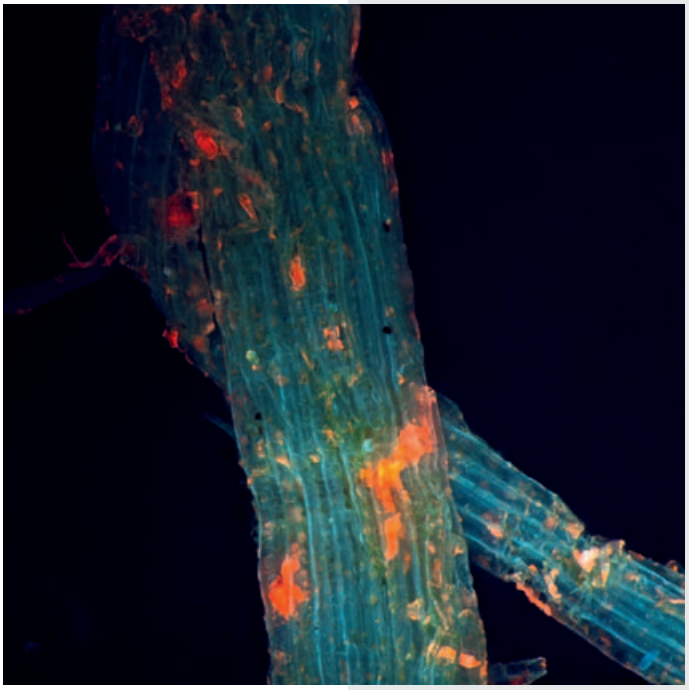
IHD®
SCIENCE BY EXPERTS



Activity Report 2014

Published/layout by: Institut für Holztechnologie Dresden gemeinnützige GmbH
April 2015
Printed by: Lausitzer Druckhaus GmbH, Bautzen
Cover image: Microscopic UV exposure of a UF-resin-glued fibre bundle for adhesive dispersion analysis

The Human Principle

The IHD and the EPH continued to grow also in 2014. Our 114 members of staff and almost 20 undergraduate or PhD students were dealing with more than 40 scientific topics for the industry and delivered their results.

We are well aware that the institute is borne by its staff, thus representing its capital. And that it is just those employees who account for the IHD and the EPH when it comes to competing with others and who may be the decisive "little extra" that makes our partners decide for cooperating with us.

For that reason, we have put the year 2014 into the service of our IHD 2030 Strategy, focusing particularly on the working conditions and motivation of our staff.

Apart from a SWOT analysis taking into account the economic and scientific situation of the two entities both internally and externally – we are very grateful for your taking part in the opinion poll –, our workers' council has turned to the motivators among our staff in a survey. There is always something left to do, to improve or to communicate more, and we are going to actively use the time ahead to implement the suggestions in our operational procedures.

In May 2014, the IHD was accredited to become an associated institute to the Faculty of Environmental Sciences at the Dresden University of Excellence. Collaboration has intensified at a new level of quality, new modules are being taken care of tutorially by our staff, and the possibility of scientific research is being improved.

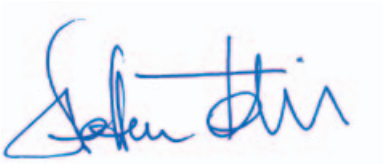
For better safeguarding and actively pursuing their interests, the Sächsische Industrieforschungsgemeinschaft e.V. (SIG), consisting of 18 industrial research facilities, was founded in April 2014. As one of the founding members, the IHD shares the view that industrial research in Saxony and Germany does exactly what politics and industry may expect it to do when it is about allocating subsidies: to encourage innovations in industry and to convert scientific findings into products and technologies. By subsequently founding an all-German industrial research association (ZUSE Association) consisting of 70 founding members, industrial research may be assigned the significance that it deserves for maintaining Germany as an industrial location.

This year, too, we could rely on the project initiators and incentive providers, on our partners in the industry and in associations – they challenged and promoted us in the process of applying for and processing research projects and, eventually, facilitated our continued effort to contribute to scientific and technological development in this branch of industry. Our special thanks go to project initiators, such as FNR, EuroNorm GmbH, AiF and Sächsische Aufbaubank (Saxon Development Bank) as well as to the Federal German Ministry for Economic Affairs and Energy, the Federal German Ministry of Food and Agriculture, the Saxon State Ministry for Economic Affairs, Labour and Transport and the Saxon State Ministry of Science and the Fine Arts.

Again this year, we owe all IHD and EPH members of staff a great debt of gratitude for their commitment which, by far, exceeded the normal measure when it came to applying for and processing research projects, to attracting services and to taking all supporting actions in both the artisanal field and controlling and project management to make 2014 a year of success. I am convinced that your openness, your commitment, your criticism and your suggestions you provided in the employees' survey will take us quite a bit further.

We are pleased to present to you as our partners this new Activity Report highlighting the endeavours undertaken by our facilities last year and do hope that, while reading it, you will find one or the other inspiration for your work, for innovations in your line of business and for joint projects.

Yours sincerely,



Dr. rer. nat. Steffen Tobisch
Head of the Institute, Managing Director

IHD® TRÄGERVEREIN e. V.

IHD® SCIENCE BY EXPERTS

EPH® SUCCESS BY QUALITY

The Institut für Holztechnologie Dresden

Members of the Board of the Trägerverein Institut für Holztechnologie Dresden e.V.

As per 31 December 2014

Hans-Jürgen Bock
Former General Manager of the Verband der Holzindustrie und Kunststoffverarbeitung Baden-Württemberg e.V.
President

Peter Albers
Managing Shareholder in the Ernst Günter Albers GmbH
Deputy

Dipl.-Volksw. Norbert Furche
Managing Director of the Verband Deutscher Leitern- und Fahrgerüstehersteller e.V.
Deputy

Dr. Dieter Döhring
Authorised Signatory of Kronospan GmbH Lampertswalde

Dipl.-Volksw. Herbert Merkel
General Manager of the Verband Holz und Kunststoff Nord-Ost e.V.

Members of the Board of Trustees in the Träger-verein Institut für Holztechnologie Dresden e.V.

As per 31 December 2014

Dr. Gerhard Görmar
Decor Druck Leipzig GmbH, Leipzig
President

Prof. Dr. Claus-Thomas Bues
Technische Universität Dresden,
Institut für Forstnutzung, Tharandt
Deputy

Dr. Heinz Haller
Süddekor GmbH, Laichingen
Deputy

Dr. rer. nat. Margot Scheithauer, Dresden
Honorary Trustee

Dr. Adolf W. Barghoorn, Fernwald

Elko Beeg
Sachsenküchen Hans-Joachim Ebert GmbH,
Schmiedeberg

Prof. Dr. Albrecht Bemmann
Technische Universität Dresden, Institut für Internationale Forst- und Holzwirtschaft, Tharandt

Dr. Dieter Döhring
Kronospan GmbH Lampertswalde, Lampertswalde

Dr. Berthold Dombo
OCI Melamine Skillcentre, Geleen,
The Netherlands

Thomas Gläser
Verband der Holz- und Kunststoffe verarbeitenden Industrie Sachsen e.V., Dresden

Prof. Dr. Andreas Hänsel
Staatliche Studienakademie Sachsen, Dresden

Christiane Hartwig-Gerth
Classen Fiberboard GmbH, Baruth/Mark

Jens Hesse
Hesse GmbH & Co., Hamm

Dr. Norbert Kalwa
FALQUON Holztechnik GmbH, Falkenhagen

Michael Ketzer
Johns Manville Sales GmbH, Wertheim

Dr. Wolfgang Knüpffer, Wernigerode

Prof. Dr. Pietro Nenoff
Labor für medizinische Mikrobiologie, Bakteriologie, Mykologie, Virologie & Infektionsserologie, Mölbis

Jorge Prieto
3P International Coating Consulting, Lünen

Dr. Peter Sauerwein
Verband der Deutschen Holzwerkstoffindustrie e.V., Gießen

Ernst-Hermann Timmermann
Deutsche Forschungsgesellschaft für Oberflächenbehandlung, Neuss

Dr. Stephan Weinkötz
BASF SE, Forschung Advanced Materials & Systems, Ludwigshafen

Heiko Wolf
Classen Fiberboard GmbH, Baruth/Mark

Members of the Trägerverein Institut für Holztechnologie Dresden e.V.

As per 31 December 2014

(In alphabetical order/locations indicated are in Germany, unless specified otherwise)

Dr. Adolf W. Barghoorn, Fernwald

Manfred Baums, Cologne

Brigitte Biffar, Neustadt

Jürgen Bock, Korntal-Münchingen

Roman Fink, Baden near Vienna, Austria

Norbert Furche, Karlsfeld

Christian Gangloff, Bühl/Baden

Dieter Humm, Munich

Dr. Jürgen Kramer, Rosengarten

Florian Knoll, Kundl, Austria

Dr. Wolfgang Knüpffer, Wernigerode

Markus Luersen, Rheda-Wiedenbrück

Pirmin R. Mandery, Kirchberg,

Dr. Margot Scheithauer, Dresden

Prof. Dr. Ulrich Schwarz, Eberswalde

Wolfhorst Wehr, Wiesbaden

Dr. Johannes Welling, Reinbek

3H-LACKE Lackfabrik Hammen GmbH & Co. KG, Hiddenhausen

3P International Coating Consulting, Lünen

AIP Innenprojekt GmbH, Limbach-Oberfrohna

BASF SE, Ludwigshafen

BauschLinnemann GmbH, Sassenberg

Berufsakademie Sachsen Staatliche Studienakademie Dresden, Dresden

BHW Beeskow Holzwerkstoffe GmbH, Beeskow

Bo-NaFaTec GmbH & Co. KG, Sontra

bso Verband Büro-, Sitz- und Objektmöbel e.V., Wiesbaden

Bundesverband Holz und Kunststoff, Berlin

Büromöbelwerk EB GmbH, Eilenburg

Büttner Energie- und Trocknungstechnik GmbH, Krefeld-Uerdingen

Classen Industries GmbH, Baruth

DECOR DRUCK LEIPZIG GmbH, Leipzig

Deutsche Forschungsgesellschaft für Oberflächenbehandlung e.V., Neuss

Deutsche Werkstätten Hellerau GmbH, Dresden

DSM Ahead, Geleen, The Netherlands

DTS-Systemoberflächen GmbH, Möckern

Dynea Austria GmbH, Krems, Austria

Egger Holzwerkstoffe Brilon GmbH & Co. KG, Brilon

Electronic Wood Systems, Hameln

Ernst Guenter Albers GmbH, Meldorf

Fachverband Holz und Kunststoff im Freistaat Sachsen, Dresden

FALQUON Holztechnik GmbH, Pritzwalk

Fördergemeinschaft für das Süddeutsche Kunststoff-Zentrum e.V., Würzburg

Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V., Remscheid

Gebrüder Heißerer, Prem/Obb.

Georg-August-Universität Göttingen, Institut für Holzbiologie und Holztechnologie, Göttingen

Gesamtverband Deutscher Holzhandel e.V., Berlin

Hamberger Industriewerke GmbH, Stephanskirchen

Hauptverband der Deutschen Holz und Kunststoffe verarbeitenden Industrie und verwandter Industriezweige e.V., Bad Honnef

Henkel AG & Co. KGaA, Bopfingen

Hesse GmbH & Co., Hamm

Hettich Managementsystem Service GmbH, Kirchlengern

Homanit GmbH & Co. KG, Herzberg am Harz

Hornbach Baumarkt AG, Bornheim

HW-Verlag „Holz", Mering

Hymmen Industrieanlagen GmbH, Bielefeld

IHD® TRÄGERVEREIN e. V.

Institut für Lacke und Farben e.V., Magdeburg

Jakob Schmid Söhne GmbH & Co. KG, Kippenheim

Johann Heinrich von Thünen-Institut, Hamburg

Johns Manville Sales GmbH, Wertheim

KLAFS GmbH & Co. KG, Schwäbisch Hall

Klebchemie M.G. Becker GmbH + Co. KG, Weingarten/Baden

Kompetenznetz Rail Berlin-Brandenburg GmbH, Brandenburg an der Havel

Kronospan GmbH Lampertswalde, Lampertswalde

MATERIALFORSCHUNGS- UND PRÜFANSTALT an der Bauhaus-Universität Weimar, Weimar

Möbelfolien GmbH Biesenthal, Biesenthal

newotec GmbH, Großröhrsdorf

NanoSys GmbH, Wolfhalden, Switzerland

O.b.u.v. Sachverständiger für das Parkettlegerhandwerk, Pockau

OCI MELAMINE, Geleen, The Netherlands

OKA Büromöbel GmbH & Co. KG, Neugersdorf/Sa.

Otto Weibel AG, Urdorf, Switzerland

Pfleiderer Faserplattenwerk Baruth GmbH, Baruth/Mark

PINUFIN Oberflächentechnik GmbH & Co. KG, Karlsruhe

PLANTAG Lacke GmbH, Detmold

Polstermöbel GmbH Oelsa-Rabenau, Rabenau

Robert Bürkle GmbH, Freudenstadt

Sachsenküchen Hans-Joachim Ebert GmbH, Schmiedeberg

Sächsischer Holzschutzverband e.V., Dresden

Sächsisches Textilforschungsinstitut e.V., Chemnitz

Scheiffele-Schmiederer KG Holzwerke, Egling a. d. Paar

Schotten & Hansen, Peiting

Spanplattenwerk Gotha GmbH, Gotha

Sueddekor GmbH, Laichingen

Technische Universität Dresden, Institut für Forstnutzung und Forsttechnik, Tharandt

Technische Universität Dresden, Institut für Holz- und Papiertechnik, Dresden

Technofol Kunststoffe GmbH, Harbke

Teknos A/S, Vamdrup, Denmark

Thüringisches Institut für Textil- und Kunststoffforschung e.V., Rudolstadt-Schwarza

Treffert Coatings GmbH, Alzenau

TÜV Rheinland LGA Products GmbH, Dresden

UPM Sales GmbH, Augsburg

Venjakob Maschinenbau GmbH & Co. KG, Rheda-Wiedenbrück

Verband der Deutschen Holzwerkstoffindustrie e.V., Gießen

Verband der Deutschen Möbelindustrie e.V., Bad Honnef

Verband der Holz und Kunststoffe verarbeitenden Industrie Sachsen e.V., Dresden

Verband der Holzindustrie und Kunststoffverarbeitung Baden-Württemberg e.V., Neustadt/Weinstraße

Verband der Holzwirtschaft und Kunststoffverarbeitung Bayern-Thüringen e.V., Munich

Verband Deutscher Maschinen- und Anlagenbau e.V., Frankfurt

Verband Holz und Kunststoff Nord-Ost e.V., Hamburg

Verein zur Förderung des Forschungsinstituts für Leder und Kunststoffbahnen (FILK) Freiberg/Sachsen e.V., Freiberg

Votteler Lackfabrik GmbH & Co. KG, Korntal-Münchingen

Willi Schillig Polstermöbelwerke GmbH & Co. KG, Ebersdorf

Members of Staff at the Institut für Holztechnologie Dresden gemeinnützige GmbH

As per 31 December 2014

Institute Management

Managing Directors

Dr. rer. nat. Steffen Tobisch
Dipl.-Kaufm. Götz Haake
Dr.-Ing. Bernd Devantier

Coordinator Research and Development

Dipl.-Math. Mathias Rehm

Staff

Department Biology/Wood preservation

Dr. rer. silv. Wolfram Scheiding
Dipl.-Ing. (FH) Björn Weiß
Dipl.-Ing. Kordula Jacobs
Dipl.-Biol. Katharina Plaschkies
B.Sc. Natalie Rangno
Dipl.-Ing. (BA) Philipp Flade

Department Materials

Dr. rer. nat. Detlef Krug
Dipl.-Ing. Andreas Weber
Dipl.-Ing. (FH) Jürgen Bonigut
Dipl.-Ing. (BA) Marco Mäbert
Dipl.-Ing. Tino Schulz
M.Sc. Martin Direske
M.Sc. Christoph Wenderdel

Department Chemistry/Environment

Dr. rer. nat. habil. Mario Beyer
Dipl.-Ing. Martina Broege
Dr. rer. nat. Sebastian Weidlich
Dipl.-Chem. Karsten Aehlig
Dr. rer. nat. Martin Fischer
Dr. rer. nat. Christiane Swaboda
M.Sc. Katrin Salzwedel
Dipl.-Chem. Christiane Osthaar

Department Physics/Components

Dipl.-Ing. (FH) Lars Blüthgen
Dipl.-Phys. Jens Wiedemann
Dipl.-Ing. Jens Gecks
Dipl.-Phys. Heiko Kühne
Dipl.-Ing. Kerstin Schweitzer
Dipl.-Ing. (FH) Joachim Beständig
Dipl.-Kfm. Peter Barth
Dipl.-Ing. Heiko Hofmann

Department Surface

Dr.-Ing. Rico Emmler
Dipl.-Ing. Christine Kniest
Dipl.-Ing. Malgorzata Anna Adamska-Reiche
Dipl.-Ing. (FH) Anissa Ghozzi
Dipl.-Ing. Detlef Kleber
Dr. rer. silv. Lars Passauer
Dr. rer. nat. Florian Kettner

Department Furniture/Interior Design

Dipl.-Ing. Susanne Trabandt
Dipl.-Ing. Matthias Weinert
Dipl.-Ing. (BA) Andreas Gelhard
Dipl.-Ing. Jean-Pierre Mouton
Dipl.-Ing. Stefan Schmidt
Dipl.-Ing. Linda Geißler
Dipl.-Ing.(FH) Tony Gauser
Dipl.-Ing. Albrecht Lühmann

Department Communication/Transfer

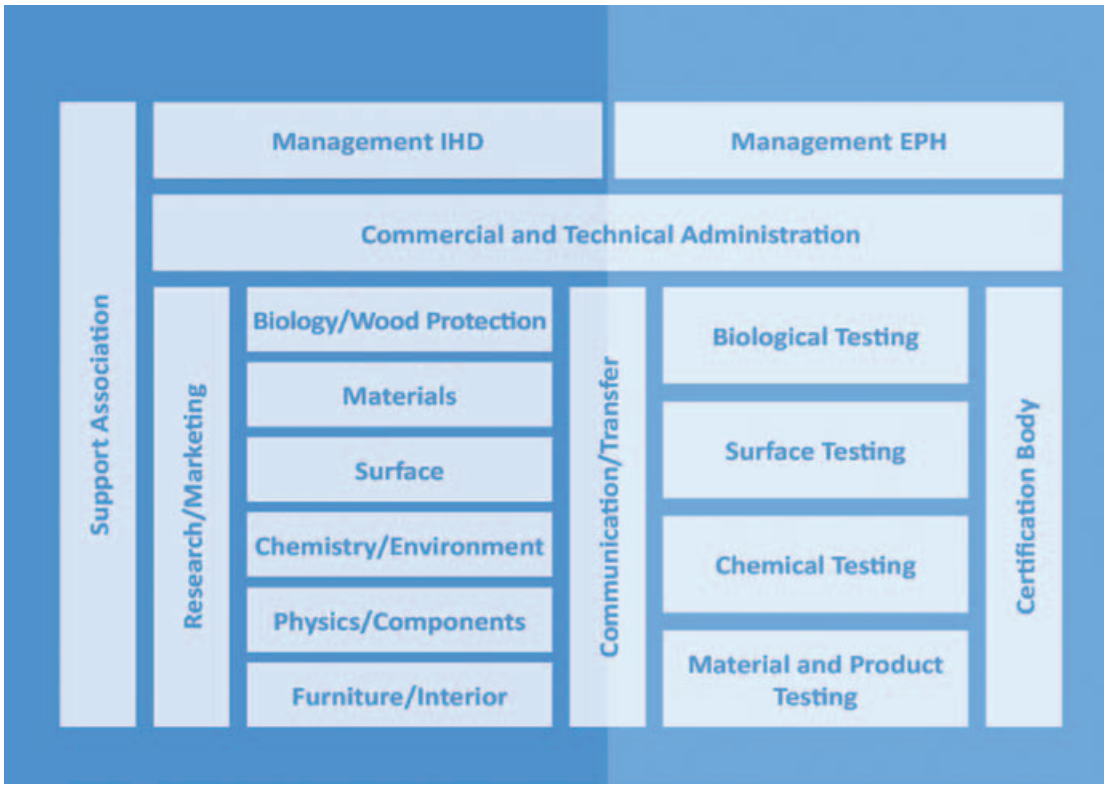
Dipl.-Betriebsw. (BA) Annett Verena Jopien
Mandy Baldauf
Dr. rer. silv. Siegfried Tzscherlich
Dipl.-Bibl. (FH) Eva Schuricht
Dipl.-Inform. (BA) Johannes-Sebastian Heinelt
Dipl.-Ing. (BA) Thomas Hupfer
Dipl.-Ing. (BA) Jens Walther
Dipl.-Inform. (FH) Katja Boneß
Christian Pötzsch

Furthermore

10 Project and testing engineers
18 Technicians
27 R&D staff
8 Staff in technical/commercial admin.
22 BA students
21 Students studying for a university diploma, a master's degree, a bachelor's degree, interns and student assistants

Organisational Structure

As per 31 December 2014



Project Overview

Completed Research & Development Projects

Title	Project Leader	In-charge	Funding Institution
WOOD, WOOD-BASED MATERIALS, WOOD PRESERVATION			
Chemical Lignin Crushing Based on the FENTON Mechanism	Mäbert	Mäbert Dr. Weidlich	BMEL/FNR
Investigations into the Manufacture of Cardboard in the Dry Process	Schulz	Wenderdel	BMWi/AiF/IGF
Investigations on the Impact of the Chip Geometry and Wood Species on the Properties of Raw-density-reduced Chipboards Manufactured from Them, in the Context of the Application of Lightweight Filler Materials	Schulz	Schulz	BMWi/EuroNorm/ INNO-KOM
Development of Procedures for the Manufacture of Products from Transparently Coated, Naturally Dark Timbers and Thermally Modified Timber (TMT)	Dr. Beyer Dr. Passauer	Dr. Passauer Wenk	BMWi/AiF/ZIM
Additives on a Montan Wax Basis for Hydrophobing Wood-based Materials	Dr. Krug	Dr. Krug Bonigut	BMWi/AiF/IGF
Development of High-quality Semi-finished Products of Special Wood-based Materials for Application in Mechanical Engineering and in Conveyor Technology	Weber	Weber	BMEL/FNR
Manufacture of Moisture-resistant and Mould-resistant Insulating Fibreboards from Modified Fibres	Weber	Direske	BMWi/AiF/IGF
FURNITURE, STRUCTURAL ELEMENTS, SURFACE			
Modification of Beech by Drying Oils and Microwaves for Outdoor Use in Gardening and Landscaping	Dr. Swaboda	Dr. Swaboda	BMWi/AiF/ZIM
Theoretical Elaboration of Design Requirements, Especially of the Choice of Materials, Analysis and Development of Suitable Hinge Systems for a Foldable Piece of Furniture	Mouton Gauser	Mouton Gauser	BMWi/AiF/ZIM
Lightweight Furniture Design Enabled by Folding Technology; Development and Proof of Suitability of New Solutions for Lightweight Design	Weinert	Weinert Geißler	BMWi/AiF/ZIM
Box Windows – Fit to Meet the Combined Requirements of Both Heat Insulation and Increased Noise Insulation for Application in New and Existing Buildings/Monuments	Schweitzer	Wiedemann	BMWi/AiF/ZIM

Title	Project Leader	In-charge	Funding Institution
Application of Molecularly Encapsulated Ethereal Vegetable Oils for In-can Conservation and the Film Coating of Dispersion Paints and Water-soluble Wood Coating	Dr. Kettner	Dr. Kettner Plaschkies	BMWi/EuroNorm/ INNO-KOM
Development of Powder-lacquering Procedures for Indoor and Outdoor Wood Surfaces	Dr. Emmler	Kleber Wenk Brendler	BMWi/EuroNorm/ INNO-KOM
Development of Non-combustible Decorative Floor and Wall Panels Based on Gypsum Fibreboards	Dr. Emmler	Dr. Fuchs Ghozzi Kniest	BMWi/EuroNorm/ INNO-KOM
Development of Solutions for Converting Existing Pre-fabricated Wooden Houses Following the Criteria of Universal Design	Trabandt	Trabandt Geißler	BMWi/EuroNorm/ INNO-KOM
Equipping Accommodation Facilities in Universal Design	Trabandt	Trabandt Gauser	BMWi/EuroNorm/ INNO-KOM
Multi-functional, Nano-structured Coating of Wooden and Laminated Floors	Dr. Kettner	Dr. Kettner Brendler Plaschkies Wenk	BMWi/AiF/IGF
Scratch-proof Coating of Wood and Plastics Based on Silica-modified, Aqueous Polyurethane Dispersions	Dr. Emmler	Dr. Emmler Wenk	BMWi/AiF/IGF
TESTING TECHNOLOGY			
Development of Test Procedures for the Faster Prognosis of Long-term Preservation of Outdoor Wood Coating	Dr. Passauer Dr. Beyer	Dr. Passauer Wenk Brendler	BMWi/AiF/IGF
Quantitative PCR Assay for Proving Dry Rot by Way of the Implemented Molecular Vitality Test	Jacobs	Rangno	BMWi/EuroNorm/ INNO-KOM
Elaboration of Parameters for Evaluating Primer Coats for Inkjet Printing on Wood-based Materials	Dr. Emmler	Dr. Fuchs Adamska-Reiche Ghozzi Brendler	BMWi/EuroNorm/ INNO-KOM
Chromate-free Fixation of Copper by Hydrophobing	Dr. Swaboda	Dr. Swaboda Dr. Fischer	BMWi/EuroNorm/ INNO-KOM
Inline Determination of Formaldehyde Emission from Sawdust of Wood-based Material during Production	Broege	Broege Kniep	BMWi/EuroNorm/ INNO-KOM

Abstracts

Chemical Lignin Crushing Based on the FENTON Mechanism

Project Leader: Dipl.-Ing. (FH) Marco Mäbert
In-charge: Dipl.-Ing. (FH) Marco Mäbert
Dr. Sebastian Weidlich
Funding Institution: BMEL/FNR

Objective

The beginning of the formaldehyde discussion has triggered developments aiming at formulating alternative gluing systems. Such developments include the approach to synthesise resins on the basis of lignin. One possibility of its application as an alternative formaldehyde-free bonding agent results from, if possible, selective fractioning of the lignin matrix into uniform compounds and their subsequent networking. Such disintegration is caused by dry rot and other brown rot fungi due to the so-called FENTON mechanism, which is a non-enzymatic reaction mechanism. The fungi generate hydroxyl radicals by means of variegated acid and induced ferro-reduction, which then split the lignin up into smaller components. This degradation is focused at for biomimetic application, as there is reason to assume that this natural degradation process yields uniform fragments that are catabolised by further mechanisms, such as in dry rot. The assumption is based on the fact that, in nature, the avoidance of disorder or diversity of metabolic processes is of primary importance.
Hence, this research project comprised investigations on the suitability of the FENTON mechanism as an approach for the chemical fragmentation of lignin before the background of an application as an adhesive for wood and wood-based materials.

Materials and Methods

The project started out from morphologically investigating the grain size distribution and fromdetermining the chemical parameters of buffer capacity and pH-value.

Preliminary tests at the IHD were able to prove a clear decrease in the medium molar mass (MN) of kraft lignin acc. to the FENTON reaction (Fig. 1). Based on those results, various differentiations in performing the reactions were applied in the course of the project.

- variation of the amount of hydrogen peroxide added,
- impact of the iron salt,
- variation of the reducing agent.

Subsequently, by using selected preferential variants, the networking of the FENTON products was investigated by means of ABES (Automated Bonded Evaluation System). Networking options using glutaraldehyde and pMDI (polymeric diphenyl methane diisocyanate) were investigated for that purpose.

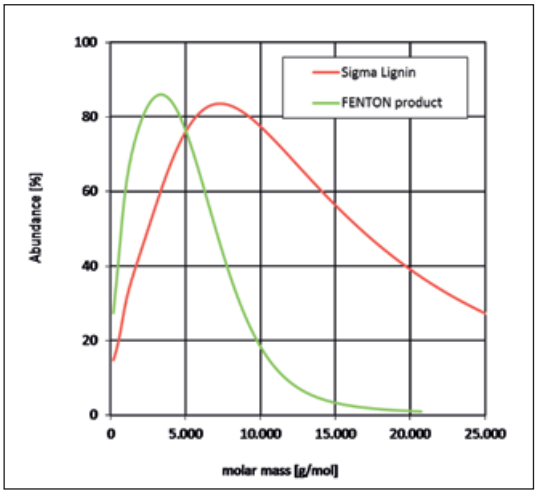


Fig. 1: Molar mass distribution of kraft lignin, of sigma lignin and of the respective product after fractioning by way of the FENTON mechanism in a preliminary test (determination of the GPC).

Findings

Chemical crushing of lignin

Proof of the impact of the performed approaches onto the fractioning process was provided by determining the medium molar mass by means of the GPC. The two initial lignins used in the project were of a medium molar mass of between 5,500 g/mol and 6,200 g/mol. A variation of the amount of hydrogen peroxide yielded lignin of medium molar masses of around 10,000 g/mol. After fragmentation, the fragments aggregated. By varying the iron salt and the reducing agent, no significant crushing could be observed in the process. Adjustments in the performance of the reactions then resulted in slightly lower medium molar masses in the range around 5,500 g/mol.

The determination of the oxygen content in selected products revealed a higher oxygen content in the FENTON macromolecule as compared to the initial lignin.

Investigations on the efficient networking of FENTON degradation products

Networking tests were performed on selected FENTON products. For that purpose, lignins were treated using the dialdehyde glutaraldehyde and the diisocynanate pMDI. The reactivity with a view to its suitability as an adhesive component for wood was investigated and evaluated by way of ABES. A comparison with the referential lignins used did not reveal any substantial increases in reactivity. A comparison with industrially applied UF resins did not allow for deriving substantial adhesive potential either.

Summary

The results of lignin fragmentation can be summarised by the following items:

- a decrease in the medium molar mass could not be achieved;
  → hence, a molar-mass-dependent increase in reactivity was not achieved by crushing;
- adjustments in the reaction conditions were able to push back verifiable aggregation of the lignin molecules to form larger macromolecular agglomerations;
- the oxygen content at the macromolecule and thus the share of functional groups containing oxygen were increased by applying the radical FENTON mechanism;
  → an increase in reactivity can be deduced from that.

Moreover, it could be shown that kraft lignin allows to be networked by both dialdehydes and diisocyanates. The findings of the study generally show that there is a networking potential in lignins.

Investigations into the Manufacture of Cardboard in the Dry Process

Project Leader: Dipl.-Ing. Tino Schulz
In-charge: M. Sc. Christoph Wenderdel
Funding Institution: BMWi/AiF/IGF
Research Bodies: Institut für Holztechnologie Dresden
Papiertechnische Stiftung

Initial Situation and Objective

The manufacture of lignocellulose-based fibreboards in the wet process requires high effort in both drying and the treatment of the resulting sewage. The dry process is an alternative that, for its advantages, is applied today almost exclusively in the manufacture of lignocellulose-based fibreboards.

With respect to the manufacture of cardboard, which is part of the papermaking industry, calculations regarding the consumption of power, water and raw material showed that, compared to cardboard manufacture in the wet process, the dry process is energetically more reasonable and economically more sensible, also with grammages of 800 g/m².

Fig. 1: Folding boxboard of dry cardboard

Modern MDF facilities permit the manufacture of MDF of low thicknesses (thinnest MDF). When appropriately adjusting the properties of these thin MDF, it should also be possible to use them for packaging purposes, substituting cardboard. A prerequisite for that is that these novel thin MDF have cardboard-like properties and can be recycled as waste paper. Therefore, the objective of the investigations was the development of suitable raw material and technology combinations allowing the manufacture of thin MDF of cardboard-like properties (termed "dry cardboard" hereinafter). The dry cardboards should permit further processing into packaging cardboard boxes and recycling via the usual waste paper recycling channels. The grammages under review ranged mainly between 300 g/m² and 800 g/m² (in single cases 100 g/m²), and their thicknesses were in the range between 0.4 mm and 1.0 mm.

Results

The dry cardboard was manufactured by modifications in the processing technology for making MDF. On the one hand, the raw materials (fibrous raw material, including waste paper, bonding agents) were varied or modified, and so were the processes for fibre fleece orientation and the hot-pressing of fleeces, on the other.

Starch, proteins and wheat flour were applied as additivies with a gluing effect. Fleeces of grammages between 300 g/m² and 800 g/m² (in single cases 100 g/m²) at low grammage deviation were manufactured by way of the Airlaid process. Sufficient creasability and foldability, comparable to that of grey board, was achieved by an additional coating with dispersion glue and by the complementary use of graphic paper, so that they allow to be used as folding boxboards. The recyclability of the dry cardboard in waste paper recycling channels could be verified.

The results allow manufacturers of medium-dense fibreboards to expand their product ranges.

With the help of the raw material/technology combination that has been developed, fibreboards

of cardboard-like properties can be manufactured, depending on the respective target market. For manufacturers of cardboard produced in the wet process, who consider necessary investments, the results render the possibility to change over to energy-saving and water-saving, therefore more reasonable technologies for the manufacture of cardboard in the dry process and thus to generate an increase in competitive benefits.

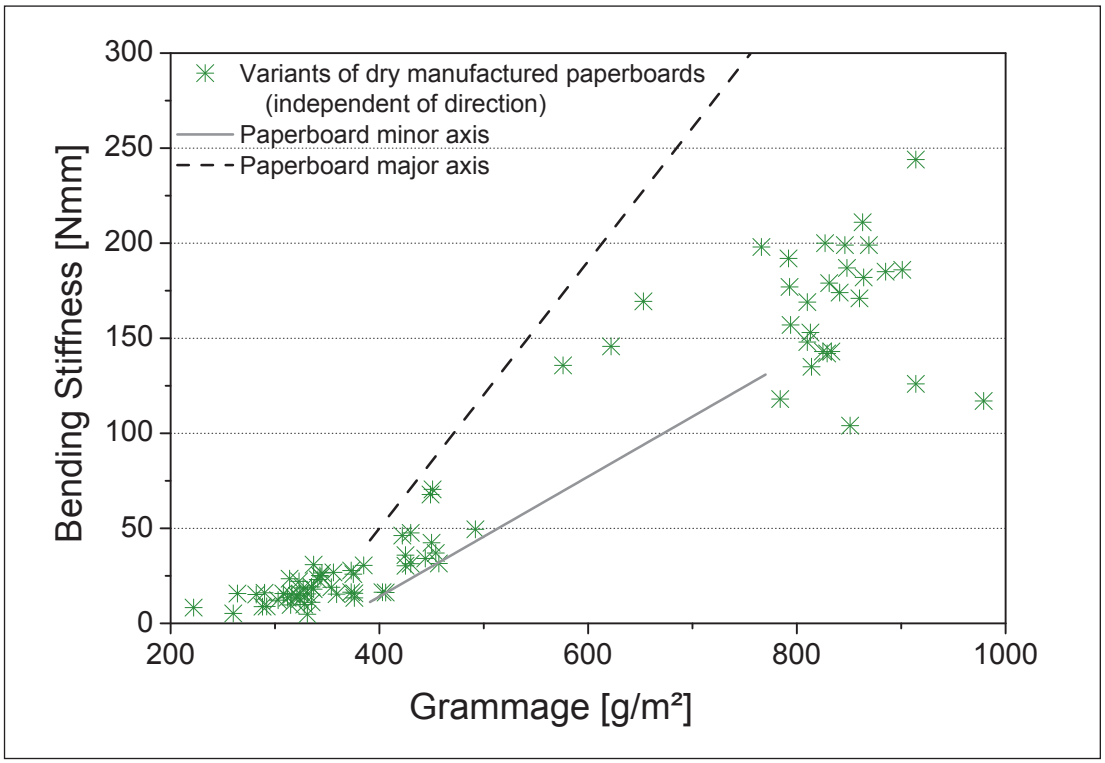


Fig. 2: Bending stiffness of the dry cardboard variants as compared to grey board in the main and side lines depending on grammage (main line: in manufacturing direction; side line: transverse to manufacturing direction)

Investigations on the Impact of the Chip Geometry and of Wood Species on the Properties of Raw-density-reduced Chipboards Manufactured from Them, in the Context of Applying Lightweight Filler Materials

Project Leader: Dipl.-Ing. Tino Schulz
In-charge: Dipl.-Ing. Tino Schulz
Funding Institution: BMWi/Euro-Norm/INNO-KOM

Initial Situation and Objective

For quite some time, the reduction of weight in the furniture industry has increasingly come into the focus of manufacturers, retailers and consumers for economic reasons (transport and assembly cost reduction), for ecological reasons (resource conservation) and for ergonomic reasons (simpler handling, enhanced functionality). Especially the ever growing expenditure for fossil fuels requires comprehensive activities to reduce transport weights. Also the competing situation between the material and energetic uses of wood resources plays a more and more important role.

The furniture industry is an essential field for applying lightweight solutions. Industrial furniture and interior design prefer to use chipboards and MDF. The main structural material are chipboards of raw densities between 600 kg/m³ and 650 kg/m³, which are too heavy for quite a number of applications. Moreover, such weights involve high efforts regarding personnel and finance when processing, handling and assembling the chipboards. In addition, there is the high cost for transporting the boards to the furniture manufacturers and for the transport of finished products to retailers/consumers.

Before that background, the objective of this R&D project consisted in reducing the raw density of chipboards. A predecessor project was able to prove that, by applying lightweight filler materials in the middle layer, the raw density of chipboards can be reduced, whereas the standard requirements of the mechanical properties of 480 kg/m³ can be met. Lightweight filler materials, such as cork granulate and unexpanded polystyrene that expands during panel manufacture only, proved especially beneficial.

The R&D project investigated correlations between the application of lightweight filler materials (cork, unexpanded polystyrene) in the middle layer of chipboards, changes in the chip geometry (chip lengths and thicknesses) and wood species (spruce, pine, birch poplar) of the chips used in the middle layer of the boards.

It was tested to what extent the combination of lightweight filler material and modified chip geometry and wood species results in positive changes in the mechanical and physical properties of the

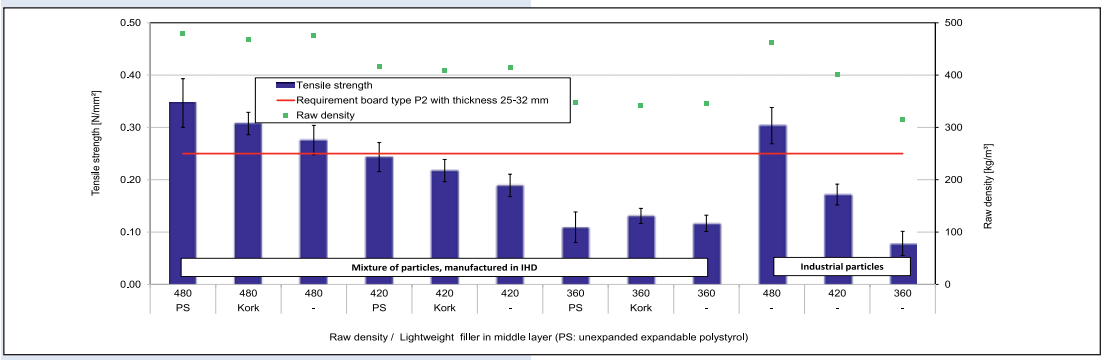


Fig. 1: Transverse tensile strength of chipboards, with varied raw densities and using a chip mix of spruce and lightweight materials in the middle layer, compared to industrial chips

Fig. 2: Coated chipboard samples with chip mixes of chips from cutting and chipping (spruce), density 480 kg/m³, with polystyrene (top), cork (second from top), without filler material (middle) compared to a chipboard of industrial middle-layer chips without filler material of a board density of 480 kg/m³ (second from bottom) and 600 kg/m³ (bottom)

Fig. 3: Chip variants produced (selection)

chipboards manufactured. It was derived from that as to what extent the raw density of the chipboards could be reduced by meeting standard requirements at the same time. It was the objective to make chipboards of reduced raw densities and of property levels sufficiently suitable for their use in furniture.

Approach

Chipboards were made by varying the kind of chip used, the wood species, the lightweight filler materials, the raw density and the press diagram. The chipboard variant made of industrial chips and without filler materials in its middle layer served as a referential variant. Generally, regarding the variation in the chip geometry and wood species, the middle-layer chip material was taken into account only. Industrial chips were used in all variants as surface layer material. Wood chips in the middle layer of the chipboard were substituted by lightweight filler materials at a share of 10 % of the mass. The application of lightweight filler materials served the objective to fill the cavities that emerged by reducing the amount of wood in the wood chip matrix with lightweight, therefore, voluminous materials, thus improving adhesion among the particles themselves. The filler materials used were unexpanded expandable polystyrene and cork particles.

Regarding the variation of the middle-layer wood chips, chips from cutting of varied chip lengths (three settings) and of varied chip thicknesses (two settings) as well from chipping, varying in chip thickness (two settings), were made at the IHD.

Regarding the wood species, spruce and pine were used as coniferous wood, and birch and poplar as deciduous wood. All chip variants were comprehensively characterised.

Results

The investigations showed that the application of lightweight filler materials substituting wood chips in the middle layer of triple-layered chipboards in combination with chips of modified chip geometries led to improvements in the board properties. The results varied depending on the wood species applied and on the respective lengths and thicknesses of the chips. It was proven that the chipboards of raw densities of up to 420 kg/m³ can be reproducibly manufactured, still meeting standard requirements.

Compared to the corresponding variants whose middle layers consisted of industrial chips without any filler material, partly higher transverse tensile and bending strengths were achieved by the raw-density-reduced chipboard variants.

Further investigations on coating, testing the screw extraction resistance, creep behaviour and surface soundness also yielded improvements as compared to the referential variants.

The results obtained represent a possible alternative and a considerable raw-material-saving potential as compared to the manufacture of standard chipboards of raw densities of approx. 600 kg/m³ to 650 kg/m³.

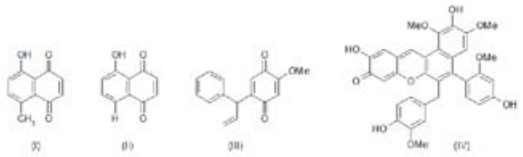
Development of Procedures for the Manufacture of Products from Transparently Coated, Naturally Dark Timbers and Thermally Modified Timber (TMT)

Project Leader: Dr. habil. Mario Beyer
Dr. Lars Passauer
In-charge: Dr. Lars Passauer
Dipl.-Ing. Simone Wenk
Funding Institution: BMWi/AiF/ZIM

Objective and Approach

The objective of the project was to develop procedures to manufacture colourfast structural elements from naturally dark, and thermally modified timbers (TMT) for top-quality interior design as well as for the deck area on yachts. The respective species of wood show a distinct tendency towards light-induced discolouration. This can frequently be seen in bleaching ($\Delta L^* > 0$) and yellowing ($\Delta b^* > 0$) in selected timbers, such as cherry, also in the darkening ($\Delta L^* > 0$) of light-exposed, transparently coated wood surfaces (Fig. 1). Light-protecting additives available in the market (organic and nano-scaled UV absorbers, radical catchers, e.g., HALS compounds) are designed especially for colour stabilisation of light-coloured timbers, thanks to their absorption behaviour, and show little effect in the respective wood species or even result, as compared to untreated dark timbers, in increased bleaching of the wood surface.

Hence, constituent parts of the project were 1) the development of novel, lightfast wood impregnations that allow to be adapted to the requirements of various light-sensitive timbers, and 2) the development of an impregnation technology providing dark timbers and TMT with permanent light protection. The development of impregnating coating systems should especially serve the depth effect of novel light-protecting additives. Thereby, the works performed within the framework of the project picked up on the knowledge obtained in a predecessor project (IGF 15840BR) on the light-induced discolouration of dark timbers and TMT. There it was also shown that light-induced greying or photo bleaching of the surfaces of respective species of wood is caused by light in the visible range ($\lambda < 400$ nm) and that, therefore, the resulting changes in colour are caused considerably by extractive matter contained in the wood. The chromophore structures of methyl-juglone (I), juglone (II), 4-hydroxyalberdigion (III) and santalin A (IV), as described in the literature and which were identified in the wood extracts from macassar, walnut, rio rosewood and padouk, can be named as examples for that.



It was the aim to stabilise or immobilise such light-sensitive wood ingredients by applying the impregnations that were to be developed. In order to guarantee an acceptance of the stabilising formulations, it was necessary to consider that the initial colour and texture of the treated wood surfaces were largely maintained. The effectiveness of the stabilisers was determined by Xenon-arc radiation and natural light exposure of impregnated and coated timbers behind window glazing.

Results

The focus of the investigations was on the development of aqueous, polymer-based low-viscous formulations of impregnating character, which were to serve as carriers for a new group of agents of stabilising effect to wood ingredients responsible for light-sensitive and wood-intrinsic discolouration of the timber. As a result of extensive testing, formulations of several light-protecting agents could be elaborated, involving various bonding-

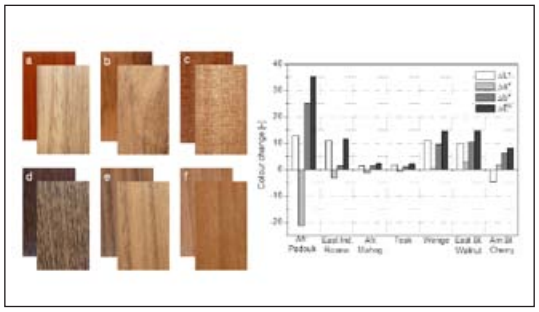


Fig. 1: Left: Transparently coated, non-stabilised timbers (a African padouk, b East-Indian rosewood, c African mahogany, d wengè, e American walnut, f American mountain black cherry) before (back) and after 42-day outdoor light exposure behind window glass (front) acc. to ISO 877-2:2009; right: corresponding CIELab colour value changes

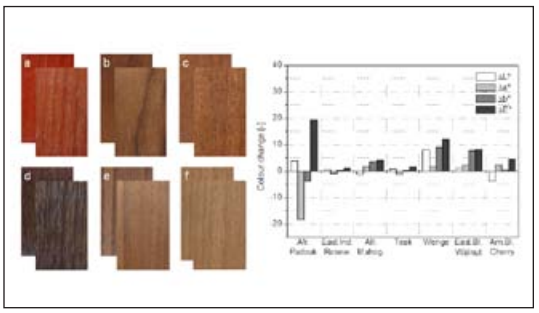


Fig. 2: Left: Transparently coated, stabilised timbers (a African padouk, b East-Indian rosewood, c African mahogany, d wengè, e American walnut, f American mountain black cherry) before (back) and after 42-day outdoor light exposure behind window glass (front) acc. to ISO 877-2:2009; right: corresponding CIELab colour value changes

agent systems and a multitude of potentially stabilising agents, which can preferably be formulated in aqueous alkyd and polyester-resin-based impregnation primers. They can be applied by brushing, rolling and spraying. Light stability clearly improved in the wood species under review by applying stabilising impregnations (Fig. 2).

The effect of novel light-protecting systems is specific to wood species, which requires to adjust the light protection impregnation to the wood species or groups of wood species to be protected (Tab. 1).

An especially stabilising effect of the light protection impregnations onto all CIELab colour components could be identified in wood species, such as East-Indian rosewood and teak (Fig. 2, right).

Thereby, photobleaching (ΔL^*) and yellowing (Δb^*), in particular, could be clearly reduced, as contrasted to unprotected surfaces (Fig. 1). Also, thorough effectiveness was achieved in especially light-sensitive timbers, such as padouk, wengè and walnut, whereas photo stabilisation of the flavonoid santalin A responsible for the red colouring of padouk (Fig. 2) remains an issue ($\Delta a^* = -18.5$). It was noticed that selected formulations are suitable for the colour stabilisation of domestic timbers, especially beech and, to a limited extent, also oak.

With respect to the processing properties of light protection impregnations, there is still demand for further optimisation. Especially further adaptation of the bonding agent components of the light protection impregnations is required in order to guarantee their processing viscosity to be sufficiently low, which should allow to be efficiently applied, e.g., by spraying or as depth impregnation of treated wood surfaces.

Tab. 1: Grouping of wood species and effective light protection impregnations

Light protection solution	Wood species
LS-1	TMT (spruce, beech, ash), wengè, East-Indian rosewood
LS-2	American walnut, oak, African padouk
LS-3	mahogany, African padouk
LS-4	beech, American mountain black cherry

Additives on a Montan Wax Basis for Hydrophobing Wood-based Materials

Project Leader: Dr. Detlef Krug
In-charge: Dr. Detlef Krug
Dipl.-Ing. (FH) Jürgen Bonigut
Funding Institution: BMWi / AiF / IGF

Initial Situation and Objective

In the production of wood-based materials, a number of special additives are mixed in. Apart from binding agents, hydrophobing agents are the most frequently administered additives. The aim of their application is to reduce swelling and the related decrease in the characteristics of the use of wood-based materials when they come in touch with water.

The goal of these investigations was to apply montan-wax-based hydrophobing agents in the manufacture of wood-based materials. Approaches to tackling this task were seen in purposefully combining systematically modified montan waxes, if necessary, also in combination with paraffinic components exploiting the synergetic effects of both active substance systems.

Material and Methods

By using montan-wax-based additives, fibreboards were produced at the laboratory of the *Materials* Department of IHD on a laboratory scale. The fibreboards were manufactured in several successive work programs (WP). The following presents and discusses the results of this property testing of fibre-based materials made in two WP on a laboratory scale. The principal parameters as well as the differences regarding board manufacture in the above-mentioned series are shown in Tab. 1.

The main differences between the two series presented consisted in having initially been treated with a bonding agent share of 12 %[1], which was reduced to 8 % in the second, and that in the first series three different additive dosages were applied (0.20 %, 0.35 % and 0.50 %), of which one (0.20 %) continued to be used.

Pine (*Pinus sylvestris*) was adopted as regards wood species. The targeted raw density was 850 kg/m^3, thickness 9.0 mm and the hot plate temperature 220 °C during hot pressing being. The bonding agent applied was a urea-formaldehyde (UF) resin commonly used in the industry.

The active basis of all above-mentioned additives was montan wax, which is a sophisticated mix of a multitude of substances.

Unlike most synthetic waxes (e.g., PE wax, FT paraffin), chemical modification of montan wax is possible owing to the availability of reactive functional groupings (e.g., carboxyl groups) after refining. Such modification can be performed with the help of a multitude of reactive partners to define special properties for application.

[1] *Dosages indicated hereinafter always relate to solid matter in relation to bone-dry fibres.*

Tab. 1: Parameters of fibreboards made on a laboratory scale

Series	A	B
Montan wax variants	1, 2, 7, 9, 13	22 ... 25
UF share (%)	12	8
Share of additive (%)	0.20; 0.35; 0.50	0.20

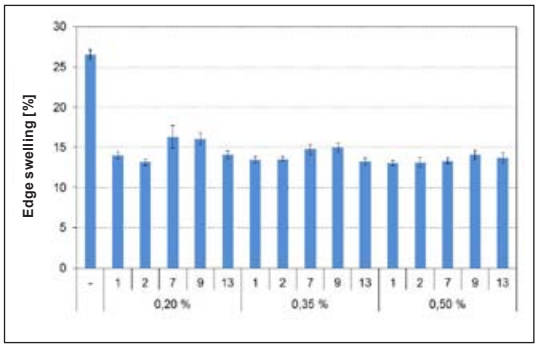


Fig. 1: Edge swelling after 24 h of water storage of UF-bonded laboratory-scale fibreboards depending on the additive applied (A Series; n = 12)

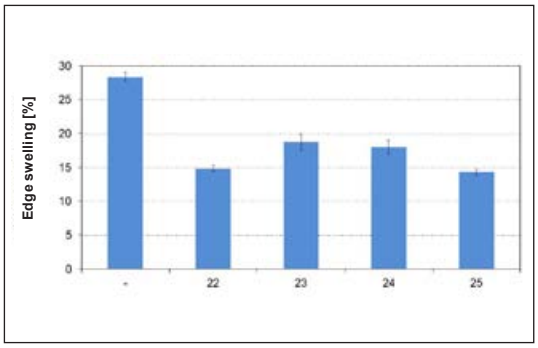


Fig. 2: Edge swelling after 24 h of water storage of UF-bonded laboratory-scale fibreboards depending on the additive applied (B Series; n = 12)

After the fibreboards were manufactured on a laboratory scale, appropriately conditioned and air-conditioned, certain properties, including raw density (EN 323), transverse tensile strength (dry; EN 319), thickness swelling after 24 and 48 h of water storage (EN 317) as well as edge swelling after 24 h of water storage (of samples coated with decorative paper; EN 13329) were tested.

Results and Discussion

A significant impact of the use of hydrophobing additives based on montan wax was especially clearly seen in edge swelling. However, regarding the additivies applied in the A series, the differences between the three dosages of 0.20, 0.35 and 0.50 % were only little (Fig. 1), which allows to conclude that the adhesive share of 12 % has an overlay effect on hydrophobing.

A reduction in the amounts of adhesives and additives made the differences between the additives applied better visible (Fig. 2) and permitted to make conclusions regarding further optimisation. It was positively noticed that all additive variants showed clearly lower edge swelling than the non-hydrophobed zero-variant.

Summary

The results shown regarding edge swelling after 24 h of water storage and the results of the transverse tensile strength (dry), of thickness swelling after 24 or 48 h of water storage unambiguously show that (Fig. 1) the montan-wax-based additives applied are fit for use in fibre material manufacture and (Fig. 2) that, even if applying 8 % of bonding agent and at an additive dosage of 0.20 %, the results exceed expected levels of acceptance.

Development of High-quality Semi-finished Products of Special Wood-based Materials for Application in Mechanical Engineering and in Conveyor Technology

Project Leader: Dipl.-Ing. Andreas Weber
In-charge: Dipl.-Ing. Andreas Weber
Funding Institution: BMEL/FNR
Research Bodies: TU Chemnitz, Fakultät Maschinenbau,
Institut Fördertechnik and Kunststoffe,
Professur Fördertechnik
Institut für Holztechnologie Dresden

Initial Situation and Objective

The wide use of ecologically beneficial and sustainable wood-based materials in mechanical and plant engineering, especially as regards conveyor technology, is hampered basically by the "emotional attitude" towards wood being considered as weak and of limited performance.

Mechanical and plant engineering, interfacing with conveyor technology, require semi-finished products of wood-based materials in which adjustable and high mechanical properties are controllable to the largest extent or are permanently available at high quality. The sizes of semi-finished products applied in structural parts (profiles, covers, etc.) tend to be smaller than in the building or furniture sectors. Thus, faults are more precarious and may, under certain circumstances, result in the functional failure of the structural part. Moreover, the fire protection issue and that of resistance towards certain media must not be neglected. Also, it would be of great benefit to maintain the "well-known" or actual advantages of wood-based materials, such as:

- advantage in price as compared to metal-based materials,
- lower demand for primary energy in their manufacture,
- its eco bonus, as it is a near-nature material (with high shares of renewable materials),

to the largest possible extent.

It was the target of research to develop a semi-finished product of suitable wood-based materials in panel design, whereas the addressed disadvantages would be minimised, so that that highly qualitative semi-finished structural parts for use in sustainable solutions could be provided to mechanical and plant engineering and, therefore, also to the conveyor technology. Their development was also expected to include a characterisation of properties regarding various types and periods of load. With that semi-finished product in hand, the later user would have a material basis of secured and high-quality properties that vary only slightly and "behave" in a well-known way. This was expected to contribute to an increased acceptance of wood-based materials by the mechanical and plant engineering sector. After first referential applications in mechanical and plant engineering have become available, the wood-based material industry has, out of this niche, been given access to a new and steady market.

It was the superior objective to purposefully modify properties for application in mechanical engineering by beneficially arranging layers in the panel-like semi-finished product.

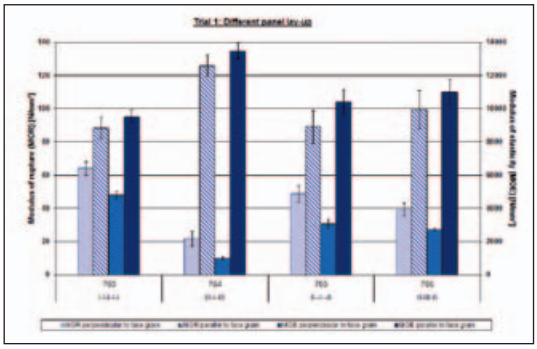


Fig. 1: Bending strength and bending modulus of elasticity of the plywood variants in the main and side lines, depending on panel structure

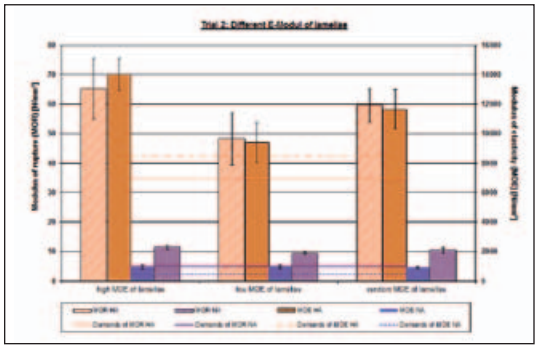


Fig. 2: Bending modulus of elasticity of solid wood panels in the main and side lines, with strength-assorted lamellas applied

Results

So far, two development or optimisation criteria have been defined for analyzing existing materials and developing a special material for application in mechanical engineering.

$$\frac{\sum \text{mechanical parameters (strengths or moduli)}}{(\text{density} \times \text{price (per } m^2))}, \text{ unit } \frac{N \times cm^3 \times m^2}{mm^2 \times g \times €}$$

This criterion is expected to lead to materials allowing for reasonable lightweight design. The criterion can be applied to both the sum of several mechanical parameters (E moduli, strengths) and to one selected parameter (e.g.), the bending modulus of elasticity, bending strength. The following applies: the higher the calculated parameter, the more suitable is the material. The target is to reach the parameters of usual metal-based materials used in mechanical engineering (e.g., AlMgSi0.5, S235JR) or to exceed them in their optimum.

The application was implemented preferably by using special plywood superstructures (Fig. 1), solid wood panels (also using strength-assorted lamellas, Fig. 2) and several OSB variants. It has become obvious that an application-specific setup is able to increase the strengths in one direction. However, the variation coefficients of the wood-based materials were generally too high. Homogenisation must be improved further by using customised designs.

Manufacture of Moisture-resistant and Mould-resistant Insulating Fibreboards from Modified Fibres

Project Leader: Dipl.-Ing. Andreas Weber
In-charge: M. Sc. Martin Direske
Funding Institution: BMWi/AiF/IGF
Research Bodies: Georg-August-Universität Göttingen
Institut für Holztechnologie Dresden

Initial Situation and Objective

Wood-fibre-based insulating materials count among the insulating materials that are ecological and especially healthy in the human habitat. As with all fibre-based insulating materials, the structural-physical framework conditions for their insulating effect and fungus resistance are of decisive importance to insulating materials based on wood fibres, too. If high moisture occurs, condensate may form in or on the surface of the insulating materials and, therefore, lead to infestation by mould.

This results in the failure of the insulation and the formation of cold bridges which, in their turn, may aggravate condensation. Consequentially, the insulating materials will lose their form stability and insulating effect, as the pores essential for insulating fill with water or get lost in that the material partially collapses (clodding). Moreover, mould infestation is highly hazardous to health.

The objective of the project was to chemically modify wood-fibre-based materials already during their stage of manufacturing and to enhance the practice-relevant properties of the wood-fibre-based insulating panels made from them. Thereby, the chemical modification potential was to be evaluated, which had proven successful with solid wood and veneers, especially with a view to reducing moisture absorption and preventing fungal infestation. The project was to find out to what extent fungal infestation and the failure of the insulating material exposed to high levels of moisture could be prevented by modification.

Results

For one thing, chemical modification was successfully performed in the batch procedure (fibres and woodchips) and, for the other, during defibration in the refining process. The raw materials (spruce, pine), the process parameters of defibration (pressure, the spacing between grinding disks) and also the modifying chemicals (siloxanes, 1,3-dimethylol-4,5-dihydroxyethylene urea (DMDHEU), low-molecular phenol-formaldehyde condensates (PF), ethanoic anhydrid (EAH)) were subjected to variation for the investigations.

The wood-fibre insulating boards of a targeted raw density of 200 kg/m³ were manufactured by means of high-frequency pre-heating (80 °C) and subsequent hot pressing (130 °C). A polymeric diphenyl methane diisocyanate (pMDI) was used for gluing the fibres.

A reduction of moisture absorption, maintaining the insulating performance at the same time, could be achieved by chemically modifying the woodchips by EAH. It showed that the conditions during the thermomechanic fibre pulping hardly result in a decrease in the fixation of chemicals in the cell wall. Furthermore, the addition of low-molecular PF during the refining process, via both the force worm feeder and the blow-line, revealed large potential. Here also fibre hydrophobing occurred, with the consequence of lower insulation material moisture. In addition to that, an improvement in the stability of the wood-fibre insulating boards could be noticed. After successful impregnation by PF and EAH also the resistance towards wood-destructive basidomycetes, not towards mould, however, could be increased.

The results enable manufacturers of insulating wood-fibre materials to targetedly improve the properties of their products by manageable investments. With the help of the new products, growth can be generated by competitive advantages. As a result of the investigations, manufacturers are shown several ways of integrating chemical modification into the manufacturing process of wood-fibre-based insulating materials. By having rendered proof of implementing chemical modification in the manufacturing process of wood-fibre materials on a laboratory scale, transfer potential into the existing manufacturing technology opens up to manufacturers of other wood-fibre-based materials (MDF, HDF, fibrous mould parts).

Fig. 1: Insulating wood-fibre board of chemically modified fibres

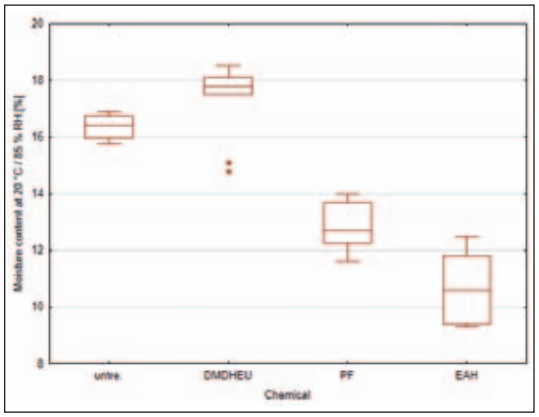


Fig. 2: Equilibration moisture of wood-fibre-based insulating materials of chemically modified fibrous material in damp climate (20/85) in contrast to the untreated reference

Modification of Beech by Drying Oils and Microwaves for Outdoor Use in Gardening and Landscaping

Project Leader: Dr. Christiane Swaboda
In-charge: Dr. Christiane Swaboda
Funding Institution: BMWi/AiF/ZIM
Cooperation Partner: Hobum Oleochemicals GmbH, Hamburg

Initial Situation and Objective

The alternative wood preservation concept of "hydrophobing" has more and more intensively been worked on in recent years. The hydrophobing agents previously investigated also include vegetable oils (linseed, poppyseed, tung oil) with a tendency towards oxidative polymerisation (drying). However, they only partially cure after full impregnation. As a consequence, there are oily or sticky spots on the wood surfaces, which can be grown over by bacteria and algae, which, in their turn, will cause black discolouration.

The project aimed at picking up on the concept of hydrophobing and removing the existing and principal shortcomings.

Hence, it was the objective to develop a new procedure of hydrophobing wood with the help of radically polymerisable natural oils or oil derivates, which the previously existing drawbacks of incomplete polymerisation was unable to render. Hydrophobing as a biocide-free alternative to treatment with chemical protective agents was thus expected to be decisively improved and made fit for the market.

These hydrophobing agents were to be introduced into the cell walls by means of a pressure procedure (empty-cell impregnation) and cured there. However, full-cell impregnation by filling the lumina was not intended.

Then, the curing process was to be initiated by microwave treatment down into the inner layers of the wood, which allowed to expect an enhanced property profile, as compared to simple oil impregnations, also with a view to biological resistence, physical-mechanical parameters and reduced tendency towards swelling and shrinking. Well impregnable beech was intended to be made fit for permanent outdoor use by way of the aspired biocide-free hydrophobing procedure.

Results

As a result of the project, a commercially producible, well impregnable recipe on the basis of a polymerised fatty acid ester was developed from a multitude of possible oils, which was tested at temperatures of 70 °C in a vacuum pressure procedure for fully impregnating wood of cross-sections of up to 100 mm and lengths of 500 mm. The empty-cell impregnation procedure developed for that purpose, in which excess oil was removed again from the cell walls by applying microwaves and vacuum, permitted, depending on the duration and intensity of the microwave treatment, to determine degrees of loading of between 150 kg/m^3 and 400 kg/m^3. The oil removed thereby could be re-used up to three times. Storage time of the oil is at least six months.

The isolene oil applied is able to cure inside wood also without any siccative. However, this process may take several weeks when the samples are air-dried (Fig. 1).

For that reason, a procedure was tested on a laboratory scale for curing by means of oxygen, by which full curing of the oil could be achieved within 24 hours, also inside the samples. The completeness of curing was proven by FTIR-spectroscopic investigations, extraction by organic solvents and physical pressing tests.

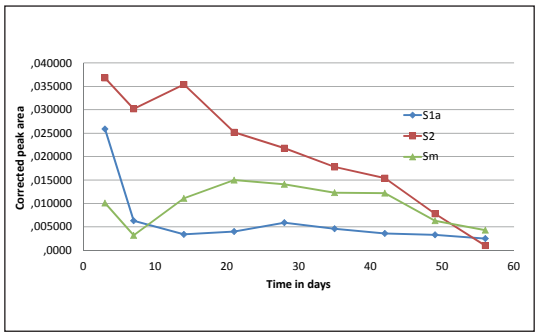


Fig. 1: Temporal course of the bands at 3010 cm^{-1} (cis DB) in beech-wood bricks after impregnation with a siccative impregnation oil (MH) (A = outer surface, S1a = 1 mm, S2 = 5 mm, Sm = centre of the sample)

The addition of siccatives, such as cobalt or manganese, even led – on average – to boosting the polymerisation process and, therefore, to enhancing the product properties, especially showing in a clearly increased resistance towards wood-destroying fungi. The oil treatment resulted in delayed water absorption by the samples as compared to wood in its natural state. The effects occurred to be of varying intensity, depending on the hydrophobing agent and the degree of siccativation (Fig. 2).

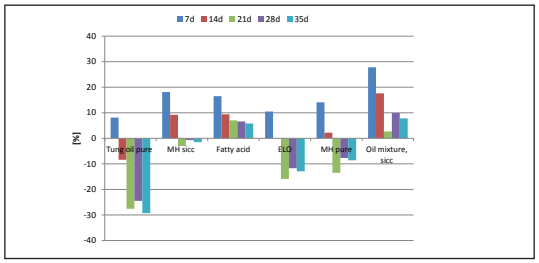


Fig. 2: Moisture exclusion capacity of several impregnators compared to beechwood in % after five weeks of storage at 20 °C / 65 % relative humidity

After a longer period of exposure to a moist climate or after several days of soaking in water, the amount of water absorbed, related to the share of wood, by the oil-treated samples of all variants was yet as high as by the natural wood samples. The expectation that, by oil treatment and subsequent curing, the swelling of the samples would be reduced was not fulfilled either. The differential swelling values of the oil-treated samples were, regardless of the degree of loading, on average above those of natural beech.

The oil treatment had its largest impact on the biological resistance of the samples. So, for example, after leaching and testing under the influence of the wood-destroying basidiomycetes Coniophora puteana and Trametes versicolour acc.to EN 113, a significant reduction in mass loss, as contrasted to natural beech, could be achieved. In this respect, the siccative variant proved to be especially effective.

However, the mass losses obtained, showed a wide spread. The maximum limit of 3 % to 5 % in mass loss was achieved in single cases to allow being graded as Hazard Class (HC) 3. Resistance testing against soft rot fungi yielded a comparable result. There, mass loss could be reduced by oil treatment from 21 m% to minimum 6 m% (Fig. 3).

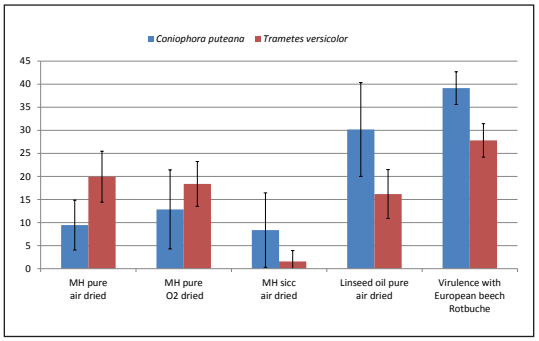


Fig. 3: Mass loss after the strain of leaching (acc. to EN 84) of several oil variants in beech samples (EN 113) as compared to native beech variants

Mass loss of 6 m% ranges close to the limit that is required to be accepted to be HC 3 and 4, and it should be worthwhile continuing the work by further modifications of the recipe in order to still meet the goal.

A clearly fungicidal effect of the hydrophobing agent with and without siccativation occurred, as contrasted to soft rot fungi, with a medium mass loss (due to fungal and bacterial attacks) of 6.1 m% in comparison to 22.3 m% in untreated test samples. Also, moisture was reduced in wood in ground contact from about 68 % in untreated samples to 35 % and to about 38 % in samples treated with a hydrophobing agent.

Conclusion

Significant property enhancement of beechwood was attained in the project by applying oxidatively curing oils in empty-cell impregnation, especially with a view to surface properties and resistance towards soft rot.

However, in order to still accomplish the intended goal of the project, i.e., application of the so treated beechwood in areas of Hazard Class 3 or 4, requires further development effort focusing on an improvement of the hydrophobing effect and better attachment of the hydrophobing agent to the cell walls.

Theoretical Elaboration of Design Requirements, Especially of the Choice of Materials, Analysis and Development of Suitable Hinge Systems for a Foldable Piece of Furniture

Project Leader:	Dipl.-Ing. Jean-Pierre Mouton
	Dipl.-Ing. (FH) Tony Gauser
In-charge:	Dipl.-Ing. Jean-Pierre Mouton
	Dipl.-Ing. (FH) Tony Gauser
Funding Institution:	BMWi/AiF/ZIM
Cooperation Partner:	Corpus Linea, Steffen Tremel e.K.

Initial Situation

A high degree of mobility and flexibility is reached if furniture can be folded. The folding mechanisms have previously been facilitated by fittings of metal or plastics. The few hinging solutions involving a textile component in use so far are based on the principle of gluing plate-like wood material onto a layer of fabric. This principle is unfavourable from a static point of view and results in furniture being heavy-weight, as much material must be arranged at a neutral level where it hardly contributes to the required stability. Also, the transfer of forces in the hinges can, due to being double-mitred, be effected via half of the plate's cross-section only. Therefore, it was the principal idea of the project to attach the fabric layers to the outside of the wood-based materials. Thereby, the forces can, for there is only one mitre then, be transferred via the entire cross-section, which allows applying thicker, yet lighter sandwich plates. The idea of mobility of foldable furniture is supported by lower weight. The outside layer of fabric is not only able to transfer forces, but can, at the same time, serve as a decorative layer by using printed-on textiles.

Material and Methods

The main task consisted in finding a suitable combination of fabrics, lightweight plate material and appropriate jointing or adhesives. For their nature of use and frequency of folding, tables and chairs are especially suited for the folding design.

Substrate panels: The project investigated several sandwich and solid-core materials as well as design solutions for force transfer, such as frame design, bar design and concealed edge bands. By way of the FEM, stiffnesses of the variants were calculated, evaluated and compared in view of the mass of the panel materials. A frame design appeared to show the most favourable ratio of bending stiffness versus mass. As manufacture is very elaborate though, a novel panel design was developed in the project (Fig. 1). It consists of two 8-mm-thick plywood panels glued to each other, provided with pocket millings of a reversely mirrored shape. This allows to partially remove material to address design requirements and necessary points of load introduction. Still, a significant reduction in weight, as compared to solid-wood material is achieved.

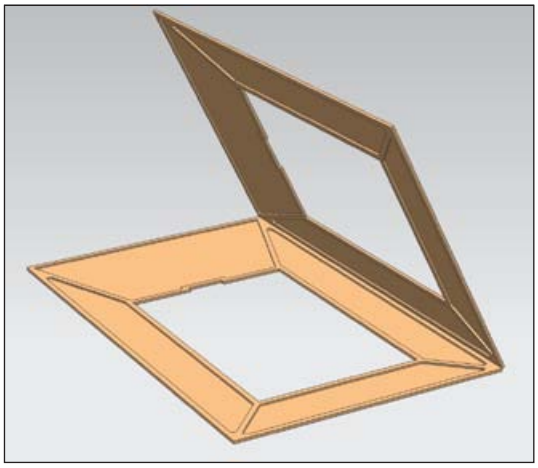


Fig. 1: Pocket sandwich

Fabrics: Several fabrics (cloth and fleece materials) and some kraft papers were investigated. A specification of the materials for textile joints by merely adopting the usual parameters, such as maximum tensile force and maximum tensile force elongation, is impossible, as they represent one part of the load only. With the help of an especially developed clamping jig with a double-sided mitre, fabrics can, initially without any influence by any gluing, but under actual load situations as prevailing in the hinge, be characterised.

The elongation-rupture test establishes the elongation behaviour in the form of a force-elongation graph. A large number of fabrics could be investigated after which the appropriate variants were subjected to a second test. The tumble test (Fig. 2) is expected to show durability during the use of the hinge. For that reason, the clamping device is fixed to the rotating drive. Thereby, the rotating axis is in line with the joint axle. The rotating drive performs a turn of ±135°. The second part of the clamping device tumbles, for reasons of gravity, around its vertical position. This does not only test the alternative bending of the fabric, but also slight elongation and a dynamic load, as they may appear during setup or removal and in the course of use.

In the tests, double calendered spunbonds revealed the best properties and are thus best suited as hinges. Also, they can very well be printed on.

Adhesives: For gluing the fabric to the substrate plate, an initial preselection was made. After an evaluation regarding the time when open, gluing compatibility, processing effort, properties of gluing and costs per m², the adhesives PVAc, phenolic resin (used as a film) and PUR were looked at in a peel test. An appropriate connection could be made by applying PVAc, as, apart from its adhesive effect, mechanical jointing is achieved, thanks to the fabric being soaked by the adhesive.

Tests of assemblies at the Furniture Test Lab

The various hinge types were initially and individually tested on special jigs in the test laboratory. In order to guarantee the durability of the fabric hinge, there was also a test on a sample hinge, consisting of a vertical substrate plate and a flap, which was equivalent to its use as a seating surface. The test was aborted after 1,000,000 cycles.

Conclusion

Based on the manufacture of the sample and experimental testing of the fabric hinges and foldable furniture assemblies, design requirements and technological manufacturing stages were derived for the manufacture of foldable furniture. As a result, a seating group including a table (Fig. 3) could be made that combined the technological developments of the project and demonstrated the benefits of the fabric hinge in conjunction with the pocket sandwich.

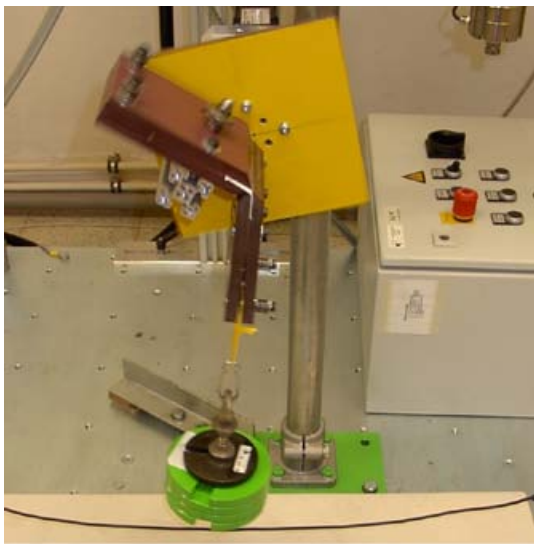


Fig. 2: Tumble test with an additional weight

Fig. 3: Foldable stool during stability testing

Lightweight Furniture Design Enabled by Folding Technology; Development and Proof of Suitability of New Solutions for Lightweight Design

Project Leader: Dipl.-Ing. Matthias Weinert
In-charge: Dipl.-Ing. Matthias Weinert
Dipl.-Ing. Linda Geißler
Funding Institution: BMWi/AiF/ZIM
Cooperation Partner: Karl W. Niemann GmbH + Co. KG

Initial Situation

The cooperation partner Karl W. Niemann GmbH + Co . KG has established in this industry as a manufacturer of furniture parts (preferrably front faces). It has at its disposal the technology and knowhow to process a high-strength, biaxially oriented, coextruded foil of polyethylene terephthalate (PET) of excellent mechanical and optical properties with high-gloss or matt surfaces. From the mechanical properties of the foil, they derived the desire to explore and open up the performance potential of this type of foil coating for use in folding technology.

Objective

The approach of the project is based on further developing the long-known folding principle. This principle is also called the mitred-corner or folding approach. Thereby, grooves are milled into one side of the plane surfaces, and the plates are folded or wound along these milled lines to become three-dimensional elements. As part of the project, the following further developments of the procedure were to be investigated, thus developing new innovative products and solutions and materialise them:

- application of high-strength and flexible coating materials (hinge) for implementing infinitely foldable corner solutions for collapsible solutions, such as fair stands;
- development of new solutions required thereby, for mechanically fixing the folds;
- development of an industrially applicable technology for highly precise milling on both sides in order to be able to allow "folding back", which was previously not implemented, thereby generating complex spatial structures;
- development of solutions to protect the milled grooves during use and transport.

Approach and Results

The mechanical performance capability of the coating was determined by establishing parameters, such as stretch, the gluing strength of the foil by means of tensile and pressure tests and a pressure test of the corner solution (Fig. 1). 8-mm-thick chip, fibre and compact boards were used. Furthermore, "hingeability" was investigated in a permanent folding test (Fig. 2). As a result of the investigations, it was established that the foil showed sufficient strength regarding both mechanical properties and gluing. With a view to the hinge properties, the test was aborted after 50,000 folding cycles, as no significant changes

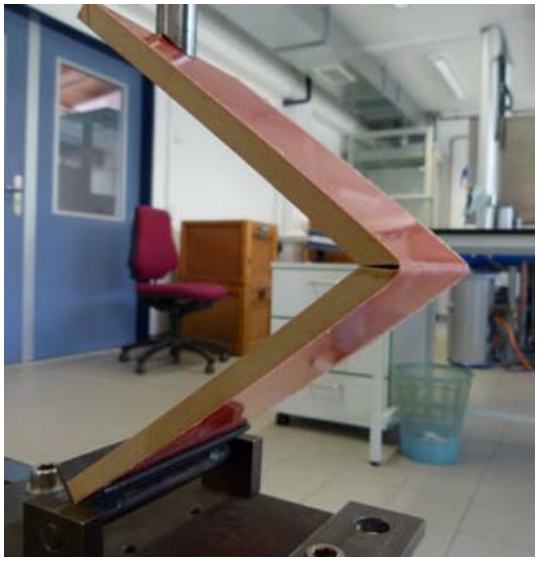


Fig. 1: Pressure test on a corner element

Fig. 2: Folding durability test

could be observed. At a relative humidity of > 65 %, significant signs of swelling were identified in the unprotected grooves, which required to seal them off. Kleiberit 555.6 could be proven to sufficiently protect the unprotected V-grooves in the chip and fibreboards. Kleiberit 555.6 is a single-component reactive sealant that, by reacting with moisture, changes from its liquid (its viscosity is almost that of water) to a solid state.

Cavities and the wood-based material structures are filled and solidified in that way. An impairment of the corner geometry of the V-joint due to swelling, when Kleiberit 555.6 was used, could not be observed. The treatment resulted in a slight discolouration (darkening) of the joint surface. Also the suitability of adhesive foil (tesafix 4965) could be proven for protecting open grooves during transport.

A calculation tool was developed to support potential users in planning foldable bottoms. Calculation rules were set up for a web-based tool with the help of analytical and numerical methods (FEM), with which potential users can compare several folding variants on the web pages of the project partners (Fig. 3). What is shown here is the respective sagging of a certain folding variant, considering the selected material and geometry conditions. Such sagging is contrasted to the thickness and mass of a flat and plane (not folded) bottom. This shows the user immediately the saving potential of his variant (material savings) at the same performance (bending). A small corpus system consisting of a folded corpus frame with a rear, grooved wall and, optionally, with a flap or door (turnable) as a closing solution that can be used depending on the position of the corpus (turned) was produced as a master series. There, the coating foil acted as a hinge. This system was presented at the BMWi Innovation Day in Berlin on 22 May 2014.

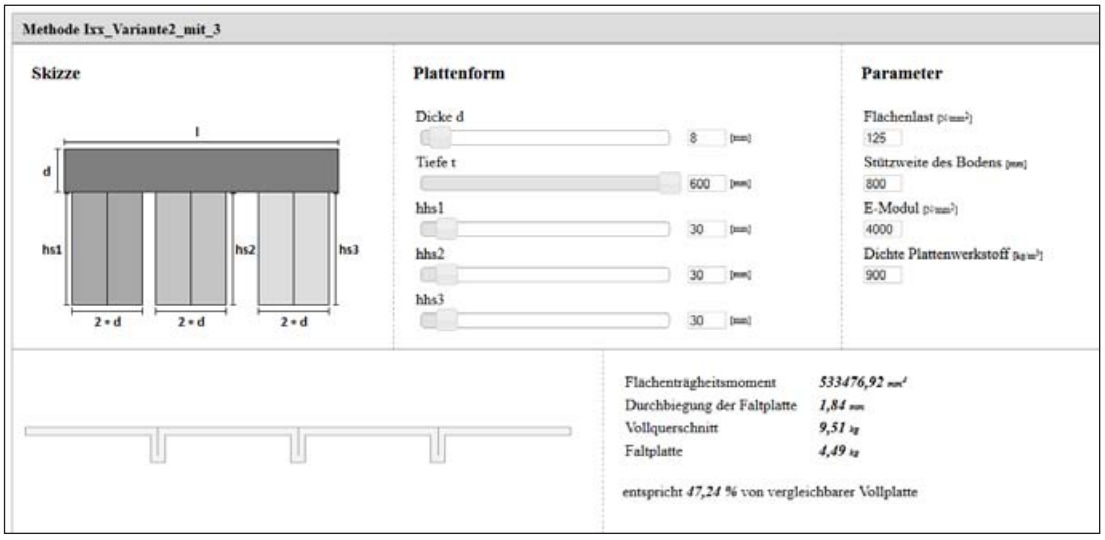


Fig. 3: Web tool for the design of foldable shelves

Box Windows – Fit to Meet the Combined Requirements of Both Heat Insulation and Increased Noise Insulation for Application in New and Existing Buildings/Monuments

Project Leader: Dipl.-Ing. Kerstin Schweitzer
In-charge: Dipl.-Ing. Kerstin Schweitzer
Dipl.-Phys. Jens Wiedemann
Funding Institution: BMWi/AiF/ZIM
Cooperation Partner: HFBB Holzfensterbau Bernau GmbH

Initial Situation and Objective

The quest for windows performing well in both heat and noise protection undoubtedly leads to double-shell design principles. It is well-known that box windows distinguish themselves in particular when looking at such performance properties. However, separated optimisation of both properties has dominated so far, due to partly contrary rules of design. Investigations into new and modern box windows for use in newly constructed and existing or even listed buildings were aimed at, combining both highly heat-protecting properties and above-average noise insulation in one structural element.

Issue

For the parallel optimisation of heat and noise-related properties of box windows, generally applicable measures of improving both properties are suitable on the one hand. These include, e.g., air-tightness and structural connections oriented towards low sound insulation measurements of joints, sealing systems of several levels and reduction of all construction-related window joints. On the other, the two structural-physical properties do follow different rules of design, which, if applied jointly, will lead to discrepancies as regards the desired total result. For example, the specific effect of functional insulation glazing and large surface areas must be mentioned here. Especially with a view to box windows, a further parameter must be taken into account, which is the relatively wide layer of air enclosed between the inside room and outside glazing levels, which does not exist in that form in single-glazed or composite designs. While it is well-known, that noise insulation improves along with an increase in box depth, practice assumes a requirement of optimal spacing with a view to heat insulation. As this knowledge is based mainly on the experience from historical designs in single glazing, the investigations needed to clarify to what extent the transfer of that knowledge to modern box windows with top-performance glazing is admissible and what noise-relevant and reasonable box depths would be feasible, without having to accept a deterioration in heat-insulating properties.

Investigations

The project differentiated between new box windows for the application scenarios "Existing" (classical French casement design) and "Newly Built" (windows undivided and one sash opening out to the outside for better light yield). As decisive factors of impact onto heat and noise protection, the constructional depth of the inner box space and the glazing combinations were varied. Depending on the purpose of application and considering criteria supporting noise insulation (e.g., thicknesses of glass, asymmetry) and apart from traditional single glazing, vacuum insulation glazing was applied in various combinations, such as laminated safety glass, 2-fold IV, 3-fold IV (conventional glass structure and so-called thin glass). The spacing between the glazing levels was between 65 mm and 235 mm. The properties relevant to heat protection (Rs, U_{g_kombi}, UW) and the convention adjusting itself within the constructional depth of the inner box space were analysed by means of numerical calculations (DIN EN 10077-2), by taking measurements acc. to the regulated heating box procedure (DIN EN ISO 12567-1) and CFD simulations.

For assessing the noise-insulating properties, the airborne sound insulation of selected box windows was established in tests (DIN EN ISO 10140-2, DIN EN ISO 717-1).

Results

Improved glazing regarding heat insulation results in lower temperature differences in the constructional depth of the box window space and, therefore, to a reduction in the driving force for convection flows, as compared to traditional glazing combinations (single glazing). Besides, by increasing the spacing in a glazing combination, the tendency towards turbulent flows decreases in the middle area of the box. This enables combined optimisation of heat and noise insulation at a high level (e.g., targeted improvement of noise insulation by increasing the spacing between glazing levels).

The box windows developed (Fig. 1) achieve the highest noise insulation class VI. Regarding heat insulation, they even undercut the requirements of the EnEV 2014 with heat transition coefficients between 1.0 W/m²K and 0.64 W/m²K. The heat transfer coefficients of glazing combinations (U_{g_kombi}) range between 0.82 W/m²K and 0.37 W/m²K. The possibility must be highlighted to make windows of top noise-insulating properties by using laminated insulation glazing in one of the levels, which at the same time have heat-insulating properties as can be achieved by 3-fold IV, and yet distinguish themselves by their filigrane appearance.

The project results were jointly presented with the project partner at the BMWi Innovation Day in Berlin on 22 May 2014.

Fig. 1: Example of a modern box window in a building of the "Existing" stock

Development of Powder-lacquering Procedures for Indoor and Outdoor Wood Surfaces

Project Leader: Dr.-Ing. Rico Emmler
In-charge: Dipl.-Ing. Detlef Kleber
Dipl.-Ing. Simone Wenk
Bernd Brendler
Funding Institution: BMWi/EuroNorm/INNO-KOM

Objective

It was the goal of the research project to develop an application procedure for the manufacture of decorative surfaces on wood for use indoors/outdoors by applying powder lacquers of low melting and curing temperatures. Products made of wood are often subjected to a lacquering process, frequently involving solvent-containing lacquers applied in several layers. Therefore, and for meeting statutory environmental requirements, the application of electrostatic powder lacquering as a method of environmentally friendly surface coating is a promising alternative. In the past, no suitable lacquers were available for the powder lacquering of wood and, even less so, for outdoor use. Investigations were carried out into the powder lacquering of solid wood, thermowood, veneered panels and weather-resistant wood-based materials by applying advanced lacquer raw materials and newly developed acrylate/polyester-based formulations.

Investigations

Tests on the further development of the powder-lacquering technology for wood-surface coating were performed on the laboratory coating unit at the IHD and under industrial conditions at a transfer partner's facility. These tests were carried out on wood species suggesting themselves for both indoor and outdoor use. Thereby, the influence of technological and material-relevant parameters on the feasibility of powder lacquering under several technological conditions (pre-treatment, application quantity, melting temperatures, UV parameters) and depending on the wood species used and wood moisture. Pigmented and transparent NT and UV powder lacquers were applied to untreated and primed wood samples. The melting temperatures ranged between 70 °C and 120 °C. The powder lacquer was applied by Corona or Tribo sprayers (Fig. 1), subsequently melted under performance-modified IR radiators and then cured either thermally or by UV radiation, depending on the recipe (Fig. 2).

Fig. 1: Use of a Tribo spray gun for applying powder to veneered samples

Fig. 2: Ceramic-coated IR radiators at IHD's technical laboratory melting the powder lacquer applied to veneer

After coating, selected surface properties were characterised. They included a visual check for faults following a defined evaluation scheme, resistance to chemicals, scratch resistance and adhesive strength. Also, selected samples were subjected to a 3,000-hour weathering test in a Xenon test device. The results obtained were compared to similar requirements for high-pressure laminates (HPL) for outdoor application acc. to EN 438-6.

Results

Correlations could be shown between the electrical properties of the substrates, the behaviour of the powder lacquer during application and the quality of the powder-lacquered surface. The results of the measurements of wood moisture and of selected electrical properties (surface resistance) revealed the correlation between both parameters and their impact on the electrostatic lacquerability of the wood samples with powder lacquers. For some wood species, (thermowood, beech, also maple and beech veneers), it was possible to determine settings in laboratory tests in which surface qualities could be achieved that passed "good" visually. The coating results from the laboratory proved the principal feasibility, but also optimisation potential was detected regarding the reduction of gas emissions during the melting and curing of the lacquer.

Tests on primed, moisture-resistant wood-based materials (plywood, fibreboards) were also promising. The application of temperature-resistant priming resulted in the closing of the surface of the substrate. This prevented gas emissions. At OEM Nu Tech, Australia, sample panels of various materials for outdoor use could be powder-lacquered flawlessly under industrial conditions. The IHD laboratory succeeded in doing so by using thermowood. These variants were used for comparing them regarding their resistance to weathering to the long-term tests of liquid lacquers for outdoor use in Australia. After 3,000 hours of exposure to weather, no differences or better properties occurred on several powder-lacquered, primed wood-based materials and thermowood variants as compared to the liquid lacquers. Regarding weather-resistant HPL, the requirements of the best HPL quality class could be met for the primed and powder-lacquered wood-based materials as well as white tones under investigation after 3,000 hours of artificial weather exposure. Thus it was shown that surfaces of sound weather resistance could be achieved by applying powder lacquer to thermowood and moisture-resistant wood-based materials (plywood, fibreboards). Interesting new applications for wood or wood-based materials for outdoor use, e.g., façades, claddings or fencing, might thus become feasible.

Development of Solutions for Converting Existing Pre-fabricated Wooden Houses Following the Criteria of Universal Design

Project Leader: Dipl.-Ing. Architektin Susanne Trabandt
In-charge: Dipl.-Ing. Architektin Susanne Trabandt
Dipl.-Ing. Linda Geißler
Funding Institution: BMWi/EuroNorm/INNO-KOM

Initial Situation

In the aging society, there is demand for adjusting residential homes to their users' needs. Structurally converting existing homes may guarantee to live self-determined lives within the familiar environment also in old age. The project applied for was to determine the possibilites of a holistic conversion of existing pre-fabricated buildings to become barrier-free and to work out a catalogue of solutions for conversion measures. The solutions were expected to be checked and transferred to target groups (users, builders, etc.) by way of visualised exemplary developments.

Objective

It was the objective of the project to develop sustainable solutions to make existing detached houses – with a special focus on pre-fabricated houses in wood-frame design – fit for their inhabitants to continue living there until the end of their lives. So far, there has been no knowledge or experience how existing pre-fabricated houses in wood-frame or wood-panel design may expertly and economically be converted. As these pre-fabricated houses prevail in almost standardised form, generally applicable rules were expected to be set up for these types of houses.

By elaborating suggestions to convert existing pre-fabricated houses meeting the needs of elderly occupants or those with disabilities, their social contacts should be maintained, their quality of living improved, their housing situation restructured and new fields of business be opened up for building firms.

It was the project's goal to

- work out generally utilisable planning documentation for the old-age-relevant conversion of pre-fabricated wooden houses with sustainable building in mind,
- develop suggestions for conversion measures and examples for their implementation,
- to prepare technical papers and tools to visualise such implementation of the planning documentation and suggestions to target groups.

Approach and Results

Starting out from analyzing the requirements of the occupants and of the existing housing stock of pre-fabricated houses in wooden-frame architecture, necessary conversion scenarios were worked out. For comprehensively describing the individual conversion desires and possibilities, it became necessary to work out a catalogue of features. Such catalogue comprised these categories:

- useful residential space,
- occupants' purchasing power,
- number of occupants,
- physical constitution,
- cognitive competence,
- competence of sensory perception,
- needs for comfort,
- needs for security,
- preparedness for change

and allocated to one of three degrees.

Furthermore, differentiation was made into preventive and situative conversion. An exemplary planning review was prepared for four residential types of pre-fabricated homes, including technical solutions of details for the wooden-frame design considering the special requirements of the wet area

(Fig. 1). Flexible use of the living space, possibilities of conversion and adjustment of windows and doors and for installing an elevator were also considered. The preparation of concepts for stow-away areas for small room corners followed. The knowledge gained helped to set up a feature-based catalogue of measures providing conversion suggestions for the respective degrees of needs.

The results were presented in information brochures and their usefulness was cross-checked by surveys of occupants of detached houses and rented apartments (n= 22), architects (n=24), craftsmen (n=14), builders of pre-fabricated houses (n=3) and providers of living space/landlords/real estate agencies (n=6, covering 14,828 residential units altogether). The users' responsiveness was mainly positive. The suggested two-stage concept of preventive and reactive measures was very well accepted by the majority (91 %) of respondents. If the suggested measures did not have the character of a conversion for people with disabilities, which is sensed to be stigmatising, they were accepted by the respondents. This is feasible by adopting preventive measures.

Fig. 1: Example of a conversion with explanations (taken from an information brochure)

Equipping Accommodation Facilities in Universal Design

Project Leader: Dipl.-Ing. Architektin Susanne Trabandt
In-charge: Dipl.-Ing. Architektin Susanne Trabandt
Dipl.-Ing. (FH) Tony Gauser
Funding Institution: BMWi/EuroNorm/INNO-KOM

Initial Situation

Hotel rooms are usually equipped with traditional and standard furniture that does not take disabilities into account. Many accommodating facilities offer some rooms that are barrier-free or meet the needs of people with disabilities. According to hotel operators, these rooms can be rented to people without disabilities at a discounted rate only. Reasons for that are seen in the often stigmatising appearance of their equipment. Today, hoteliers do not keep available a large number of such rooms for economic reasons. Only some offer several accessible rooms; but these are usually hotels specialising in the target group of people with disabilities, not wanting to address other guests.

Objective

The subject of the project is to develop guidelines for design, construction and manufacture to equip accommodation facilities for individual, all-round barrier-free and accessible use in accordance with the principles of Universal Design. In that respect, focus is on the issues of flexibility and combinability, upgradability and longevity, individuality, functionality and mobility as well as reasonable pricing. It also covers the prototyping of such equipment modules.

Approach and Results

The widely varied requirements of furniture for accommodations were determined in a first step. This did not only involve occupants of rooms (patients in a sanatorium or hotel guests), but also the requirements of management levels (for reasons of economy) or service personnel (for reasons of handling).

Based on the requirements summarised in a catalogue, the guest areas were further subdivided (into access, entrance and reception areas, corridors, rooms with a bathroom, dining halls) from the points of view of interior design and furnishing, bearing the criteria of orientation and information in mind.

The development of floor plan design solutions for all guest areas took into special account necessary space for movement. A concept was developed for orientation within the accommodation facility and for providing information having people with limited visual or aural competencies in mind.

Detail solutions were worked out for furnishing a sample room and evaluated based on a survey among experts. Not all the suggestions could be implemented, for either economic or hygienic reasons. In a review of these solutions, they were improved and then served as a basis for the manufacture of functional samples. Solutions were provided, for example, for effortlessly handling wardrobe doors, on a par for both left-handed and right-handed users, which can

Fig. 1: Solution of a handle for corpus furniture

Fig. 2: Backlit handle at corpus furniture

Fig. 3: Bed in the sample room

Fig. 4: Chair, table and wardrobe in the sample room

be produced serially and efficiently on traditional machines. The handle solution was combined with a backlighting concept which allows to easily find them, also at night (Figs. 1 and 2).

The functional samples were subjected to stability and durability tests and tested by guests during their stays in the sample room of a sanatorium (one to three weeks). Fig. 3 and Fig. 4 show the complete sample room.

The users (n=12) were interviewed for their experience in handling the novel furnishing. This survey yielded high-level acceptance of the new equipment. There were differing statements regarding the appropriateness of the bed, which was tuned to the needs of a wheelchair user. The target group of heavily disabled wheelchair users was deleted from the the catalogue, when the requirements were weighted for economic reasons. Special nursing care beds are available for that group of people. On request of the project partners, the bed shall be reviewed from the point of view of the people concerned in another project.

Scratch-proof Coating of Wood and Plastics Based on Silica-modified, Aqueous Polyurethane Dispersions

Project Leader: Dr.-Ing. Rico Emmler
In-charge: Dr.-Ing. Rico Emmler
Dipl.-Ing. Simone Wenk
Funding Institution: BMWi/AiF/IGF
Research Bodies: Institut für Lacke and Farben gGmbH, Magdeburg
Fraunhofer-Institut für Betriebsfestigkeit und Systemzuverlässigkeit, Darmstadt
Institut für Holztechnologie Dresden

Introduction

Aqueous lacquers are based on polymeric dispersions of fine, 50-200-nm-large particles, which are set in such a way that they, as soon as the water evaporates, merge to form a homogeneous film, also at low temperatures. Such lacquer films are vulnerable to scratching, especially to micro scratching. One issue in the project was whether such susceptibility could be reduced by adding hard, inorganic nanoparticles. Simply mixing nanoparticles into aqueous lacquers lets them aggregate, and compounding of the inorganic nanoparticles with the organic phase of the bonding agent does not occur. In order to avoid that, the nano particles must be built directly into the dispersed polymeric particles. This was expected to be successful with aqueous polyurethane dispersions (PUD), which increasingly supersede the previously common acrylate dispersions.

A second issue was how to differentiate evaluations of micro scratch resistance, as the previously established micro scratching procedure acc. to EN 16094 was incapable of doing so.

Objective

The goal of the project was to develop novel, polyurethane-based aqueous lacquers (physically drying, two-component and UV-curing) for indoor applications of wood and plastics with significantly improved micro scratch resistance. The improvement was to be achieved by permanent incorporation of silica-nanoparticles in the lacquer polymer. These works were carried out by the project partners LBF and ILF. The development of a differentiating micro scratch test procedure was the task to be done by the IHD. The following refers to this second part of the task exclusively.

Material and Method

The methodical testing investigations were carried out on ten different aqueous lacquering systems, which were examined as they were, and also modified by aerosoles.

The Martindale unit, which generates large-size Lissajous movements on samples measuring 150 mm by 150 mm, served as the test device. Several scratching materials were examined for their fitness to serve differentiation. Contact pressure and the cycle count were to be determined in such a way that scratching occurred and no significant abrasion or polishing took place. For evaluation, a change in gloss (reduced by micro scratches; procedure A) and visual judgment of existing traces of scratching, evaluated by a descriptive numerical code (procedure B) were determined as parameters. After investigation concerning differentiability and repeatability, the test parameters were defined in an IHD works standard draft, IHD-W-474. The test procedure was validated and optimised in comparable tests performed with the project partner ILF, further involving three more lacquering systems for plastics.

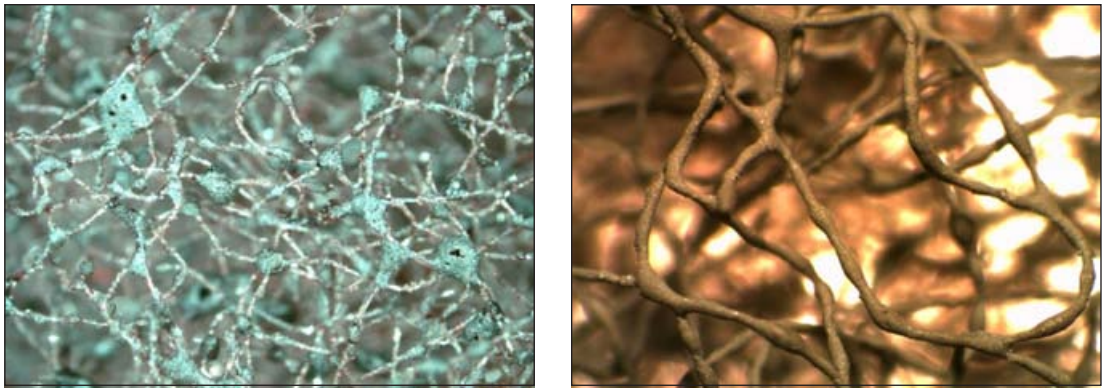


Fig. 1: Scratching materials according to Procedures A and B, acc. to IHD-W-474 (left: Scotch Brite 3M CF-HP 7447+, Scale 20:1; right: Scotch Brite 3M CF-HP 7448+, Scale 10:1; Photos by Weiss, IHD)

Results

Tab. 1 shows the derived test parameters, which appeared to provide sound repeatability and differentiability. Deviating from EN 16094, the scratch materials SB 7448+ and SB 7447+ (Fig. 1) proved to be suitable friction materials. Two comparative tests were performed on wood and plastic coatings, adopting the parameters shown in Tab. 1. After the first test series, the application of lacquers to the samples was improved, the description of the IHD works standard was slightly modified and examiners were trained. Tab. 2 shows exemplarily the results of the second test on plastic lacquers. Sound agreement was achieved to a large extent between both institutes, so that IHD-W-474 was adopted by the project partners in further investigations on the PUD systems modified by silica-nanoparticles.

Conclusion

With the micro scratching procedure acc. to IHD-W-474, IHD developed a differentiating and reproducible test procedure, which was jointly validated with the project partner ILF in comparative tests. CEN TS 16611 for the micro scratch resistance of furniture surfaces, issued late in 2014, adopts the same test materials/test parameters, also resting on the experience from the project on the micro scratch resistance of water-based lacquers.

Tab. 1: Test parameters acc. to IHD-W-474

Parameters	Procedure A	Procedure B
Friction material:	SB 7448+	SB 7447+
Contact pressure:	6 N	6 N
Cycle count:	80 (5 LB)	80 (5 LB)
Evaluated by :	Changes in gloss	Visual assessment of a scratch image acc. to an evaluation scheme, by an experienced examiner
Evaluated after:	24 h	24 h

Tab. 2: Results of the comparative tests on plastics substrates (examples)

Lacquering system on /type of lacquer	Established change in gloss in % acc. to IHD-W-474, Procedure A		Establisdhed degree of scratching* acc. to IHD-W-474, Procedure B	
	IHD	ILF	IHD	ILF
ABS/uncoated	97	97	5	5
ABS/100%UV	18	11	3	1
ABS/1K-water	97	98	5	4
PC Lexan/2comp-PU	68	75	5	5
PC Lexan/100%UV	19	8	3	3
PC Lexan/1com-water	94	93	5	4

* 1 ... 5: scratches invisible or only a few ... mix of the Lissajous figure and many scratches

Development of Test Procedures for the Faster Prognosis of Long-term Preservation of Outdoor Wood Coating

Project Leader: Dr. habil. Mario Beyer
Dr. Lars Passauer
In-charge: Dr. Lars Passauer
Dipl.-Ing. Simone Wenk
Bernd Brendler
Funding Institution: BMWi/AiF/IGF
Research Bodies: Institut für Holztechnologie Dresden
TU Dresden, Institut für Pflanzen and Holzchemie

Objective and Approach

It was the objective of the project to investigate various already established, but also novel chemical and physicoanalytical procedures and methods for characterising and testing surfaces, for their predictive reliability regarding the long-term and protection behaviour of outdoor wood coating. Apart from the classical surface test methods to determine changes to the degree of gloss or colour, adhesion and water and vapour permeability, this is also about microscopic (light microscopy, REM, Raman microscopy) and micromechanical procedures (determination of micro hardness), thermochemical analytical methods (DSC) and several spectroscopic (FTIR, Raman, UV/Vis, fluorescence spectroscopy) and chromatographic methods (GPC, GC/MS, Pyr-GC/MS, HS-SPME-GC/MS). A GC/MS system, combined with a micro UV lamp, was used as a completely novel analytical device (Fig. 1a), which served the identification of volatile photochemical degradation products (Fig. 1b) that are formed immediately after being irradiated by UV light. In the field of characterising various types of wood coating and their photochemical degradation, there is the novel method for determining ion permeability as well as the new chemiluminescence-based analysis (CL). There is hope, by applying them, to be able to make statements on the impact of structural pores and oxidiation resistance of bonding agents and additives on the weathering resistance of wood coating. Within the scope of the project, initially those procedures were expected to be worked out which, if possible during the early period of strain, indicate weather-dependent changes in the chemical structures and changes resulting from them in physicochemical and chemical properties. Also, the measurements and test results obtained were to be related to the protective behaviour of the coating, which was obtained from artificial and natural weathering tests.

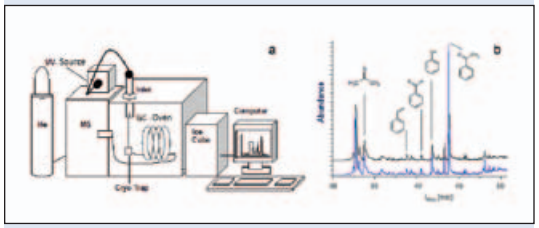


Fig. 1: a) Schematic setup of a GC/MS system connected to a micro UV xenon short-arc irradiator; b) chromatogram of slightly volatile photooxidative degradation products of a transparent styrene-acrylate-based lacquer film

Results

The following analytical methods have proven to be especially suitable to detect weather-related changes in the chemical structure of the coating materials in the early period of strain: 1) FTIR-ATR, 2) DSC, 3) UV-GC/MS, 4) HS-SPME-GC/MS and 5) the CL analysis. With their help, photochemcial degradation mechanisms as described in the literature could be reproduced, but also new insights with a view to 1) the chemicophysical degradation of wood coating and 2) the influence of several additives on changes of properties of the coating materials relating to that context, could be obtained. So it could be shown that weather-dependent

material changes are quite substantially caused by leaching, emission and photooxidative degradation of coalescence agents, (temporary) softeners and defoamers/deaerators. Furthermore, the photocatalytic effect of titanium dioxide, applied as a white pigment, could be verified, which was especially apparant when photosensitive bonding agent components (e.g., PS) or additives (e.g., PEG) were prevailing. What was also successful was the demonstration and development of relevant effects in dependence on weathering time, which allowed to make statements regarding respective trends of reaction and the sensitivity of coatings and their components towards photolytic and photooxidative degradation (Fig. 2).

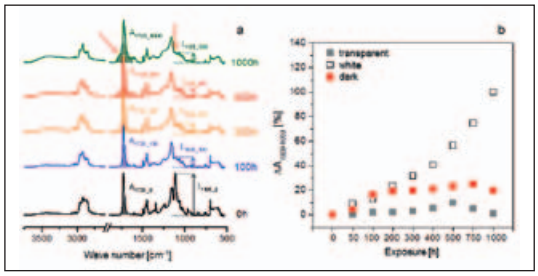


Fig. 2: a) FTIR-ATR spectrums of a white-pigmented, styrene acrylic wood coating after several periods of weathering (0-1000 h); integrals and intensities of selected ranges are highlighted; b) changes in per cent of the peak integral of υ(C=O) styrene acrylic wood coating variously pigmented depending on the weathering duration

Methods with the help of which weather-dependent and physical properties could immediately be detected, are measuring procedures to determine 1) the glass transition temperature, 2) micro hardness, 3) colour and 4) gloss.

By means of the temporal courses of these changes in properties during artificial and outdoor weathering, correlations with changes in chemical structures could be derived. Mathematical-statistical modelling was further able to establish significant interdependencies between 1) the lacquer recipe and protection behaviour, and 2) changes in physical properties during artificial weathering and protective behaviour (Fig. 3). Proceeding from that, it was possible, by applying procedures of multiple regression, to derive prognostic models which, by including recipe data, physical and physicochemical properties of unweathered referential coatings as well as changes in the properties during artificial weathering, allow to make orienting forecasts for macroscopic properties that are connected to the protection behaviour of wood coatings (Fig. 4). A transfer of these procedures into practice appears generally possible, it is, however, subject to result evaluation of previously uninvestigated coating systems.

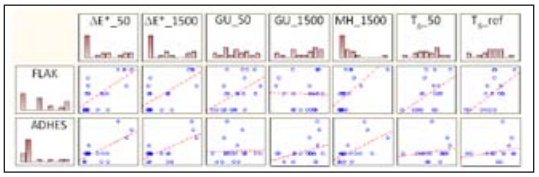


Fig. 3: Extract from a spread graph matrix with correlations between selected macroscopic properties of wood coatings after 24 months of outdoor weather exposure (FLAK: degree of peeling, ADHES: adhesion) and physical properties of unweathered (Tg_ref) as well as 50/1500 h artificially weathered coatings (ΔE: colour difference, GU: degree of gloss, MH: micro hardness, Tg: glass transition temperature)*

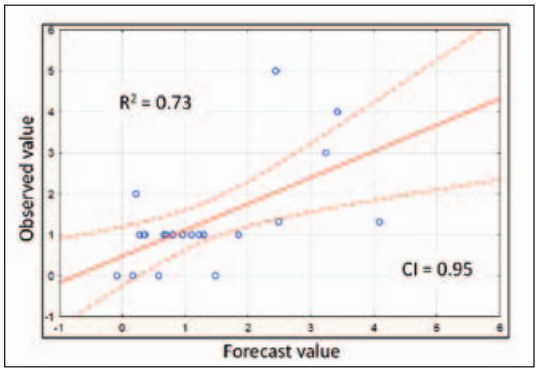


*Fig. 4: Predictive reliability of a linear, multiple regression approach to estimate adhesion properties acc. to ISO 2409 (long-term prognosis) based on the variables of pigmenting, colour distance ΔE*_50, micro hardness MH_1500, glass transition temperatures Tg_ref and Tg_50*

Quantitative PCR Assay for Proving Dry Rot by Way of the Implemented Molecular Vitality Test

Project Leader: Dipl.-Ing. Kordula Jacobs
In-charge: Dipl.-Ing. Sc. Natalie Rangno
Funding Institution: BMWi/EuroNorm/INNO-KOM
Cooperation Partner: Institut für Polymorphismus and Mutationsanalytik, Saarbrücken
Institut für Bioinformatik der Universität Saarbrücken

Initial Situation and Objective

The most dangerous and, yet by far, most frequent fungal wood destroyer in buildings in Central Europe is dry rot Serpula lacrymans (Wulfen: Fr.) Schroeter apud Cohn (Fig. 1).

Fig. 1: Genuine dry rot infestation of a balcony substructure

Due to its highly destructive potential, special restructuring measures are prescribed for this fungus, which involve clearly higher costs than compared to regular restructuring caused by other fungi (Grosser et al. 2003). Inevitably, proof or exclusion of infestation by S. lacrymans is one of the most important tasks of wood preservation experts within the scope of building refurbishment and evaluation.

Fungal determination within the scope of damage assessment first requires a visual on-site inspection by an expert. If this does not result in conclusive findings, standard laboratory investigations need to be performed (DIN 68800-4:2012). These may involve macroscopic and microscopic analyses, cultivation tests or forms of biological proof, DNA analyses in particular (Gros ser et al . 2013).

The majority of molecular-biological evidencing systems for wood-destructive fungi are based on the specific amplification of rDNA-ITS sequences by means of conventional PCR and subsequent gel electrophoresis (e.g., Jacobs et al. 2010, Schmidt and Moreth 2006, Schmidt and Moreth 1999). Also real-time PCR procedures are increasingly being used (Jacobs et. al 2013). Moreover, the DNA chip technology has been in use at the IHD since 2010, applying species-specific rDNA-ITS probes (Rangno et al. 2010, Jacobs et al. 2010).

The competence and experience of providers of PCR-based diagnostics in the field of wood and building preservation is widely varied or partly non-existent. The "inhouse methods" in use vary strongly, and there is no universal standard. This results in the necessity of evaluating and standardising available methods. Besides, rapid progress in molecular biology provides numerous approaches towards the further development and enhancement of DNA-based diagnostic methods, e.g., for proof of the respective harmful organisms being alive or dead.

Due to the disadvantages and the potential of improvement of existing diagnostic measures, a two-year R&D project was initiated, co-funded by the German Federal Ministry of Economic Affairs and Energy (BMWi).

The aim of the project was to develop a quantitative PCR assay for proving genuine dry rot as well as its closest relative, wild dry rot (S. himantioides) on the basis of new molecular markers and the implementation of proof of the fungi being alive or dead. At the same time, the sensitivity and specificity of the proof was envisaged to be higher than that of conventional PCR.

Results

At first, several genomic DNA areas were investigated and evaluated with a view to their suitability as differentiation markers as well as to the quantification of the target organisms.

As a result, it was shown that both a repetitive marker identified from whole-genome sequences (360-fold occurring repeat motif) and a mitochondrial marker also derived from inherent sequences are principally suitable for the differentiation and quantification of genuine dry rot. Both approaches are of interest for commercial use, but require a comprehensive sequence data basis for developing and validating proof assays.

Therefore, the core DNA markers based on the betatubulin gene, which was also developed as part of the project, and the modified markers from the rDNA-RTS region proved to be favourites for the assay design. Especially the combination of both systems showed a high potential for differentiation, not only regarding genuine dry rot, but also concerning other dry rot in buildings. A probe-based multiplex qPCR assay was developed on their basis and validated in a field test.

The assay was supplemented by implementing extraction and amplification control and universal fungal proof (PAN fungus probe). Apart from the classical application of genomic DNA in graded dilutions, the use of artificial single-strand template oligonucleotide constructs also stood the test.

For the molecular-biological vitality determination or the live/dead proof, two of the betatubulin-gene-derived splice PCR primer combinations were successfully tested on the live and dead material. The specific range of application and the framework conditions for respective diagnostics are yet subject to investigation, but the principally verified functionality is promising for commercial use.

Within the scope of validation, a verification limit of 100 fg of genomic DNA or 1.5 spores/ml was proven in an extraction formulation (corresponding to 15 spores/ml) for the multiplex-probe assay at 95 % reliability. Furthermore, the reproducibility of diagnostic findings was demonstrated on three different qPCR devices (StepOne by Applied Biosystems, Q-Tower by Analytik Jena and Piko-Real by Thermofisher). The reliability, specificity and sensitivity of the assay were eventually confirmed in a field test on twenty timbers from practice, damaged by fungi.

Conclusion

The project results can be applied immediately to the development or further development of diagnostic products for the laboratory proof of fungi, especially the real-time PCR kit for genuine and wild dry rot as well as a DNA extraction kit for higher fungi and fungus-infested timber. Moreover, the solutions found can, regarding their marker structure and assay setup, be transferred to other destructive organisms.

Literature

DIN 68800-4 (2012). Holzschutz – Bekämpfungs- und Sanierungsmaßnahmen gegen Holz zerstörende Pilze und Insekten. Beuth-Verlag

Grosser, D., Flohr, E., Eichhorn, M. (2003). Echter Hausschwamm – Erkennung, Lebensbedingungen, vorbeugende Maßnahmen, bekämpfende chemische Maßnahmen, Leistungsverzeichnis. WTA-Merkblatt E1-2-03. Wissenschaftlich-Technische Arbeitsgemeinschaft für Bauwerkserhaltung und Denkmalpflege e. V., Referat Holzschutz

Grosser, D., Hertel, H., Radovic, B., Willeitner, H. (2013). Holzschutz – Praxiskommentar zu DIN 68800 Parts 1 to 4. (DIN, iVTH, R. Marutzky, Eds.) Beuth-Verlag

Jacobs, K., Gäbisch, M., Rangno, N. (2013). Pilznachweis in verbautem Holz mittels Real-Time-PCR; Neues Diagnostiktool für den Nachweis des Echten Hausschwamms, Holztechnologie 54(3) 38-43

Jacobs, K. (2010). Molekularbiologische Diagnose holzzerstörender Pilze (Basidiomyceten) in Praxisproben. F&E-Bericht Reg.-Nr. 15348 BR, cf. item 7

Jacobs, K., Rangno, N., Scheiding, W., Müller, D., Hiller, C., Brabetz, W., Weiß, B. (2010). Detection of wood destroying fungi using DNA microarray technology. International research group of wood preservation, Annual Meeting 2010, Biarritz

Rangno, N., Müller, D., Jacobs, K., Hiller, C., Brabetz, W., Weiß, B. (2010). Buildings rot fungus diagnosis based on PCR and DNA microarray detection. Mycoses, 53(5) 375-462

Schmidt, O., Moreth, U. (1999). rDNA-ITS sequence of Serpula lacrymans and other important indoor rot fungi and taxon-specific priming PCR for their detection. International research group on wood preservation, IRG/WP 99-10298

Schmidt, O., Moreth, U. (2006). Molekulare Untersuchungen an Hausfäulepilzen. Zeitschrift für Mykologie, 72(2)

Elaboration of Parameters for Evaluating Primer Coats for Inkjet Printing on Wood-based Materials

Project Leader: Dr.-Ing. Rico Emmler
In-charge: Dr.-Ing. Ingrid Fuchs
Dipl.-Ing. M. Anna Adamska-Reiche
Dipl.-Ing. (FH) Anissa Ghozzi
Bernd Brendler
Funding Institution: BMWi/EuroNorm/INNO-KOM

Introduction

Currently, there are no standardised properties/features nor relevant test methods fit to characterise the print substrate for printing on wood-based materials. Likewise, there is a lack of defined parameters and relevant limit values for characterising test prints and for predicting the printing quality. Primer coats and print builds are developed today, preferably following the "trial and error" approach.

Objective

The objective of the project was to derive parameters of the print substrate having an impact on the print quality in digital printing. For that purpose, suitable procedures were to be developed and adjusted for measuring the print quality and influential parameters of the print substrate.

Material and Methods

The influence of wood-based materials was investigated on two different, uncalibrated HDF panels. One panel consisted of coniferous wood partly containing parts of bark, the other containing no bark at all.

Apart from the radiometric determination of the density profiles and thickness swelling (acc. to DIN EN 317) of both panels, the surface pH value, the colouring and the contact angle of the uncoated panels were determined. Prior to coating, the panels' top sides were sanded on a belt sander (sanding sequence: K180P, K320D; D = diagonal sanding). The surface roughness of the uncoated and coated HDF was measured optoelectronically applying the GFM 3D surface measuring device "MikroCAD".

Within the scope of Project 9, various primers were available as print substrates. The following properties were established in the primer coats:

- the colour in the L*a*b* model,
- the degree of whiteness,
- the surface topography,
- the degree of gloss,
- the contact angles after 1 s, 10 s and 60 s, surface energy and
- the pH-value.

The printing methods under review were inkjet printing in the single-pass and multi-pass procedure, using the CMYK colour model.

The single-pass printer at the IHD was extended in the course of the project by pinning units. Pinning means UV-LED units arranged behind the single printheads. This facilitates pre-curing and fixation of the ink after as early as 0.3 s after the ink droplet has hit the surface.

In order to be able to evaluate the effects of the changes in influentiual parameters, a test file was developed as a print template, containing, apart from a print image as it is usual in the industry (maple decor), another part suitable for the image-analyzing and evaluating system DOMAS of Papiertechnische Stiftung (PTS).

The print quality was evaluated visually by trained test persons following an evaluation scheme that was developed within the scope of the project and compared to the results rendered by the image-analyzing system DOMAS. The image-analyzing system preferably characterised the uniformity of the print and the contour definition of the prints. Furthermore, the colours of the full tone areas on the completed prints were measured.

Results

The investigations showed that the best print results, determined by visual evaluation (of both the single-pass and the multi-pass print), were achieved on surfaces of low roughness. Apart from the print substrate, there are also the procedural stages and ink properties that significantly influence the print quality.

Basically, the following parameters are suitable for evaluating the print substrate:

- colours in the L*a*b* model, degree of whiteness,
- surface topography,
- contact angles after 1 s, 10 s, 60 s, surface energy.

The surface energy of the print substrate must verifiably be higher than the surface tension of the print ink. In this context, the time lag between the droplet hitting the substrate and the curing unit taking effect must be taken into account. The longer the time lag, the more the ink droplet will have the chance to spread. The print substrate should prevent such spreading as best as possible, i.e., the contact angle change over time should be as little as possible. The positive effect of swift droplet fixation was also confirmed by installing the pinning units (Fig. 1).

The degree of whiteness mainly has an effect on colour reproduction. Impacts of the surface pH-value on the print quality were not verifiable.

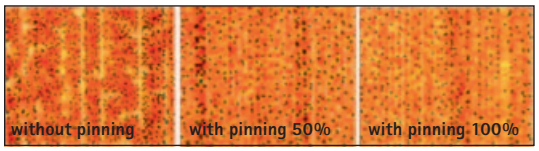


Fig. 1: Microscopic images of maple decor, with and without pinning of varying intensity (Scale: 10 : 1, left no pinning, centre 50 % performance, right: 100 % performance)

Conclusion

As a result of the investigations, it was found that the roughness of the print substrate is the main parameter influencing print quality. Moreover, the surface energy and the degree of whiteness and L*, a*, b* values of the print substrate and priming coat are of importance. The timely fixation of the ink droplets by way of LED pinning affects print quality positively.

A set of regulations in the form of IHD works standard IHD-W-476 was worked out for evaluating the print quality, consisting of requirements regarding the application of primers, the definition of primer properties, the application of a test print and its subsequent evaluation.

Literature

Emmler, R.; Fuchs, I.; Adamska-Reiche, M. A.: Neueste Entwicklungen beim Inkjet-Digitaldruck auf Holzwerkstoffen. In HOB (2014)6, pp. 56-58

Emmler, R.; Fuchs, I.; Adamska-Reiche, M. A. Neues zum Inkjet-Digitaldruck auf Holz- und Holzwerkstoffen. Tagungsband des HTK 03./04. April 2014 in Dresden, ISBN 978-3-86780-385-4, pp. 90-104

Chromate-free Fixation of Copper by Hydrophobing

Project Leader: Dr. Christiane Swaboda
In-charge: Dr. Christiane Swaboda
Funding Institution: BMWi/EuroNorm/INNO-KOM
Cooperation Partner: Hobum Oleochemicals GmbH, Hamburg

Initial Situation and Objective

Timbers in soil contact or in direct contact with water must chemcially be preserved against biological degradation by fungi and other microorganisms. The range of agents still permitted for that purpose is becoming smaller and smaller, as, due to European legislation, wood preserving agents must comply with the Biocides Directive, and as compounds that used to be very effective, such as creosotes and CCA salts, have been banned from that list meanwhile. Timbers in soil contact must be anticipated to be infested by organisms living in the ground that are capable of eroding various biocidal protection principles. Organic fungicides, for example, are degradated or copper is precipitated as an insoluble and thus ineffective copper oxalate. The most common wood-preserving agents for application in Hazard Classes 4 (in permanent contact with ground and fresh water) and 5 (installations in cooling towers, in permanent contact with sea water) have since been formulations with the biocide copper used with chromate as a fixation agent. The chromium(VI) and chromium(III) compounds, derived from the first, used for fixation, do not have any biocidal effect. However, the chromium(VI) compounds applied are highly toxic (carcinogenic and allergenic), so that possibilities of avoiding them, e.g., in hydrophobing are highly welcome.

The objective of the project was to work out a new concept to protect structural wooden parts in outdoor use exposed to leaching (Hazard Classes 2 to 4) with copper-containing agents combined with a hydrophobing feature based on drying oils. Contrary to the Royal procedure, hydrophobing in this respect was to penetrate into the inner parts of the timber, with the protective agent being introduced into the wood in the single-step process of empty-cell impregnation and cured there by means of microwaves.

Results

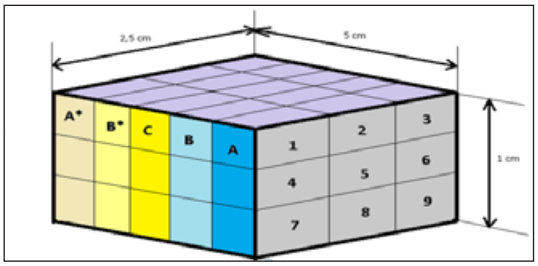
In the project under review, an oil recipe based on an isomerised soybean oil was developed that is fully curable on test samples of 10 mm x 10 mm x 50 mm, with or without a siccative, in an oxygen atmosphere after 17 to 24 hours. Furthermore, copper compounds in the form of copper soap were synthesised and introduced into the wood by way of the single-step impregnation procedure directly with the oil or also as an aqueous copper acetate solution by way of the two-step procedure before oil impregnation.

For copper placement sufficing Hazard Class 4, copper concentrations of 9 g/l to 13 g/l of oil were formulated. The storage stability of an isomerised oil mixed with copper octanoate was tested for a period of three months. Any notable polymerisation in the presence of Cu2+ in the form of the hydrophobic octanoate did not occur.

It could be shown that the distribution of copper in the wood across the entire cross-section of the sample was homogeneous (Fig. 1). Thereby, it had to be taken into account that the initially introduced quantity of the agent could reduce again due to empty-cell impregnation. It was noted that approx. only half (1.1 g/kg) of the originally introduced amount of copper (1.8 g/kg to 2.6 g/kg) remained in the wood after microwave treatment.

For accelerating the curing process, the test samples were stored in an oxygen atmosphere (p=10 bar) at an increased temperature (70 °C) for about 24 hours. This resulted in an almost complete decrease of the double compounds down into the interior of the timber in all cases, which was interpreted to be the result of almost complete curing.

The addition of a Co/Zr siccative had a heavily accelerating effect on the curing, while microwave treatment without a siccative did not lead to a faster decrease in



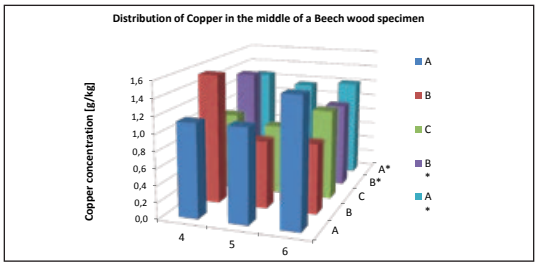


Fig. 1: Test sample completely soaked with copper octanoate/oil *and treated with microwaves, split, individual samples dissolved by means of nitric microwave pulping, copper content investigated by MP-AES*

the double compound. Copper octanoate itself has an additional siccative effect, which accelerates the networking reaction also by having the Co/Zr siccative to be added. In conjunction with the traditional siccative, however, it has a reaction-delaying effect.

In the presence of copper ions during the storage period, there was a slowly oxidative degradation effect in the oil in the samples previously looking well-cured. Increased mass loss was also noticed on the samples subjected to outdoor weathering after several months, due to sticky oil escaping from them.

This effect also had an impact on the leaching behaviour of copper, tested acc. to EN 84. In the two-week process, a delay in copper leaching was noted only when liquid, copper-containing oil had completely been removed from the wood. Then the oil-soluble copper octanoate, contrary to the variant hydrophobed by aqueous copper acetate, showed a lower leach rate than the chromate-fixed wood-preserving agent Korasit CC (Fig. 2).

Tests on the biological resistance towards the test fungi *Coniophora puteana* and *Trametes versicolour showed fungus-impeding tendencies, with both* variants with and without copper. So the mass loss, as contrasted to the virulence test, could be reduced in all variants by at least 50 %. Grading into HC 5 requires, however, a maximum mass loss of 3 % , which was achieved by only one variant (siccative oil) in the presence of *Trametes versicolour.* Especially notable was the large spread within the test group of oiled timbers, which was in no causal relationship with the batch treated with the agent. (Fig. 3).

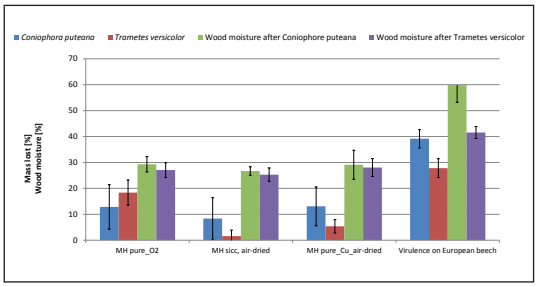


Fig. 2: Amount of copper in [%] leached from the initial amount contained in the wood after leaching (EN 84), mean values of n=20*

One reason could be in the oil leach due to the liquefying process caused by copper, which resulted in the fact that the agent eventually remaining in the test sample did not unfold any significantly larger fungus-impeding effect than the hydrophobing effect due to the remaining oil. Analogue tendencies also showed

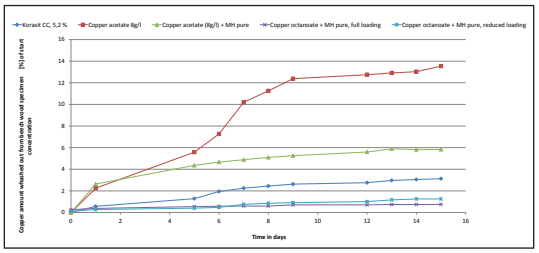


Fig. 3: Mass loss and wood moisture after EN 113 testing

in the resistance testing of soft rot, whereby, due to hydrophobing and in spite of the leaking of the copper-containing oil, the fungus-releated mass loss could be reduced by 60%, too, as contrasted to natural beech.

Conclusion and Outlook

It can be summarised that the project goal, i.e., to achieve a reduction in copper leaching by hydrophobing, was met. Addition of copper to the oil had, despite complete initial curing, a liquefying effect on the oil, which eventually is counterproductive for the aspired use in HC 4 and HC 5. So, due to the remaining hydrophobing effects, better resistance towards fungi could be achieved, but, contrasted to the siccative variants without any agent, there was no further increase in these effects. A new approach consists in applying other leachable biocides, such as boron compounds or oils modified during application, which do not need to be cured oxidatively. First preliminary tests have already been performed and shall become part of a follow-up project that has already been applied for.

Inline Determination of Formaldehyde Emission from Sawdust of Wood-based Material during Production

Project Leader: Dipl.-Ing. Martina Broege
In-charge: Dipl.-Ing. Martina Broege
Sebastian Kniep
Funding Institution: BMWi/EuroNorm/INNO-KOM
Cooperation Partner: Fagus-GreCon Greten GmbH & Co. KG, Alfeld

For manufacturers of wood-based materials it is desirable to have available a measuring method for determining formaldehyde emission which allows to continuously monitor compliance of limit values, on the one hand, and to have measured values available for process optimisation, on the other. For that purpose, it is inevitable to move formaldehyde measuring out of the laboratory onto the production line, i.e., to implement at least one atline measuring.
The objective was formulated out of this initial situation to develop an approach and a procedure that allow formaldehyde measurements to be carried out fast enough in order to facilitate process control. At the same time, the measuring results were expected to be sufficiently verifiable to initially establish correlations with the help of the derived methods and, beyond that, by applying the test chamber method. The latter results in the claim to measure formaldehyde directly and to use no procedures which, in their turn, are based on correlations, such as the NIR spectroscopy.

Fig. 1: Apparatus for determining formaldehyde emissions from wood-based chips

The IHD and the company GreCon were working jointly on that issue. An idea was developed to measure emissions from chips obtained from newly pressed panel material. Here, sampling the chips from the exhaust of the diagonal saw or of the edge trimming device is a favourable idea. This procedure allows to measure a representative portion of chips from the middle and surface layers.
The formaldehyde analyser made by Medizin- and Labortechnik Engineering GmbH (MLE) was used for formaldehyde determination. The device performs the acetyl-acetone method automated by means of the injection flow method.
Based on preliminary investigations, GreCon developed a measuring apparatus working in cycles. It includes all components to determine formaldehyde emissions. Three sampling plates are moved in a circle and cyclically run through the stages of material feeding, the measuring chamber and disposal. The successful testing of the measuring apparatus was followed by tests on a laboratory and then industrial scale.
The results at hand are based on industry-scale tests, whereas chipboards of various qualities, i.e., of varying formaldehyde emission levels and of varying thicknesses, were involved. Figure 2 shows a compilation of formaldehyde emission values of

chipboards of various qualities. These values represent average values of their respective test series of one product each. The products of E1 quality varied, among other things, across a wide range of thicknesses, which contributes to the spreading of the results. Products of CARB II or F**** quality demonstrate, according to the definition, a lower emission level than E1 products. The results show that the three different qualities E1, CARB II and F**** are well distinguishable. The lowest formaldehyde emission from chips found, i.e., 0.4 ppm, ranged clearly above the blind value level of < 0.02 ppm.

Figure 3 shows formaldehyde emissions from chips contrasted to those from the chipboard. Here, too, the entire range of products accordingly observed was included in the respective presentation.

As a result of the development effort, there is a measuring apparatus for determining the formaldehyde emission from wood-based chips, which, as part of a future overall concept is envisaged to be used in inline monitoring and which supplies information on the course of the process to be used as a basis for optimisation tasks. The results of the practical tests show the fitness of the measuring apparatus to work under industrial conditions. Formaldehyde emissions from chips of chipboards of lower emission levels can also be measured and differentiated. It was shown that correlations can be established between the formaldehyde emission from chips and formaldehyde contents or emissions from relevant wood-based panels as regards products or plant facilities.

Further works consist in automating sampling, the development of an industry-scale version of the formaldehyde analyser and the electronic link-in of the apparatus. In a further step, it shall be incorporated into a production process.

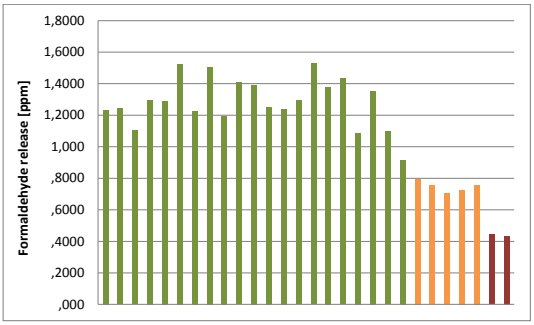


*Fig. 2: Formaldehyde emission (mean values) from chips, chipboards of different qualities and thicknesses; Green: E1 quality; Orange: CARB II quality, Red: F**** quality*

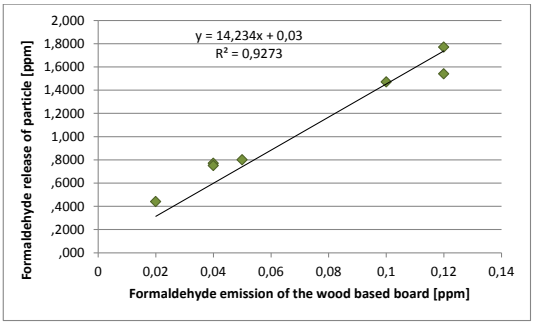


Fig. 3: Comparison of formaldehyde emissions from chips to formaldehyde emissions from the wood-based board (ASTM D 6007), chipboards of different qualities and thicknesses

Entwicklungs- and Prüflabor Holztechnologie GmbH (EPH)

A 2014 Review

The year 2014 was another eventful and successful year for the EPH as a service provider of the Institut für Holztechnologie Dresden (IHD). 2014 saw consequently continued efforts aimed at the structuring and specification of the EPH and its main fields of business as a test laboratory, monitoring and certification body.

The Certification Body for Quality Management Systems that has been existing at the IHD since 1995 has been extended by the business field of Environmental Management Systems and, after having passed the audit in October 2014, integrated into the EPH at the end of the year.

Certification of product quality, including internal on-site control, is EPH's most vital line of business, whereas product certification is frequently supported by the top-quality performance of the specialists working at the laboratory accredited in accordance with EN 17025.

The immediate test services rendered by the EN-17025-accredited laboratory and its departments of Biological, Surface, Chemical and Material and Product Testing, and, last but not least, of the NIMM-EPH laboratory in Detmold, Germany, continues to be the second important pillar of EPH's business activities.

Apart from product certification regulated by statutory rules (BauPG, ProdSG), "voluntary monitoring and product certification" keeps growing in importance.

In 2014, a modified "Corporate Design" was introduced in IHD and EPH, which, of course, had an impact on the appearance of the EPH. Now, the slogan "SUCCESS BY QUALITY", together with the brushed-up logo, adorns the test records and certificates, without having lost the recognition value of the image that had been known for years.

Its policy of planned investments into technical test equipment was pursued in 2014, too.

In 2014, the Quality Management team headed by QM-in-charge, Mr. Heiko Hofmann, tackled the challenges of continually developing the quality management system of the test laboratory in accordance with EN 17025 and of the product certification body. Both the accredited test laboratory and the product certification body had to stand the test of a system audit in 2014. For the product certification body, this meant an additional change to a new accreditation standard. With a view to its successful completion, the EPH quality management system for product certification is now being converted to the EN 17065 standard.

Jointly with the management and staff, clients' requirements of reliable test and certification services within the scope of valid accreditations could be met. In 2014, the laboratory performed or participated again in numerous round-robin and comparative tests for safeguarding the quality of test results.

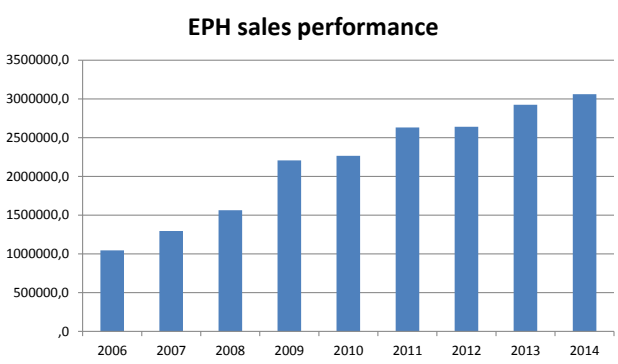


Fig. 1: Development of EPH's turnover

Development of Turnover

In 2014, the EPH services reached a volume of approx. € 3,060 thousand. This is another increase by 4.6 % as compared to the previous year (€ 2,925 thousand).

The service volume consists of a wide service portfolio, in which the services offered by the testing, monitoring and certification body (PÜZ) for products as well as internal on-site production control take a key position. Thereby, the PÜZ body can rely on the sound base of the laboratory departments performing chemical-analytical, biological and physicomechanical test procedures. In this context, also the monitoring tasks gained further importance, including collaboration with representatives acting worldwide. Apart from the test and monitoring services meeting the CARB-IKEA requirements, the complex scope of services for floor covers of the various types, which EPH can offer, continued to gain in significance in 2014, be it regarding CE marking or obtaining approvals from building authorities. But the physicomechanical, biological and wood-anatomical tests made a vital and stable contribution to the wide range of EPH services in 2014, too.

The test hall inaugurated in 2010 boosted the conditions for testing structural elements (windows, doors) and of wood and wood-based materials thoroughly. Structural element manufacturers placed testing orders of a volume of approx. € 290 thousand with the EPH in 2014.

Also in that year, manufacturers and traders of wood, coated and uncoated wood-based materials assigned the EPH with a service volume exceeding € 1,000 thousand.

In the field of floor covers, a service volume of more than € 850 thousand was handled – again a clear increase as compared to the year before.

The EPH does business for the furniture industry in many ways: as a GS (Tested safety mark), testing and certification body, as a test laboratory for surface properties of foil and lacquers, for product components or for the proof of emission properties. In addition to that, the furniture sector initiates many formaldehyde tests in the wood-based material industry. Altogether, an order volume of € 250 thousand was recorded for this line of business.

Laboratory Unit of Biological Testing

In 2014, the laboratory unit Biological Testing achieved an increase in turnover of 25 % as compared to the previous year; the 2014 turnover was € 134 thousand. Its testing focused on

Fig. 2: Mould testing on coatings acc. to ASTMD 3273

- the effectiveness of wood-preserving (wood-destroying fungi, blue stain),
- durability (mainly of TMT and wood-based materials),
- bacterial resistance (floors, plastics),
- mould resistance of building and insulation materials and
- the diagnosis of harmful organisms.

The turnover of molecular-biological diagnostics rose by 50 %, whereby proof of genuine dry rot was requested in most cases (an accredited procedure). The majority of clients were experts or building and refurbishment companies.

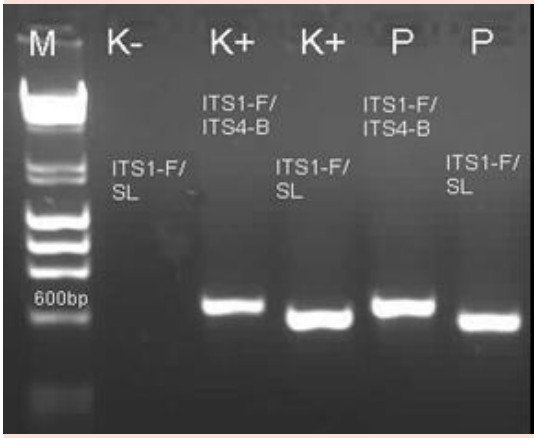


Fig. 3: Positive Yes/No DNA test for Serpula lacrymans (M marker; K- negative control; K+ positive control (universal + specific PCR); P sample (universal + specific PCR)

The larger share of durabilty testing related to thermally modified timbers and bamboo products.
A clear increase was seen in the field of mould resistance of coatings and of insulation materials of renewable raw materials. Antibacterial properties were sought after especially with a view to laminate and vinyl flooring.
Within the scope of certifying for the "Quality Mark TMT", the TMT manufacturers Fromsseier Plantage A/S (Denmark) and Novawood Orman Ürünleri Dış Tic. A.Ş., (Turkey) were successfully monitored.

Fig. 4: Signs of corrosion on structural parts of an organ (windchest) caused by formic acid and acetic acid (Photo by IHD, Aehlig)

Laboratory Unit of Chemical Testing

In 2014, this part of the accredited laboratory, where mainly chemical-analytical test procedures are applied, was characterised by extending its analytical competence and by modifying the analytical procedures for determining very volatile, volatile and semi-volatile organic compounds.
The chemical testing services subdivide into the following special fields:

- wood and wood-based materials – formaldehyde emission and content, heavy metals, n/i-paraffin contents and distribution,
- gaseous air contaminants – volatile and semi-volatile organic compounds (VVOC, VOC and SVOC) emitted from building materials, furniture, adhesives, lacquers, museum showcases, in ambient room air and the like,
- coating materials and adhesives – VOC content in lacquers, migration of heavy metals, in-can preservatives, molar ratio of UF glues and the like,
- wood-protection agents in used wood and wood for building purposes, wood-based materials, art-historical objects and in ambient room air.

In 2014, the analytical possibilities of the laboratory were adjusted to the needs of the market. In particular, this included to establish methods for determining softeners based on phthalic acid, isocyanates and selected non-metals by means of the atomic emission spectroscopy (MP-AES). For measuring formic acid and acetic acid from air samples, sampling and analytical determination were enhanced by ion chromatography, so that lower concentrations in air samples of real objects, such as organ pipes or museum showcases, can be measured. Isocyanates in air samples are determined by means of HPLC with fluorescence detection after derivatisation.

Formaldehyde Testing of Wood and Wood-based Materials

This testing area comprises the entire range of formaldehyde testing of wood, wood-based materials and related products.
Also in 2014, the CARB and IKEA quality benchmarks regarding formaldehyde emission and third-party monitoring of related products were important. Accordingly, wood-based materials must be certified and third-party monitored by a "Third Party Certifier" (TPC). For that purpose, the TPC needs to employ test laboratories that have been accredited for formaldehyde testing according to ASTM standards. The laboratory unit Chemistry of the EPH has been approved by CARB and IKEA and has at its disposal the required number of test chambers and testing and evaluation methods. Currently, the Chemical Laboratory is taking care of 33 manufacturers of wood-based materials within the scope of CARB certification. Apart from CARB, 29 companies are monitored on a voluntary basis regarding their compliance with E-1 requirements of wood-based materials and decorative foils in accordance with the DIBt guideline. Moreover, formaldehyde testing is a constituent part of the proof of performance as required within the scope of CE marking.

In addition to the standardised testing procedures for determining formaldehyde emissions from wood-based materials, special approaches for adhesives or cured bonding agents as well as formaldehyde emissions at temperatures of up to 120 °C are provided.

Gaseous Air Pollutants (VVOC/VOC/SVOC)

Emissions of very volatile, volatile and semivolatile organic compounds play an increasing role with respect to the quality of products for interiors. They may cause odours and substantially affect interior air quality.

Diverse products, such as modular furniture, upholstered furniture, elastic and rigid floor covers, adhesives and coatings, whose VOC emissions are regulated for obtaining environmental marks or approvals from building authorities are tested at the Chemical Laboratory.

Parquet and laminate production requires third-party monitoring acc. to DIBt requirements. Within the scope of third-party monitoring, VOC examinations were performed in 2014 on products of 48 authorisation holders.

VVOC/VOC/SVOC determination requires a wide range of sophisticated analytical equipment in conjunction with appropriate test chambers and sampling systems, which was further expanded in 2014. The laboratory is currently using 53 test chambers of various sizes.

The determination and evaluation of olfactory parameters as well as the sensed intensity and acceptance are increasingly being included in product testing. The EPH has successfully participated in such round-robin tests and is now performing those examinations in its new olfactory laboratory.

It is expected that, after the expiry of the trial phase, an olfactory evaluation will be incorporated into approvals by building authorities and into environmental marks, such as RAL-UZ 38 and RAL-UZ 176. Since 2014, the EPH has been accredited for testing in accordance with the Finnish M-1 classification. Evaluation of acceptance is one part of the requirements. Principally, the trend can be observed that, apart from international requirements in general, mainly the French VOC classification and the Belgian VOC regulation will gain in importance.

Coating Materials and Adhesives

Coating materials are paints, lacquers and foils. Statutory regulations as well as requirements of environmental marks limit, e.g., VOC, heavy metals, in-can preservatives, polycyclic aromatic hydrocarbonates (PAH) or softeners contained in these products. Another field relates to the determination of heavy-metal migration from coatings and materials for toys. In this respect, further elements were adopted by the testing programme after revising the DIN EN 71-3 standard. Examinations for paraffin contents and distribution (n/i paraffins), formaldehyde, phthalates and polycyclic aromatic hydrocarbons (PAH) in products and in air samples round off its scope of tasks (Fig. 6). In 2014, emphasis in this area was on the determination of VOC contents in lacquers. Apart from the classical methods of characterising bonding agents, such as the molar ratio, viscosity and formaldehyde emission, the carbon-nitrogen ratio can also be determined with the help of an elemental analyser. One method to determine diisocyanates in room air was elaborated and has been available since January 2014.

Fig. 5: Olfactory test acc. to ISO 16000, Part 28

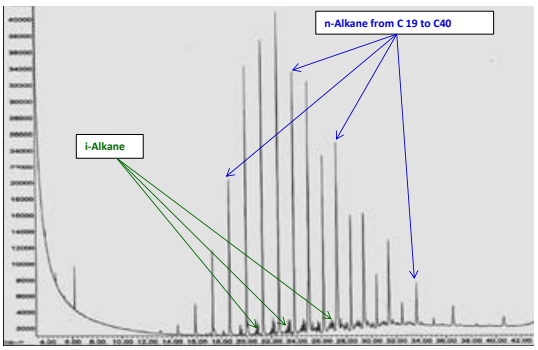


Fig. 6: Gas chromatogram of paraffins (n/i alkanes) extracted from a chipboard

Wood Preservatives

The use of wood preservatives has always raised many issues. They include the identification of wood protection agents in museum artefacts, roof constructions, structural elements, construction waste and in room air. In 2014, this area of chemical analytics dealt preferably with the following fields of activity:

- Monitoring of wood-based materials with a view to organochlorine wood protection agents,
- Determination of the organochlorine wood protection agents pentachlorphenol (PCP), lindana (HCH) and dichloro-diphenyl-trichlorethane (DDT) as well as mercury and arsenic in art objects and wood-based materials,
- Determination of compositions of crystalline sediments on structural timber (phosphatic flame retardants, fluorides, chlorides, sulphates and others), see Fig. 7.

Fig. 7: Macerated beam surface with hydrogen phosphate and sulphate crystals (Image by IHD, Weiß)

Laboratory Unit of (Physical) Material and Product Testing

Wood and Wood-based Materials

Also in 2014, examinations for determining elastomechanical and structural-physical properties of materials in the context of monitoring procedures by building authorities and of individual services were in the focus of the Physical Laboratory. Apart from wood and wood-based materials, the tests were performed increasingly on plastics and composite materials. In collaboration with the working group Structural Elements, tests were performed regarding the load-bearing capacity of structural parts that are used in windows and doors, as glass fasteners or other fastening elements.

Individual test programmes were set up and processed for partners in industry and trade. This related to the load-bearing behaviour of furniture mounting brackets and pin-like jointing elements as well as to the adhesive bonding quality of multiply parquet.

Fig. 8: Sample for testing adhesives for wooden structures statically loaded acc. to DIN EN 15416-2

After the publication of technical specification CEN/TS 16354, numerous underlay materials for floor coverings were characterised. This included tests for determining acoustic properties, heat conductivity, their behaviour under pressure, under permanent pressure and under dynamic load. Test equipment was procured for that purpose or appropriately adjusted. Similar tests were performed on wood-fibre insulation materials.

Within the scope of testing adhesives for use in timber construction, tests were performed for the first time to examine the long-term behaviour of adhesives acc. to DIN EN 15416-2. The testing methodology for these adhesives was adjusted to the requirements of the newly issued DIN EN 301 standard and the standard series of DIN EN 302. Suitability tests were also carried out on PVAc glues and adhesives for the manufacture of multiply solid wood panels.

Tests acc. to DIN EN 16205 for testing walking noise by means of a hammer mill were established in the Sound Laboratory. Also tests for walking noise and footfall noise were performed on a wide range of flooring systems.

Structural Elements

In the 2014 period under review, the work field "Structural Elements" saw a high demand for testing services regarding CE marking and safe structural elements.

CE-relevant tests focused on the determination of performance properties, such as air permeability, driving rain impermeability and wind resistance of large-size and combined window and door installations.

Regarding mechanical burglary protection, especially window system tests in resistance class RC2 (DIN EN 1627) for plastic profile systems in conjunction with specific security fittings were at the centre of attention. Another key area was the testing of window and door elements of wood or wood-aluminium in resistance class RC3, partially combined with antipanic requirements. These structural elements were intended preferably for use in the public domain.

Fig. 9: Deformation test

Supplementary to above-mentioned test services, numerous tests were performed in 2014, too, for proving the mechanical strength and durability (impact resistance, permanent functionality) of windows, doors, fittings or structural components. The determination of technical ventilation parameters of structural parts and products for the ventilation of living space must be mentioned as another, quite current field of testing.

The extent of determinations of technical heat insulation parameters for structural elements/profiles by way of calculation or measuring could continue to expand in 2014. Especially the field of outer doors saw a high increase. These services were assigned by numerous renowned German manufacturers.

The conversion of the climate test stand for windows now also allows to prove their deformation behaviour in extreme climates ranging from -10 °C to +70 °C, by being able to swiftly change the setup (ramps) within two hours at the longest.

Thanks to rendering top-quality services fully satisfying its customers' requirements, the EPH was able to further consolidate its acceptance among companies in the structural element industry and could also acquire many new customers in 2014.

Fig. 10: Testing of a passenger seat

Fig. 11: Test setup for mattresses

Furniture and Vehicle Seat Testing

General Furniture Testing

In 2014, the team of mechanical furniture and vehicle seat testing at the Dresden location was joined by Albrecht Lühmann. The laboratories has at its disposal state-of-the-art equipment for testing furniture, furniture fittings, matresses and upholstery material as well as road and rail vehicle seats. There was special demand in 2014 for tests on vehicle seats in accordance with GRULA (German acronym for the basics of design and testing of passenger seats in rail vehicles), also regarding physiological requirements.

The furniture test laboratory in Dresden faced the special challenges in connection with testing rail and road vehicle seats and is able, with the aid of the portal test stand set up in 2013, to react flexibly to the requirements of most varied falling object test samples.

Apart from standardised material and functional testing for obtaining the GS mark, tests accompanying developments in progress were on high demand in classical furniture testing, also tests performed acc. to RAL-GZ 430 in the capacity of an accredited test body of the Deutsche Gütegemeinschaft Möbel e.V.

The scope of tests on carcass and seating furniture and also tables for various uses is complemented by the testing and evaluation of upholstery and related materials. The proof of their fitness for use acc. to the requirements of RAL-UZ 119 "Blue Angel for Mattresses" was also a noted topic in 2014. The test stand for mechanically ageing matresses (roll-on testing) permits testing under normal climatic conditions 23/50 and in a sleeping den climate.

Certification Body for Device Safety

In 2014, the GS Certification Body was able, thanks to the services provided by the furniture test bodies in Dresden and Detmold, to record a growth in orders by 57 %. The Certification Body newly issued 14 GS certificates and extended 13 GS certificates. A list of GS certificates issued has been published on EPH's website under the "Furniture" tab.

Currently, 37 manufacturers of furniture products are registered with the Certification Body.

Laboratory Unit of Surface Testing

Floor Covering

Tests on floors of various elastic surfaces, with wood-based materials as a substrate, but also elastic LVT flooring acc. to EN ISO 10582 with click connection were at the centre of attention in 2014 in the laboratory area. Also testing of multi-layered modular floors acc. to EN 16511 were on high demand. In addition to that, a multitude of tests was performed on classical wooden and laminate floors, but also on various cork flooring variations. And also testing of the system of underlay material for laminate floors acc. to CEN TS 16354 came increasingly into focus.

2014 was the first year when the EPH was fully accredited as a notified fire test body for floor covers acc. to EN 14041 and EN 14342. This was reflected in a clearly increased turnover in fire tests performed on floors and underlay material.

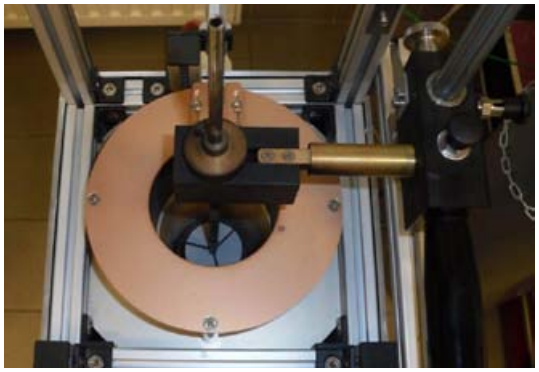


Fig. 12: Non-combustibility oven

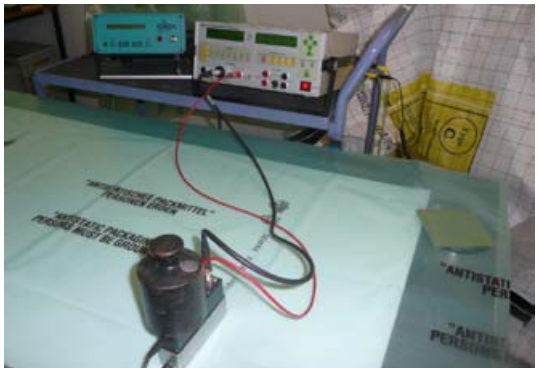


Fig. 13: Measuring the electrical resistance of packaging material

The fire test stand for floor coverings and wall claddings for vessels acc. to the IMO code was increasingly asked for as development-in-progress tests. The audits for being approved as an IMO test body and for being accredited to perform tests to prove the non-combustibility of building products, for example, by means of a non-combustibility oven (Fig. 12) or to establish the calorific value of materials were passed.

Testing of Coatings and Surfaces

Especially wood coatings for outdoor use were in the focus in 2014 when it came to determining the usability properties of lacquers and varnishes. Many tests were aimed at proving the sealing effect towards wood ingredients by applying coats of priming.

And again a large number of surface tests assigned by manufacturers of internal doors was performed in accordance with the revised version of RAL GZ 426/5.

Also tests simulating environmental conditions (resistance towards climate, light, temperature and weathering) were increasingly on demand. One focus was on proving the applicability of various wood surfaces of counters to the exclusive interior design of stores under varying climatic conditions worldwide, remaining yet unaffected. Various climate resistance tests were also performed for pieces of furniture in caravan manufacture.

Electrostatic Evaluation of Surfaces

To prevent floors from charging electrostatically when being walked on continues to be an important topic for floor cover manufacturers and users alike. That's why again in 2014, a multitude of elastic and laminate floor covers were evaluated in walking tests acc. to EN 1815 regarding their electrostatic charging. But also many other products and materials, particularly those containing plastics, such as packaging material (Fig. 13), were tested regarding their electrostatic charging behaviour and their usability in explosion-protected areas. Very complex processes, such as the fuelling of cars, are the subject of considerations when dealing with electrostatic charging. Car-fuelling processes are simulated in the EPH's test chamber at low temperatures (5 °C) and in low humidity (< 30 %) (Fig. 14).

Fig. 14: Laboratory test for recording electrostatic charges developing during fuelling a car

Trainings and Instructions

Tailor-made trainings for companies on topics, such as "Electrostatic charges – How to detect, remove and avoid them" was continued. Also potential heads of laboratories were prepared in individual instruction courses for running laboratories in production facilities for wood-based/flooring materials, focussing on determining mechanical parameters and surface properties as well as formaldehyde emissions.

Laboratory Unit NIMM-EPH Detmold

The equipment for furniture and material testing at the Detmold test laboratory was further improved in 2014 and extended by the end of the year by procuring another test field for testing seating furniture.
NIMM-EPH was able to further consolidate its standing as a recognised partner in the furniture and furniture supply industry in the OWL/Lippe region and beyond. The voluntary course to become a "Furniture Test Technician", which was started in 2011 at the test facility, supplementing the training of technicians at the Felix-Fechenbach-Berufskolleg (FFB) in Detmold, was successfully completed by eight participants in 2014, having obtained a qualification certificate.

Recognised Body for Proving the Conformity and Usability of Building Products (PÜZ)

In preparation of the system audit performed by DAkkS following the criteria of the EN 17065 standard, the structure of the „Certification Body for Products and On-site Production Monitoring" was reorganised in 2014.

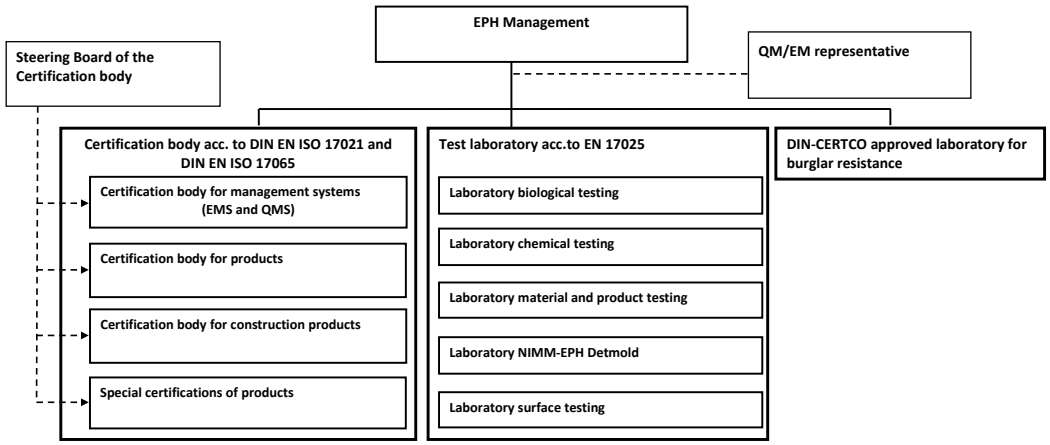


Fig. 15: EPH's organisational structure

In accordance with the requirements of the standard and of the accreditation body (DAkkS), a guiding committee was installed to take care of the public interest in all certification decisions. The worldwide cooperation with representatives and partner institutes was intensified in 2014. With regard to the requirements of both CARB/IKEA and the European Construction Products Regulation (BauPVo), the EPH and its representatives attributed high importance to the meeting that took place in Dresden in 2014. Apart from the obligatory part devoted to training, the special focus was on the mutual exchange of experiences and getting to know each other personally. In 2014, the EPH succeeded in offering its services to numerous businesses worldwide. For that purpose, the special competence of the Dresden staff and of representatives is a sound basis for supporting enterprises worldwide in correctly interpreting the sophisticated rules and requirements of the BauPVO when they are confronted with drafting declarations for product specifications and with complying with the modified rules of CE marking wood-based materials acc. to EN 13986, of floor covers acc. to EN 14041 and EN 14342, of wall and ceiling claddings acc. to EN 438-7 and of windows and doors acc. to EN 14351-1.
But the German usability rules for building products acc. to the Federal States' Building Regulations (LBO) did not lose in importance either. A series of products required the approval or a test certificate issued by building authorities, on top of CE marking.

In the face of the duty in Germany to obtain, in addition to CE marking, approvals from the building authorities for elastic, textile and laminate flooring acc. to EN 14041, for wooden flooring acc. to EN 14342 and for solid wood panels, the EPH further extended its scope of services as a third-party monitoring body in cooperation with partners in 2014. As regards flooring, 45 facilities in 19 countries are currently being monitored.
The international network of competent inspectors for annual third-party monitoring of manufacturers after they had been issued an approval by building authorities continued to be enhanced in accordance with the quality management rules of our product certification body.

The EPH is a member of the Group of European CARB Certifiers and, as an approved CARB (TPC 10) body, was assigned in 2014 with the third-party monitoring of 33 facilities. Apart from CARB, 29 businesses are being monitored regarding their compliance with E-1 requirements for wood-based materials and decorative foils acc. to the DIBt guideline on a voluntary basis.
Beyond that, the EPH was active in 2014 as a monitoring body for statutorily unregulated (voluntary) quality associations, such as Qualitätsgemeinschaft Holzwerkstoffe e.V., in monitoring WPC products and in monitoring and certifying thermally modified timber (TMT) and also for the new RAL quality association "3-D Furniture Fronts".

Certification Body for Management Systems

The Certification Body for Management Systems, which has been accredited since 1995 and which used to be a structural unit of the IHD, has now been under the roof of the EPH since 22 December 2014. It is, apart from having recently been re-accredited by the Deutsche Akkreditierungsstelle (DAkkS) for the certification of quality management systems (QMS) acc. to DIN EN ISO 9001, also accredited for the certification of environmental management systems (EMS) acc. to DIN EN ISO 14001. The accreditations remain valid until 2020.
For its expert competence, it purposefully keeps being specialised in the fields of wood-related trades, the manufacture of wood and wooden materials, the manufacture of windows, doors, façade and structural elements, the manufacture of mechanical and chemical pulp, paper and cardboard as well as closely related areas in the chemcial industry, engineering, commercial trade and in rendering services.

First of all, the QMS helps a company to guarantee the quality of its products with the help of economic organisational structures, thus improving its competitiveness. It also builds the clients' confidence in their capability of supplying products of stable quality. The EMS serves to continually enhance environmental protection, especially to prevent environmentally relevant incidents by uncovering needs for action or removing weak points. Moreover, it boosts its image towards authorities, clients, suppliers, insurers and others.
It suggests itself to combine QMS and EMS as numerous individual measures, such as taking legal requirements into account, defining tasks and responsibilities, training staff, managing and guiding processes or performing internal audits, are constituent parts of both systems.
As early as in December 2014, the certification body for managements systems successfully finalised the first two audits combining QMS and EMS already.

Cooperation in Expert Commissions and Tuition

IHD Membership in

Arbeitskreis Dresdner Informationsvermittler e.V. (ADI)
Berufsakademie Sachsen, Staatliche Studienakademie Dresden
DECHEMA Gesellschaft für Chemische Technik und Biotechnologie e.V.
Deutsche Forschungsgesellschaft für Oberflächenbehandlung e.V. (DFO)
European Wood Drying Group (EDG)
Fachagentur Nachwachsende Rohstoffe e.V. (FNR)
Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V. (FGW)
Forschungsvereinigung „Holztechnologie" in der Arbeitsgemeinschaft industrieller Forschungsvereinigungen e.V. (AiF)
Forschungsvereinigung Werkstoffe aus nachwachsenden Rohstoffen e.V. Rudolstadt
IHK-Fachausschuss Technologie und Innovation
Internationaler Verein für Technische Holzfragen e.V. (iVTH)
Interessengemeinschaft Leichtbau e.V. (igel)
Kompetenzzentrum LignoSax
Netzwerk „Dresden – Stadt der Wissenschaften"
Sächsische Industrieforschungsgemeinschaft e.V. (SIG)
Sächsischer Holzschutzverband e.V.
Association of European Producers of Laminate Flooring (EPLF)
Verband Innovativer Unternehmen e.V. (VIU)
Wirtschaftsrat Deutschland

Activities as Experts and Evaluators

Beiratsvorsitzender im Sächsischen Holzschutzverband e.V.	Björn Weiß
Fachagentur Nachwachsende Rohstoffe e.V.	Dr. Steffen Tobisch
DAkkS-Fachbegutachter	Dr. Bernd Devantier
Kuratorium der WNR	Dr. Steffen Tobisch
Mitglied des Fachgremiums Holzschutz der IHK zu Leipzig	Björn Weiß

Involvement in Standardisation Committees

DIN – NA Timber Industry and Furniture (NHM)		
NA 042	Board	Dr. Steffen Tobisch
NA 042-01-07-10 AK	Arbeitskreis Beratungsausschuss zur DIN 4074 Teil 3	Jens Gecks
NA 042-01-14 AA	Spiegelausschuss zu CEN/TC 175 „Rund- und Schnittholz"	Dr. Wolfram Scheiding
NA 042-02-06 AA	Beschichtete Holzwerkstoffe	Dr. Rico Emmler
NA 042-02-15 AA	Holzwerkstoffe	Dr. Steffen Tobisch
NA 042-02-15-01	Spiegelausschuss zu CEN/TC249/WG13	Andreas Weber Matthias Weinert
NA 042-03-01 AA	Holzschutz-Grundlagen	Björn Weiß
NA 042-03-04 AA	Bekämpfender Holzschutz	Björn Weiß
NA 042-03-06 AA	Spiegelausschuss zu CEN/TC 38 „Dauerhaftigkeit von Holz und Holzprodukten"	Kordula Jacobs Dr. Wolfram Scheiding
NA 042-04-30 AA	Laminatfußböden	Dr. Rico Emmler
NA 042-05-02 AA	Küchen/Badmöbel	Dr. Rico Emmler
NA 042-05-04 AA	Außenmöbel	Andreas Gelhard
NA 042-05-05 AA	Schul- und Objektmöbel	Jürgen Korf
NA 042-05-08 AA	Möbeloberflächen	Dr. Rico Emmler
NA 042-05-11 AA	Stühle, Tische	Andreas Gelhard
NA 042-05-13 AA	Kindermöbel	Andreas Gelhard
NA 042-05-14 AA	Betten/Matratzen	Andreas Gelhard
NA 042-05-15 AA	Polstermöbel	Andreas Gelhard
NA 042-05-19 AA	Büromöbel	Andreas Gelhard
CEN/TC38/WG 28	Performance classification	Dr. Wolfram Scheiding
CEN/TC112	Wood-based panels	Dr. Steffen Tobisch
CEN/TC112/WG4	Test methods	Jens Gecks
CEN/TC112/WG5	Regulated dangerous substances	Dr. Steffen Tobisch Dr. Sebastian Weidlich
CEN/TC112/WG7	Semi-furnished and finished products	Dr. Rico Emmler
CEN/TC112/WG8	OSB	Dr. Detlef Krug
CEN/TC112/WG9	Solis Wood Panels	Dr. Detlef Krug
CEN/TC112/WG11	Particle Boards and Fiberboards	Dr. Detlef Krug
CEN/TC112/WG13	Mandate	Dr. Steffen Tobisch
CEN/TC134/WG9	Laminate Floorings	Dr. Rico Emmler
CEN/TC175/WG33	Bambooflooring	Dr. Rico Emmler
CEN/TC175/WG36	Specific user requirements - Other timber products	Dr. Wolfram Scheiding
CEN/TC207/WG7	Furniture Surfaces	Dr. Rico Emmler
CEN/TC249/WG4	HPL	Dr. Rico Emmler
ISO/TC89	Wood-based panels	Dr. Steffen Tobisch
ISO/TC219/WG3	Laminate Floorings	Dr. Rico Emmler

DIN – NA Construction (NABau)		
NA 005-04 FBR	Holzbau	Dr. Steffen Tobisch
NA 005-04-01 AA	Holzbau	Jens Gecks Dr. Steffen Tobisch
NA 005-04-01-03 AK	Holzwerkstoffe/Schnittholz	Jens Gecks Dr. Steffen Tobisch
NA 005-04-01-04 AK	Geklebte Produkte	Jens Gecks
NA 005-04-01-06 AK	Holzschutz, Holzmaste, Schalungsträger	Jens Gecks
NA 005-04-01-08 AK	Prüfnormen, charakteristische Werte	Jens Gecks
NA 005-09-02 AA	Einbruchschutz	Joachim Beständig
DIN – NA Material Testing (NMP)		
NA 062-04-37 AA	Prüfung weich-elastischer Schaumstoffe	Andreas Gelhard
DKE in DIN and VDE Electrostatics		
AK 185	Elektrostatische Sicherheit	Detlef Kleber
KRdL in VDI and DIN Commission for Keeping the Air Clean		
NA 134-01-24 AA	Emissionsminderung/Holzbearbeitung und -verarbeitung	Karsten Aehlig Dr. Wolfram Scheiding
NA 134-03-07-04 UA	Bioaerosole und biologische Agenzien – Luftgetragene Mikroorganismen und Viren	Kordula Jacobs

Collaboration in Expert Committees and Working Groups

AK3 „Möbel" im EK5	Andreas Gelhard
AMK – Arbeitsgruppe Technik und Normung	Dr. Rico Emmler
Anwendungstechnischer Ausschuss Fachgruppe Dekorative Schichtstoffplatten Arbeitsausschuss Elektrostatische Aufladung bei der DECHEMA	Lars Blüthgen Dirk Hohlfeld Detlef Kleber
Arbeitsgruppe „Bodenbeläge und Klebstoffe" beim DIBt	Karsten Aehlig
Arbeitsgruppe „Parkette" beim DIBt	Karsten Aehlig
Arbeitsgruppe „Sachverständige Prüfstellen" beim DIBt	Martina Broege
Arbeitskreis „Analytik" des RAL-Güteausschusses „Holzschutzmittel"	Dr. Martin Fischer
Arbeitskreis Dresdner Informationsvermittler e.V. (ADI)	Dr. Siegfried Tzscherlich
Arbeitskreis Kastenmöbel der Deutschen Gütegemeinschaft Möbel e.V.	Matthias Weinert
Arbeitskreis Polstermöbel der Deutschen Gütegemeinschaft Möbel e.V.	Andreas Gelhard
Arbeitskreis Umwelt/Wohnhygiene der Deutschen Gütegemeinschaft Möbel e.V.	Karsten Aehlig Martina Broege
Bund-Länder Arbeitskreis "Materialprüfung"	Dr. Bernd Devantier
DECHEMA-Fachgremium „Mikrobielle Materialzerstörung"	Katharina Plaschkies

DFO-Fachausschuss Beschichtung von Holz und Holzwerkstoffen	Dr. Rico Emmler Detlef Kleber Dr. Christiane Swaboda Dr. Mario Beyer
Deutsche Gesellschaft für Mykologie	Kordula Jacobs
Deutschsprachige Mykologische Gesellschaft	Natalie Rangno
EK 5: „Sonstige Technische Arbeitsmittel und verwendungsfertige Gebrauchsgegenstände" EPAL/UIC Working group "Technology"	Dr. Bernd Devantier Martina Broege
EPLF Working group "Technology"	Dr. Rico Emmler
EEPLF Expert Committee "Technology", Ad-hoc-Working groups „Walking sound" and "Underlayment"	Heiko Kühne
Erfahrungsaustauschkreis „Einbruchschutz", EK-ES	Joachim Beständig
European Forest-Based Sector Technology Platform German National Support Group	Mathias Rehm
Europäische Gesellschaft für Lackiertechnik	Detlef Kleber
Fachbeirat der Stiftung Warentest	Karsten Aehlig Dr. Bernd Devantier Dr. Rico Emmler
Forschungskreis Holzwerkstoffe	Dr. Detlef Krug
International Research Group on Wood Protection (IRG/WP)	Kordula Jacobs Dr. Wolfram Scheiding
Programmbeirat Forstwissenschaften der TU Dresden	Dr. Steffen Tobisch
Sektorgruppe SG06D „Fenster und Türen"	Heiko Hofmann
Sektorgruppe SG18/20D „Holzbau/Holzwerkstoffe"	Jens Gecks Dr. Steffen Tobisch
Wissenschaftlich-Technische Arbeitsgemeinschaft für Bauwerkserhaltung und Denkmalpflege e.V., Referat 1 „Holz"	Björn Weiß
WTA-AK19 „Dekontamination von mit Holzschutzmitteln belastetes Holz"	Karsten Aehlig
Zertifizierungsausschuss „Einbruchschutz"	Joachim Beständig
Studienkommission Technik der Berufsakademie Sachsen	Dr. Mario Beyer
Nationale Expertengruppe zum BVT – Merkblatt Konservierung von Holz und Holzerzeugnissen mit Chemikalien	Dr. Wolfram Scheiding Dr. Mario Beyer
Fachausschuss „Regelungen für chemische Einsatzstoffe und Emissionsgrenzwerte" in den Österreichischen Umweltzeichen für Produkte aus Holz und Holzwerkstoffen/Möbel/Fußbodenbeläge/ Witterungsbeständige Holzprodukte	Martina Broege

Tuition

Subject	Teaching facility	Member of IHD staff
Anatomy and chemistry of wood	Staatliche Studienakademie Dresden Studienrichtung Holz- und Holzwerkstofftechnik	Dr. Mario Beyer Björn Weiß
Electrostatics	BG Rohstoffe und chemische Industrie (RCI), Ausbildungszentrum Maikammer	Detlef Kleber
Liquid lacquering/powder lacquering	Berufsschule Adolf Kolping Dresden	Bernd Brendler
Wood in the context of a sustainable climate strategy of political relevance	Technische Universität Dresden	Dr. Steffen Tobisch
Wood science/wood preservation	Sächsischer Holzschutzverband e.V.	Björn Weiß
Wood preservation	Europäisches Institut für postgraduale Bildung (EIPOS)	Björn Weiß
Wood preservatives	Europäisches Institut für postgraduale Bildung (EIPOS)	Karsten Aehlig
Wood-based materials	Staatliche Studienakademie Dresden Studienrichtung Holz- und Holzwerkstofftechnik	Dr. Steffen Tobisch
Design, wood engineering, structural elements	Staatliche Studienakademie Dresden Studienrichtung Holz- und Holzwerkstofftechnik	Joachim Beständig Kerstin Schweitzer
Surface finishing	Technische Universität Dresden	Martina Broege Dr. Rico Emmler (Lehrbeauftragter) Dr. Ingrid Fuchs Detlef Kleber Dr. Christiane Swaboda
Pellets	Technische Universität Dresden	Dr. Steffen Tobisch
Furniture and interior design planning	Staatliche Studienakademie Dresden Studienrichtung Holz- und Holzwerkstofftechnik	Matthias Weinert
Quality management/ measuring and testing technology	Staatliche Studienakademie Dresden Studienrichtung Holz- und Holzwerkstofftechnik	Dr. Bernd Devantier Dr. Ingrid Fuchs
The material vs. the energetic use of wood	Technische Universität Dresden	Dr. Steffen Tobisch
Finishing and functionalisation of wood and wood-based materials	Technische Universität Dresden	Dr. Rico Emmler Dr. Wolfram Scheiding Dr. Steffen Tobisch
Research management and factory planning	Hochschule für nachhaltige Entwicklung Eberswalde (FH)	Lars Blüthgen

Publications and Presentations

Publications

Aehlig, K.; Keller, S.; Gäbele, M.; Tenzler, C.
Formaldehydabgabe aus Massiv- und Sperrhölzern unter höheren nutzungstypischen Temperaturen
Holztechnologie 55(2014)4. - pp. 5 - 11

Beyer, M.; Aehlig, K.
Farbreaktionen und ihre Ursachen; IHD Dresden: Natürliche Gerbstoffe im Holz - nützlich, aber auch problematisch
Parkett-Magazin (2014)4. - pp. 98 - 100

Blüthgen, L.
3-D-Armierung
Poster- und Projektpräsentation – 21. Innovationstag Mittelstand des BMWi, Berlin, 22 May 2014

Bonigut, J.
Entwicklung multifunktionaler wachshaltiger Additive für Holzwerkstoffe
Poster- und Projektpräsentation – 21. Innovationstag Mittelstand des BMWi, Berlin, 22 May 2014

Bonigut, J.; Krug, D.
Thermisch behandelte Massivholzplatten für Fassaden
Holz-Zent.bl. 140(2014-10-10)41. - pp. 997 - 998

Bonigut, J.; Krug, D.; Mieth, A.; Abraham, J.
Wasser-Abweiser. IHD prüft Additive auf Montanwachsbasis für die Hydrophobierung von Holzwerkstoffen
MDF-Magazin 2014. - pp. 66 – 69

Bonigut, J.; Krug, D.; Stuckenberg, P.
Dimensional stability and irreversible thickness swell of thermally treated oriented strandboards (OSB)
Eur. J. Wood Prod. 72(2014)5. - pp. 593 - 599

Brischke, C.; Welzbacher, C.R.; Gellerich, A.; Bollmus, S.; Humar, M.; Plaschkies, K.; Scheiding, W.; Alfredsen, G.; Van Acker, J.; De Windt, I.
Wood natural durability testing under laboratory conditions: results from a round-robin test
Eur. J. Wood Prod. 72(2014)1. - pp. 129 - 133

Emmler, R.
Systemgedanke; Neue Normen für Laminatböden und deren Unterlagen
Laminat-Magazin 18(2014). - pp. 100 - 103

Emmler, R.; Fuchs, I.; Adamska-Reiche, M. A.
Neueste Entwicklungen beim Inkjet-Digitaldruck auf Holzwerkstoffen
HOB, Holzbearb. 61(2014)6. - pp. 56 - 58

Fischer, M.; Mäbert, M.; Jacobs, K.; Bonigut, J.; Krug, D.
Hydrothermischer Aufschluss von Lignozellulosen sowie zugehörige Analytik
Holztechnologie 55(2014)2. - pp. 5 - 10

Fuchs, I.; Spensberger, J.
Die Geschichte der sächsischen Möbelindustrie
Holz-Zentralbl. 140(2014-09-12)37. - pp. 883 - 884

Hettrich, K.; Pinnow, M.; Volkert, B.; Passauer, L.; Fischer, S.
Novel aspects of nanocellulose
Cellulose 21(2014). - pp. 2479 - 2488

Krug, D.; Weidlich, S.; Lilie, B.
Untersuchungen zur prinzipiellen Verwendbarkeit von Cellulosederivaten als Klebstoff in der Holzwerkstoffindustrie
Holztechnologie 55(2014)5. - pp. 18 - 24

Kühne, H.; Blüthgen, L.; Thiele, E.; Kuhne, M.; Döring, H.
Bautextilien für dauerhaftes Feuchtemonitoring in Holz- und Betonbauwerken
Holztechnologie 55(2014)4. - pp. 30 - 37

Kühne, H.; Will, J.; Friedl, D.; Thiele, E.
Mehrlagige holzbasierte Schichtwerkstoffe mit dreidimensionaler Armierung
Holztechnologie 55(2014)3. - pp. 18 – 25

Nenoff, P.; Winter, I.; Winter, A.; Krüger, C.; Herrmann, J.; Gräser, Y.; Rangno, N.; Maier, T.; Gräser, Y.
Trichophyton thuringiense H. A. Koch 1969 – ein seltener geophiler Dermatophyt, erstmals vom Menschen isoliert
Hautarzt 65(2014)3. - pp. 221 - 228

Passauer, L.
Analyse- und Prüfverfahren zur schnelleren Prognose des Langzeitschutzes von Holzbeschichtungen
Poster- und Projektpräsentation – 21. Innovationstag Mittelstand des BMWi, Berlin, 22 May 2014

Passauer, L.
Neuartige Lichtschutzkonzepte zur Stabilisierung dunkler Hölzer und von Thermoholz
Poster- und Projektpräsentation – 21. Innovationstag Mittelstand des BMWi, Berlin, 22 May 2014

Plaschkies, K.; Jacobs, K.; Scheiding. W.; Melcher, E.
Investigations on natural durability of important European wood species against wood decay fungi. Part 1: Laboratory tests.
Internat. Biodeterioration & Biodegradation 90(2014)May. - pp. 52 - 56

Rangno, N.; Heiser, V.; Thiele, G.; Jacobs, K.; Langensiepen, P.; Scheiding, W.
Sequence analysis of the rDNA-ITS-Region of 50 wood decay fungi for development of probes for LCD-array diagnostics
Mycoses 57(2014)Suppl.2. - p. 25

Rangno, N.; Jacobs, K.
Sequenzanalyse der ITS-rDNA-Region von 27 Hausfäulepilzen für die Entwicklung der DNA-Chip-Sonden
Holztechnologie 55(2014)1. - pp. 33 – 38

Rangno, N.; Jacobs, K.; Langensiepen, P.
Effective DNA extraction methods for molecular diagnostics of wood decay fungi
Mycoses 57(2014) Suppl.2. - p. 43

Scheffler, R.; Blüthgen, L.; Gecks, J.; Bues, C.T.; Bäucker, E.
Dauerschwingversuche an Prüfkörpern der Bambusarten *Phyllostachys pubescens* und *Guadua angustifolia*; Teil 2: Results und Schlussfolgerungen
Holztechnologie 55(2014)1. - pp. 11 – 15

Schweitzer, K.
Hochwärmedämmende Kastenfenster bis Schallschutzklasse VI
Poster- und Projektpräsentation – 21. Innovationstag Mittelstand des BMWi, Berlin, 22 May 2014

Schweitzer, K.
Kastenfenster sind eine leistungsfähige Alternative
bauelement + technik 9(2014)5 - pp. 38 – 39

Schweitzer, K.
Kastenfenster neu entdecken
baustoff praxis 33(2014)10 - pp. 20 – 21

Trabandt, S.
Neue benutzerorientierte Möbel für die Pflege
Poster- und Projektpräsentation – 21. Innovationstag Mittelstand des BMWi, Berlin, 22 May 2014

Wagenführ, R.; Weiß, B.
Abura
Holztechnologie 55(2014)2. - no page number

Wagenführ, R.; Weiß, B.
Ako
Holztechnologie 55(2014)6. - no page number

Wagenführ, R.; Weiß, B.
American Whitewood
Holztechnologie 55(2014)3. - no page number

Wagenführ, R.; Weiß, B.
Bintangor
Holztechnologie 55(2014)4. - no page number

Wagenführ, R.; Weiß, B.
Eberesche
Holztechnologie 55(2014)1. - no page number

Wagenführ, R.; Weiß, B.
Fichte
Holztechnologie 55(2014)5. - no page number

Weinert, M.
Möbelleichtbau durch Falttechnologie
Poster- und Projektpräsentation – 21. Innovationstag Mittelstand des BMWi, Berlin, 22 May 2014

Wenderdel, C.; Schulz, T.; Strunz, A.-M.
Mitteldichte Faser-Schachtel. IHD untersucht die Erzeugung von dünnen MDF für Verpackungszwecke (Trockenkarton)
MDF-Magazin 2014. - pp. 74 – 77

Wenderdel, C.; Weber, A.; Pfaff, M.; Sonntag, U.; Theumer, T.
Spezielle Methoden zur morphologischen Charakterisierung lignocelluloser Faserstoffe; Teil 1: Stand der Technik and theoretische Ableitung einer Partikelklassifizierung
Holztechnologie 55(2014)6. - pp. 12 - 19

Wiedemann, J.; Schweitzer, K.
Visualisierung des Strömungsverhaltens der im Zwischenraum von Kastenfenstern eingeschlossenen Luft mittels CFD (Computational Fluid Dynamics)
Holztechnologie 55(2014)4. - pp. 18 - 24

Presentations

Bonigut, J.; Krug, D.
Thermisch behandelte Massivholzplatten für Fassaden
8. Europäischer TMT-Workshop, Dresden, 22-23 May 2014

Direske, M.; Scheiding, W.; Flade, P.
A new test method to determine cracking susceptibility of thermally modified wood
7th European conference on wood modification ECWM7, Lisbon, Portugal, 10-12 March 2014

Emmler, R.
A new technology for onsite UV/UV-LED curing of wood flooring finishes
PRA's 9th Internat. Wood Coating Congress, Amsterdam, The Netherlands, 14-15 October 2014

Emmler, R.
Harmonisierung der EN-Normung für Möbeloberflächen aus CEN TC 207 WG 7 mit den Normen für HPL (EN 438-2; EN 438-3) und für melaminbeschichtete Platten (EN 14322/EN 14323)
HDH-Workshop „Möbeloberflächen", Frechen, 25 February 2014

Emmler, R.
Multilayer-Products: Dimensional stability under influence of changing temperature – normative test methods and requirements
MMFA-Mitgliederversammlung, Frankfurt a.M., 30 September 2014

Emmler, R.
Multilayer-Products – Light fastness – normative test methods and requirements
MMFA-Mitgliederversammlung, Frankfurt a.M., 30 September 2014

Emmler, R.
Prüfverfahren für Möbel- oder Türkanten, die in Deutschland angewendet werden – Überblick, Vor- und Nachteile in Hinblick auf eine europäische Normung
HDH-Workshop „Möbeloberflächen", Frechen, 25 February 2014

Emmler, R.
Untersuchungen zur Reproduzierbarkeit der Prüfmethoden zur Klassifikation nach CEN TS 16209
HDH-Workshop „Möbeloberflächen", Frechen, 25 February 2014

Emmler, R.; Fuchs, I.; Adamska-Reiche, M.A.
Neues zum Inkjet-Digitaldruck auf Holz- und Holzwerkstoffen
16. Holztechnologisches Kolloquium, Dresden, 3-4 April 2014

Flade, P.
Rissbildung an TMT: Problem und Lösungsansätze
8. Europäischer TMT-Workshop, Dresden, 22-23 May 2014

Flade, P.
Thermo-Esche funktioniert nicht? Probleme, Erfolge, Alternativen
Terrassendielen-Seminar des GD Holz, Hamburg, 13 February 2014

Flade, P.; Scheiding, W.; Weiß, B.
Performance of thermally modified timber in use class 3.2
1st Conference on performance and maintenance of bio-based building materials influencing the life cycle and LCA, COST Action FP 1303, Kranjska Gora, Slovenia, 23-24 October 2014

Fischer, S.; Thümmler, K.; Bender, H.; Passauer, L.; Tech, S.; Wagenführ, A.
Biobasierte Brandschutzmittel für Holzwerkstoffe und Dämmstoffe
16. Holztechnologisches Kolloquium, Dresden, 3-4 April 2014

Gauser, T.
Möbelentwicklung im Wandel
Poster. – Entwerfen, Entwickeln, Erleben (EEE), Dresden, 26-27 June 2014

Hero, T.; Weidlich, S.; Lilie, B.; Krug, D.
Poster. – Studie zur prinzipiellen Verwendung von Cellulose-Derivaten (CD) als Klebstoff
2. Kooperationsforum „Kleben von Holz und Holzwerkstoffen", Würzburg, 23-24 June 2014

Jacobs, K.; Weiß, B.; Plaschkies, K.; Scheiding, W.
Pilzspektrum an frei bewitterten Hölzern – Identifizierung holzzerstörender Pilze an Buchen- und Kiefernholz und Vergleich verschiedener Standorte
Deutsche Holzschutztagung 2014, Brunswick, 18-19 September 2014

Jacobs, K.; Weiß, B.; Plaschkies, K.; Scheiding, W.; Conti, E.; Melcher, E.; Fojutowski, A.; LeBayon, I.
Diversity of wood decay fungi in test fields across Europe
1st Conference on performance and maintenance of bio-based building materials influencing the life cycle and LCA, COST Action FP 1303, Kranjska Gora, Slovenia, 23-24 October 2014

Kleber, D.; Emmler, R.
Elektrostatische Aufladung von WPC-Terrassendielen – Ursachen und Diskussion von Möglichkeiten zur Vermeidung und Sanierung
Terrassendielen-Seminar des GD Holz, Hamburg, 13 February 2014

Krombholz, A.; Weber, A.; Werner, P.
Nutzung von Produkten des Organosolv-Verfahrens für Werkstoffe und Bauteile im Rahmen der Bioökonomie
naro.tech, 10. Internationales Symposium „Werkstoffe aus nachwachsenden Rohstoffen", Erfurt, 17 September 2014

Meyer, L.; Maier, G.; Jacobs, K.; Brischke, C.
Using isolates of decay fungi from field test samples for durability tests under laboratory conditions
1st Conference on performance and maintenance of bio-based building materials influencing the life cycle and LCA, COST Action FP 1303, Kranjska Gora, Slovenia, 23-24 October 2014

Passauer, L.; Beyer, M.; Freese, M.; Fischer, S.; Hillig, J.; Peters, J.
A multi-method approach to predict the weather-related ageing of exterior wood coatings
PRA's 9th Internat. Wood Coating Congress, Amsterdam, The Netherlands, 14-15 October 2014

Passauer, L.; Beyer, M.; Freese, M.; Fischer, S.; Hillig, J.; Peters, J.
Neue Analyse-Verfahren zur Prognose der Dauerhaftigkeit von Holzbeschichtungen im Außenbereich
DFO-Qualitätstage, Karlsruhe, 21-22 October 2014

Passauer, L.; Beyer, M.; Freese, M.; Fischer, S.; Peters, J.
Untersuchungen von Mess- und Prüfverfahren zur schnelleren Prognose der Leistungsfähigkeit von Holzbeschichtungen für den Außenbereich,
DFO-Tag der Holzbeschichtung, Bad Salzuflen, 18 March 2014

Passauer, L.; Beyer, M.; Freese, M.; Fischer, S.; Peters, J.
A multi-method approach for the prediction of the weather-related ageing of wood coatings.
2nd European Technical Coatings Congress, Cologne, 2-5 September 2014

Plaschkies, K.
Mikrobieller Befall an Kunstgütern aus Holz. Ursachen, Diagnostik, Bekämpfung, Prävention
3. Mikro-Workshop Inn-O-Kultur „Mikrobieller Befall auf Kulturgütern", 13 May 2014, Jena

Plaschkies, K.; Scheiding, W.
Susceptibility of wood-polymer composites against mould, wood staining fungi and algae
1st Conference on performance and maintenance of bio-based building materials influencing the life cycle and LCA, COST Action FP 1303, Kranjska Gora, Slovenia, 23-24 October 2014

Prieto, J.; Passauer, L.; Beyer, M.
Novel colour stabilization concepts for dark wood and TMT
2nd European Technical Coatings Congress, Cologne, 2-5 September 2014

Prieto, J.; Passauer, L.; Beyer, M.; Emmler, R.
Untersuchungen für Lichtschutzlösungen dunkler Hölzer.
DFO-Tag der Holzbeschichtung, Bad Salzuflen, 18 March 2014

Rangno, N.
Entwicklung eines PCR-ELISA – Verfahrens für die Diagnostik von Dermatophyten
Poster. – 21. Innovationstag des BMWi, Berlin, 22 May 2014

Rangno, N.; Heiser, V.; Thiele, G.; Jacobs, K.; Langensiepen, P.; Scheiding, W.
Sequenz analysis of the rDNA-ITS region of 50 wood decay fungi for development of probes for LCD-array diagnostics
48. Wiss. Tagung der Deutschsprachigen Mykologischen Gesellschaft, Salzburg, Austria, 4-6 September 2014

Rangno, N.; Jacobs, K.; Langensiepen, P.
Effective DNA extraction methods for molecular diagnostics of wood decay fungi
Poster. – 48. Wiss. Tagung der Deutschsprachigen Mykologischen Gesellschaft, Salzburg, Austria, 4-6 September 2014

Scheiding, W.; Direske, M.
Comparison of reaction to water and moisture of sapwood and heartwood of Pinus sylvestris L., thermally modified with two treatment intensities
7th European conference on wood modification ECWM7, Lisbon, Portugal, 10-12 March 2014

Schröfl, C.; Mechtcherine, V.; Krug, D.; Wenderdel, C.; Götze, M.; Hempel, S.; Noack, I.
Gefügeausbildung in zementgebundener Spanplatte bei Verwendung unterschiedlicher Holzarten und Portlandkompositzemente
Tagung Bauchemie, GDCh Fachgruppe Bauchemie, Kassel, 6-8 October 2014

Schweitzer, K.
Moderne Kastenfenster für erhöhte Wärme- und Schallschutzanforderungen
10. PaXclassic-Fachtagung, Leipzig, 8 November 2014

Swaboda, C.; Fischer, M.; Salzwedel, K.
Entwicklung eines neuen Verfahrens zur Hydrophobierung von Holz und Fixierung von Wirkstoffen mit chemisch härtenden Ölen
Deutsche Holzschutztagung 2014, Brunswick, 18-19 September 2014

Tobisch, S.
Aktuelle europäische Entwicklungen im Holzwerkstoffbereich
TU Dresden, Professur für Holztechnologie und Faserwerkstofftechnik, Dresden, 6 June 2014

Tobisch, S.
Auswirkungen der Waldstrategie auf die Holzwirtschaft
7. SMUL-Themennachmittag, Sächsisches Staatsministerium für Umwelt und Landwirtschaft, Dresden, 25 September 2014

Weber, A.
Entwicklung von Qualitätshalbzeugen aus Spezialholzwerkstoffen für Anwendungen im Maschinenbau und in der Fördertechnik
Forschungskreis Holzwerkstoffe, Brunswick, 30 April 2014

Weidlich, S.; Aehlig, K.
Untersuchungen zur Wirkungsweise von Harnstoff als Formaldehydfänger in Holzwerkstoffen
4. Fachtagung Umweltschutz HWS-Industrie, Göttingen, 15 May 2014

Weidlich, S.; Hero, T.
Studie zu Untersuchungen zur prinzipiellen Verwendung von Cellulose-Derivaten (CD) als Klebstoff
2. Kooperationsforum „Kleben von Holz und Holzwerkstoffen", Würzburg, 23-24 June 2014

Weiß, B.
Holzschädigende Pilze an Spielplatzgeräten
Fachbereichstag des TÜV Süd, Chemnitz, 11 April 2014

Weiß, B.; Flade, P.
Der Echte Hausschwamm (Serpula lacrymans); Untersuchungs- und Bestimmungsmöglichkeiten
7. Holzfachtreffen am Landesamt für Denkmalpflege Sachsen, Dresden, 9 October 2014

Wenderdel, C.; Krug, D.; Niemz, P.
Mechanical properties of single fibres ad fibre bundles of fibre pulp made of scots pine for the manufacture of MDF
WCTS & FPS Convention, Quebec, Canada, 10-13 August 2014

Wenderdel, C.; Schulz, T.; Krug, D.; Strunz, A.-M.
Dry process cardboard production – an alternative for manufacturers of wood-basel panels
9th European Wood Based Panels Symposium, Hanover, 8-10 October 2014

Wenderdel, C.; Schulz, T. ; Krug, D., Strunz, A.-M.
Very thin medium density fibreboards (MDF) with paperboard-like properties as reusable packing material
57th International Convention of Society of Wood Science and Technology, Zvolen, Slovakia, 23-27 June 2014

Wenderdel, C.; Schulz, T; Schramm, S.; Strunz, A.-M.
Dry manufacturing of paperboards
Papier-und-Karton-Symposium der PTS, Munich, 17-18 September 2014

Wenderdel, C.; Schulz, T.; Schramm, S.; Strunz, A.-M.
Untersuchung zur Herstellung von Karton im Trockenverfahren
PTS-Forschungsforum, Heidenau, 8 May 2014

Zierdt, P. ; Weber, A.; Costard, H.
Herstellung und Bewertung von Wood Plastic Composites aus biobasierten Polyamiden und chemisch modifizierten Buchenholzfasern
naro.tech, 10. Internationales Symposium „Werkstoffe aus nachwachsenden Rohstoffen", Erfurt, 17 September 2014

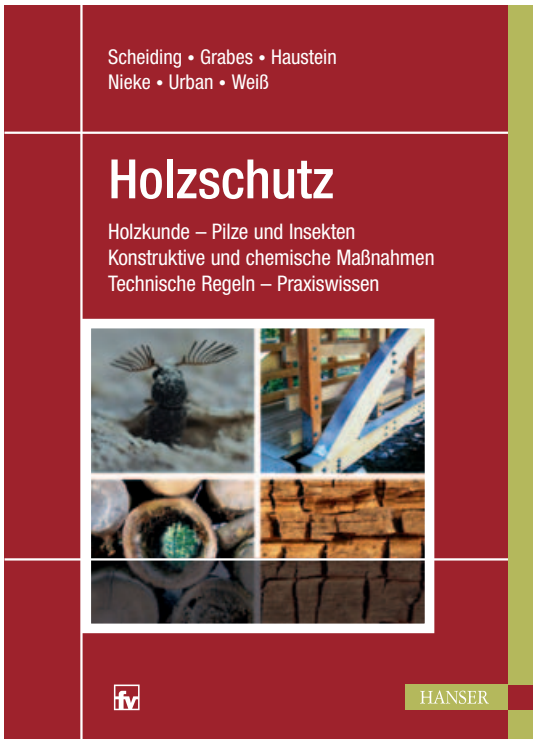
Wood Preservation Textbook Newly Released

The textbook "Holzschutz" ("Wood Preservation") was issued by Fachbuchverlag Leipzig in Carl Hanser Verlag Munich early 2015. It is the result of a cooperation between the Institut für Holztechnologie Dresden gemeinnützige GmbH and the Sächsischer Holzschutzverband e.V. and builds on the long-standing theoretical and practical experience of its seven authors in wood preservation.

As early as in the 1970s, Fachbuchverlag Leipzig was publishing a series of special books in the field of wood technology, which were commonly known as the "red series" (for their red book covers) and highly regarded by experts. The publishing house took up this tradition already back in 2006 by releasing the special book "Holztrocknung" ("Timber Drying") (by Trübswetter), continuing the series with the volume "Zerspanung von Holz and Holzwerkstoffen" ("Chipping of Wood and Wood-based Material") (by Gottlöber) in 2014 and more recently with the book "Holzschutz" ("Wood Preservation").

In a clearly laid out form, the textbook is a compilation of all the vital aspects of preventive and active wood preservation, presented comprehensibly. Starting out from the scientific basics of wood and abiotic and biotic damaging factors, state-of-the-art structural and chemical preservation measures are explained by taking the currently applicable statutory, normative and technical regulations into account.

This book is meant to be both a course book and guidebook as well as a book of reference for practitioners. It therefore focuses on apprentices and students, but also on architects, civil engineers and builders, experts of wood and wood preservation, garden designers or landscapists or those working in the timber trade.



Wolfram Scheiding, Peter Grabes, Tilo Haustein, Vera Haustein, Norbert Nieke, Harald Urban, Björn Weiß

Pocketbook – Carl Hanser Verlag GmbH & Co. KG (published in January 2015)

280 pages, numerous four-colour images, flexible cover

Book: € 29.99 (ISBN: 978-3-446-44240-5)

E-book (PDF): € 23.99 (ISBN: 978-3-446-44000-5)

Participation in Fairs 2014

Domotex

Hanover, 11-14 January 2014

Its main topics were the new possibilities of customised research and development regarding digital printing, properties of fire protection, emission, surfaces and noise and the development of specific floor systems.
Furthermore, standardised, customised and inline development tests were on offer, and the experts of EPH's accredited certification, monitoring and testing body informed on the procedure of obtaining the general approval from building authorities/ monitoring of floors acc. to EN 14041/EN 14342, parquet and screed sealing, adhesives, sports hall floors and underlay material.

The IHD/EPH further participated in the following fairs and exhibitions:

WINDOOR expo
Prague, Czech Republic, February 2014

Senior Nursing Care Special Exhibition ave neo
Hanover, March 2014

Cooperation Forum; Gluing Wood and Wood-based Materials
Würzburg, June 2014

Experts' Conference
Dresden, September 2014

ZOW

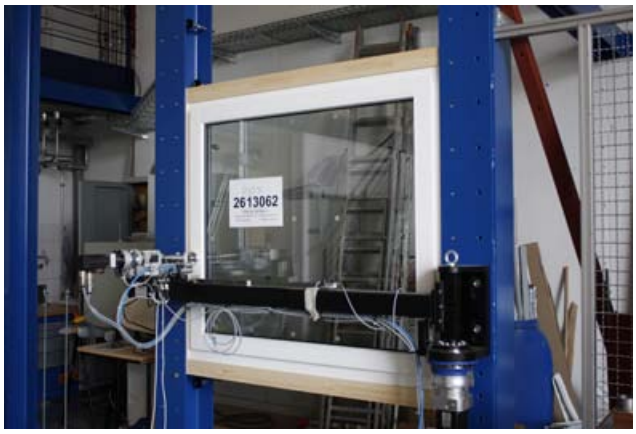
Bad Salzuflen, 10-13 February 2014

Apart from their test services provided to the furniture industry, the IHD and EPH presented numerous research projects. Investigations into novel light protection concepts for naturally dark and thermally modified timbers, into the powder lacquering of wood-based materials by pressing as well as into the application of high-frequency drying of water-based lacquering systems.

Fensterbau Frontale

Nuremberg, 26-29 March 2014

This year's fair stand focused on the multiple possibilities of practice-related research in the field of structural elements. As an example, a project on the development of box windows was introduced that united the implementation of both heat-insulating and noise-insulating properties.
The subsidiary EPH presented its wide scope of services regarding window and door technology. Apart from CE marking for windows and doors, for sawn construction timber and burglary resistance, the expert audience also asked for the determination of heat-insulating properties.



21st BMWi Innovation Day for SME BMWi

Berlin, 22 May 2014

At the 21st BMWi Innovation Day for SME, the IHD presented, jointly with its partners from industry and the sciences, nine research projects, hence being the most successful exhibitor at this show of innovative services of the Federal Republic of Germany.
The exhibits of box windows of combined heat/noise protection, table and seating furniture for use in nursing care, lightweight furniture-making by means of folding technology, colourfast structural elements of naturally dark wood species and thermally modified timber, of methods of proof on colourfastness, multifunctional resin-containing additives for wood-based materials, on the manufacture of cardboard in the dry process, on the PCR-ELISA procedure for diagnosing dermatophytes, and on multi-ply wood-based laminated materials for use in the field of sports raised a vivid and keen interest among politics and business. Future innovations were being discussed with both co-exhibitors and new partners in industry and the sciences. Talks with representatives of the German Bundestag and of federal ministries showed that the innovation support scheme pursued by the BMWi (German Federal Ministry of Economic Affairs and Energy) substantially contributed to increasing the achievement potential of SME.

Events

In the International Focus: Thermowood

The TMT Sector Met in Dresden for the Eighth Time

The 8th European TMT Workshop took place in Dresden on 22 and 23 May 2014. With 85 participants from 17 countries (including four from overseas), the IHD, having hosted this event, could draw a positive balance, as the denseness of similar events (COST, IRG, ECWM) was particularly high this time. With almost 60 %, the share of foreign participants was predominant, which reflects the difficulties of timber modification in Germany.

In his introduction, Dr. Wolfram Scheiding (IHD) explained the current market situation and the – still favourable – framework conditions for modified timbers. The papers presented by experts from research facilities dealt with practical topics, such as on crack formation (Philipp Flade, IHD), façade panels (Jürgen Bonigut, IHD), coating (Prof. Holger Militz, Göttingen University), durability (Prof. Andreas O. Rapp, Hanover University) and quality assurance (Lothar Clauder, Hochschule Eberswalde). The second block of topics concentrated around European issues with relevance to business in the industry. Dr. Ed Suttie (BRE/UK) lectured on CEN standardisation, Peter Barth (EPH) spoke about the EU Timber Trade Regulation, Ralf Spiekers (Bundesverband Holz und Kunststoff) talked about the EU Construction Product Regulation and Gus Verhaeghe (InnovaWood/Brussels) discussed European research incentives, especially for SME.

The third block widened the perspective to look overseas. Matthew Aro (University of Duluth, Minnesota) reported on research activities in the US and Canada and, which has almost become a tradition, the workshop was closed by Prof. Martin Despang (University of Hawaii), who presented new architectural possibilities for the application of modified timbers. The participants had ample opportunity during breaks and while seeing the accompanying exhibition presented by several companies and also on occasion of a social get-together at a restaurant in the historical centre of Dresden to have personal, professional and business talks.

The next TMT Workshop is scheduled for spring 2016.

Fig. 1: Photo session with speakers: Prof. M. Despang, R. Spiekers, L. Clauder, Dr. E. Suttie, Prof. H. Militz, P. Flade, Prof. A. Rapp, J. Bonigut, Dr. W. Scheiding (from left)

Fig. 2: View of the auditorium at the Sächsische Landesbibliothek – Staats- und Universitätsbibliothek Dresden (SLUB)

The 2014 IHD Innovation Prize Award

Fig. 1: Jury President, Prof. Claus-Thomas Bues, with project team members Linda Geißler and Winfried Hänel, the Chairman of the Trägerverein, Hans-Jürgen Bock, Attorney-at-law, and the Head of the IHD, Dr. Steffen Tobisch (from left)

On 3 June 2014, the Trägerverein Institut für Holztechnologie Dresden e.V. awarded the 2014 Innovation Prize to the project work "Development of new functional chairs for use in nursing care" by authors Susanne Trabandt, Winfried Hänel, Linda Geißler, Tony Gauser (IHD) and Frank Göhler (Sitzmöbel Göhler, Mulda).

"The award-winning work is dedicated to one of the most vital topics of the future: demographic change", said Jury president, Prof. Dr. Dr. habil. Claus-Thomas Bues (holding a tenure for forest utilisation at the Dresden University) in his statement of reason. The number of people requiring care will clearly increase in the decades to come, and so will the number of nursing care facilities and senior daycares. Everyday routines in these facilities are characterised by many situations in which the residents are dependent on support by the nursing staff, e.g., when sitting down or standing up.

These complex movements were documented by the working group around Ms. Trabandt with the help of a specifically developed, multi-stage analytical approach consisting of video observations, surveys of residents and nursing staff and of comprehensive measuring by means of a newly developed measuring chair, and subsequently subjected to an interrelated risk assessment. The jury regarded this multifactorial approach to be trendsetting for future research approaches in this field.

Eventually, the intelligent interlinking of the various findings resulted in a convincing product optimally adjusted to the needs of nursing care and, very soon after its presentation at leading special fairs, enjoyed brisk demand by practitioners. So the prize was awarded to a project that is convincing, concludent in itself, that has partially applied for being patented and that is largely complete. It is also a project that brings great relief to nursing staff and residents alike when having to cope with their daily routines. And it is of commercial interest to the industrial partner that was involved in its implementation.

The project consortium of representatives of the sciences and of small and medium-sized enterprises proves impressively that businesses from several fields of industry and the IHD as a research facility complement each other ingeniously.

The ROTUMA seating group that has resulted from the project was presented at numerous fairs and special exhibitions in 2014. Users and nursing care staff alike were highly delighted by it.

Outlook: The successful collaboration between the IHD and the company Sitzmöbel Göhler in Mulda will be continued in 2015 in a project to develop a nursing care armchair with functional variants for immobile patients.

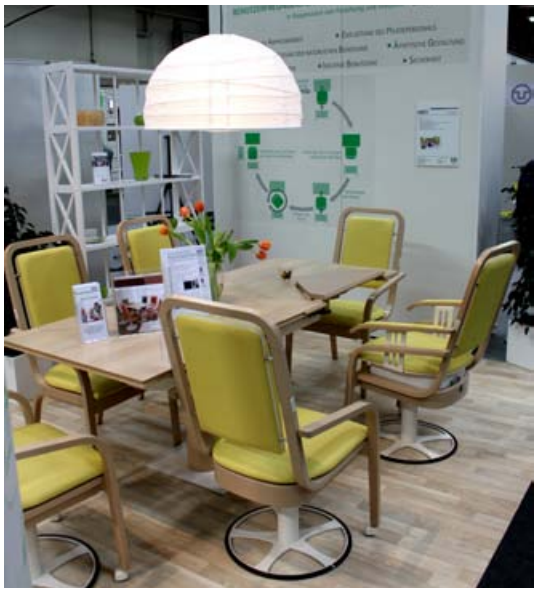


Fig. 2: Presentation of the project results at the Leipzig Special Fair on Senior Nursing Care

International Meeting of EPH Representatives

EPH representatives from eight countries in Europe, Asia, Central and South America met in Dresden on 25 and 26 September 2014. During the biennial meeting, the international EPH representatives were intensively trained for their monitoring and testing responsibilities and familiarised with the latest regulations and documents. The agenda also included current themes from the CARB/IKEA programme on EUTR down to CE marking acc. to BauPVO. Apart from instructions on theoretical contents, the training schedule also contained practical exercises in the test laboratories and with the documents of the product certification body, such as checklists and reporting forms.

The criteria for being selected as an EPH representatives are to show highly professional competence and personal integrity. Therefore, all the EPH representative have completed a specialist training in the fields of woodworking or wood-processing technology. However, they were appointed representatives only after having passed a witness audit. The regular exchange of experience and global networking with partners is essential for EPH's activities as an internationally acting testing, monitoring and certification body to meet customers' requirements.

The various partners also contributed to the vivid exchange during the meeting with their individual and country-specific experiences, which made the event rewarding for everybody, also greatly boosting mutual understanding.

The EPH network of highly qualified specialists and laboratories has steadily grown in the past: the EPH will also in the future continue to pursue its course of internationalisation.

Fig. 1: EPH representatives and EPH staff

3rd EPH Service Days

The EPH Service Days took place on 27 and 28 November 2014 for the third time. The EPH, which specialises in testing, monitoring and certification services basically for the wood-processing branches of industry, gave its visitors an opportunity to inform themselves about current issues with a view to its products. Physicomechanical, chemical and biological tests were demonstrated and statutory and normative requirements for the issuance of certificates and quality marks were discussed in 14 presentations relating to the product categories Furniture/Vehicular Seats, Floor Covers/Underlay Materials, Structural Elements as well as Wood/Wood-based Materials. The participants paid special attention to the implementation of a certification body for Environmental Management Systems (EMS) acc. to ISO 14001, which from 2015 will expand EPH's scope of services in conjunction with the certification body for Quality Management Systems (QMS) acc. to ISO 9001. The inspection of the laboratories and the demonstration of selected test methods was welcomed with great interest and used for discussing special questions. The next Service Days are scheduled to take place in 2016.

Internal Colloquiums in 2014

January	Matthias Weinert: Lightweight furniture design enabled by folding technology; development and proof of the suitability of new solutions for lightweight design
	Christoph Wenderdel: Investigations into the manufacture of cardboard in the dry process
March	Detlef Kleber: Development of an application technology for powder-lacquering solid wood surfaces
	Stefan Schmidt: Development of a test method for proving properties reducing the risk of tumbling and its consequences on floors and floor covers
	Dr. Florian Kettner: Application of molecularly encapsulated ethereal vegetable oils for in-can preservation and film protection of dispersion paints and aqueous wood coatings
	Marco Mäbert: Lignin crushing based on the FENTON mechanism
	Christoph Wenderdel: Investigation into the development of a microstructure and morphology in cement-bonded chipboards considering technological impacts
	Kerstin Schweitzer: Development of a Box Window – Fit to Meet the Combined Requirements of Both Heat Insulation and Increased Noise Insulation for Application in New and Existing Buildings/Monuments
April	Dr. Rico Emmler: Scratch-proof coating of wood and plastics based on silica-modified, aqueous polyurethane dispersions
	Dr. Lars Passauer: Development of Procedures for the Manufacture of Colourfast Structural Products from Naturally Dark Timbers and Thermally Modified Timber (TMT)
	Malgorzata Anna Adamska-Reiche: Fundament for uniform European assessment procedures for surface and adhesive quality, as well as improvement of climate resistance of parquet floors
	Malgorzata Anna Adamska-Reiche: Elaboration of Parameters for Evaluating Primer Coats for Inkjet Printing on Wood-based Materials
May	Malgorzata Anna Adamska-Reiche: Development of an approach for permanently linking-in digitally generated print images on concrete products into a protective coating system in order to make concrete products provided with colourfast and wear-resistant decors for long-term use
	Jens Wiedemann: Development of a sprewadable building material and investigations into laser-induced curing behaviour
	Susanne Trabandt: Conversion of a pre-fabricated wooden house into Universal Design
	Dr. Rico Emmler: Development of non-combustible decorative floor and wall panels based on gypsum fibreboards
	Kordula Jacobs: Molecular markers for diagnosing mould and actinobacteria

June	Andreas Weber: Development of high-quality semi-finished products of special wood-based materials for application in mechanical engineering and in conveyor technology
	Christine Kniest: Development of a procedure for the fine machining of 3-D surfaces
	Dr. Rico Emmler: Dedvelopment of a longlife, water-based UV lacquer UV as a system to be manually applied to elastic floor covers on site
	Martina Broege: Inline determination of formaldehyde emissions from sawdust resulting from material processed during production
	Dr. Christiane Swaboda: Investigation of the chromate-free fixation of copper by hydrophobing
	Jürgen Bonigut: Development of multifunctional wax-containing additives for wood-based materials
September	Kerstin Schweitzer: Investigation of the principle of effect of sealing profiles, capable of allowing diffusion, in the space of the fold between the casement and blind frame of a window, and proof of functionality of complete structural elements
	Andreas Gelhard: Principal investigations of heat-transportation processes in seating structures with the objective to improve the heating-up and cooling-down behaviour
	Tony Gauser: Development and testing of jointing solutions for furniture corpuses and additional assemblies for the non-residential area to be mounted toollessly
	Christoph Wenderdel: Optimisation of the raw density profile of cement-bonded chipboards, perpendicular to board level
	Lars Blüthgen: Non-destructive quality evaluation of coniferous trunk wood applying ultrasonic and radar methods
	Dr. Martin Fischer: Chemical reactions of wood ingredients with oleochemical reactants as a basis for developing novel bio-based polymeric materials
	Heiko Kühne: Development of an interior design element of increased requirement regarding noise and fire protection
	Dr. Martin Fischer: Development of permanently hardly flammable products of spruce wood for structural and façade elements
October	Dr. Detlef Krug: IVHF-based development of wood-based materials having an optimised raw density profile
	Tino Schulz: Investigations into the material use of fibre-like by-products (rejects)from the Organosolv procedure with the objective to make thin fibreboards and thick-walled moulded parts
November	Christine Kniest: Prediction models for the fire classification of multi-ply, surface-treated products containing shares of wood

Mentoring of Students Studying for a Diploma, a Bachelor's, a Master's or a Doctoral Degree and of Interns at the IHD or EPH

Diploma Students

Toni Salomon
Technische Universität Dresden
Investigation into the absorption capacity and the curing behaviour of several adhesives in wood-based fleeces of low raw density under high-frequency heating
Mentor at the IHD: Dipl.-Ing. (BA) Marco Mäbert

Maxi Ulbricht
Hochschule für Technik and Wirtschaft Dresden (FH)
Material properties of used wood
Mentor at the IHD: Dipl.-Ing. Jens Gecks

Students for a Bachelor's Degree

Mathias Braun
Staatliche Studienakademie Dresden
Draft of an application scenario for a document management system based on Alfresco
Mentor at the IHD: Dipl.-Ing. (BA) Thomas Hupfer

Johann Friedrich Hilpert
Staatliche Studienakademie Dresden
Further development of the method to investigate the user behaviour of overweight people
Mentor at the IHD: Dipl.-Ing. Architektin Susanne Trabandt

Maik Kadraba
Hochschule für Technik and Wirtschaft Dresden (FH)
Chromium-free copper fixation
Mentor at the IHD: Dr. rer. nat. Christiane Swaboda

Amelie Neugebauer
Staatliche Studienakademie Dresden
Potential and limits of social media applications in communication at research facilites by example of an SME company
Mentor at the IHD: Dipl.-Inf. (BA) Johannes-Sebastian Heinelt

Peter Stuckenberg
Staatliche Studienakademie Dresden
Comparative investigations of properties of OSB made of thermally pre-treated strands and of thermally after-treated OSB
Mentor at the IHD: Dipl.-Ing. (FH) Jürgen Bonigut, Dipl.-Ing. Andreas Weber

Students for a Master's Degree

Henry Bartsch
Technische Universität Dresden
Adhesive distribution on thermomechanically produced wood fibres
Mentor at the IHD: M. Sc. Christoph Wenderdel

Nicole Starke
Technische Universität Dresden
Uncovering value-creating potentials of the wood species of poplar by thermal modification
Mentor at the IHD: Dr. rer. silv. Wolfram Scheiding

Sebastian Stein
Technische Universität Dresden
A comparison of electrical procedures to determine wood moisture
Mentor at the IHD: Dr. rer. silv. Wolfram Scheiding

Agata Turanska
Internationales Hochschulinstitut Zittau
Characterisation of actinobacteria in interior rooms
Mentor at the IHD: Dipl.-Biol. Katharina Plaschkies, Dipl.-Ing. Kordula Jacobs

Setareh Behboudi Poshteh
Technische Universität Dresden
Principal investigations into the fire behaviour of two-component PUR lacquers
Mentor at the IHD: Dr. rer. nat. Florian Kettner

Sebastian Deibel
Technische Universität Dresden
Investigations into the weathering resistance of phenol-formaldehyde resins
Mentor at the IHD: Dr. rer. silv. Lars Passauer

Students for a Doctoral Degree

Zsolt Molnár
University of West Hungary, Faculty of Wood Science
Stability of finished, natural wood surfaces
Mentor at the IHD: Dr.-Ing. Ingrid Fuchs, Dr.-Ing. Rico Emmler

Interns

Lukás Horák
Česká zemědělská univerzita v Praze

Anja Kampe
Hochschule für nachhaltige Entwicklung Eberswalde (FH)

Kevin Kretschmer
Clemens Wirth
Hochschule für Technik and Wirtschaft Dresden (FH)

Benjamin Hoppe
Christian Jurenz
Falco Wiedmer
Technische Universität Dresden

IHD/EPH as a Practice Partner for Students at Universities of Cooperative Education

Peter Stuckenberg, Johann Friedrich Hilpert, Florian Tillack, Charlotte Darmer, Martin Schallhammer, Sven Haueis, Martin Keschke, Alexander Schaaf, Marvin Schölzel, Jürgen Schubert, Christian Klepel, Matthias Obst, Doreen Hamann, Elke Steen, Agnes Schade, Kristian Eicke
Staatliche Studienakademie Dresden
Practical vocational training – Wood Technology

Mathias Braun, Stephan Koksch, Benjamin Paßler
Staatliche Studienakademie Dresden
Practical vocational training – Information Technology

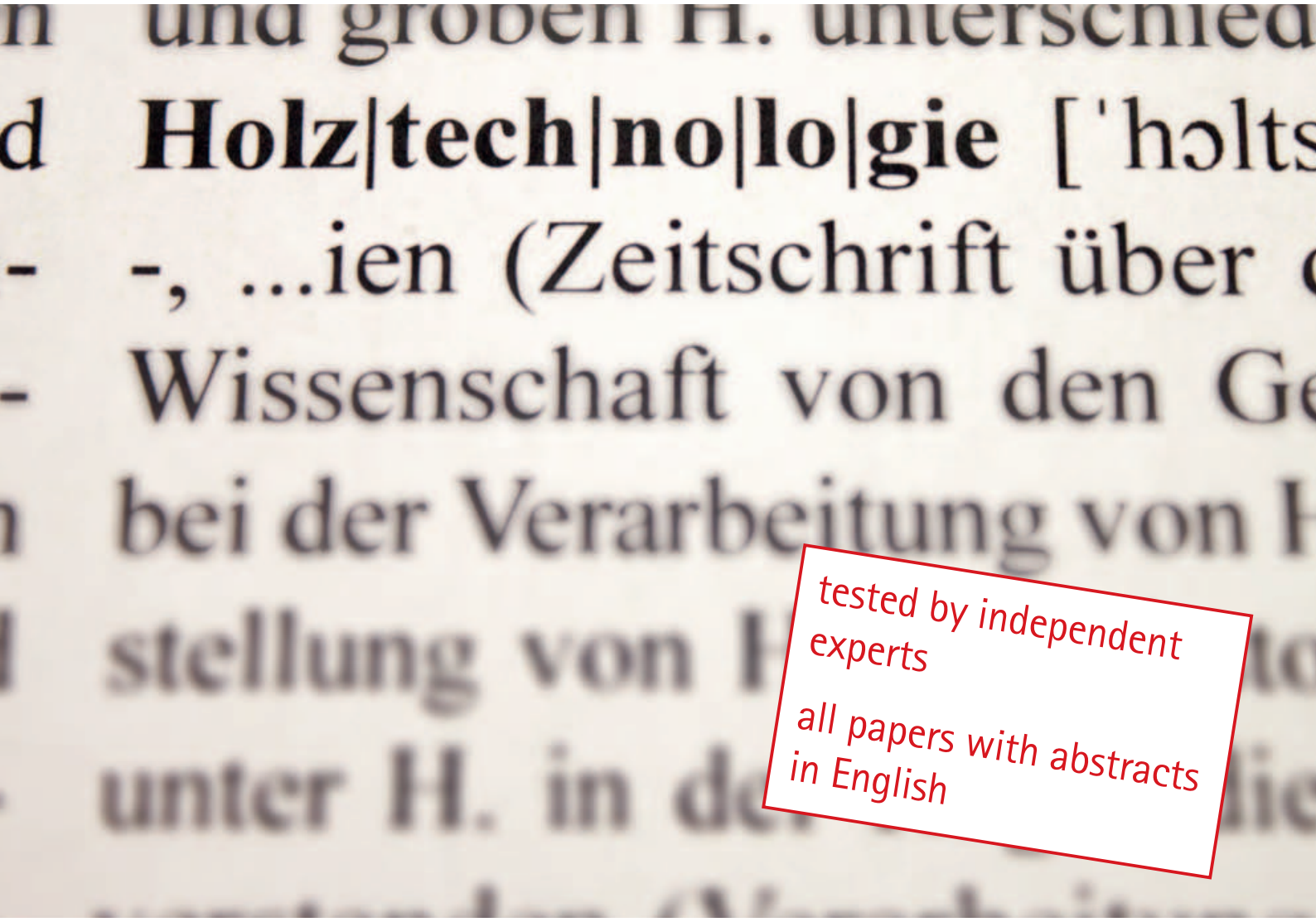
Amelie Neugebauer, Jeannette Winter
Staatliche Studienakademie Dresden
Practical vocational training – Media Informatics

Alice Walther
Staatliche Studienakademie Riesa
Practical vocational training – Event and Sports Management

Sophie Hiller, Melanie Sickert
Staatliche Studienakademie Riesa
Practical vocational training – Environmental Technology

Franziska Zimmer
Staatliche Studienakademie Riesa
Practical vocational training – Biotechnology

Interface between research and industry



tested by independent experts

all papers with abstracts in English

exclusive contributions about R&D findings in the fields of:

- Wood science
- Wood-based materials and composites
- Wood modification and processing
- Surface technology
- Bonding agents
- Furniture, structural elements

Published by the Institut für Holztechnologie Dresden and Institut für Holz und Papiertechnik at the Technische Universität Dresden

Archive of journals from 2005 on, permanent series, subscription service, notes to authors and contact partners at **www.holztechnologie.de**

ORDER YOUR TEST COPY NOW!
NO SUBSCRIPTION! NO FURTHER OBLIGATIONS!

Coupon

Titel: .....
Name: .....
First name: .....
Company: .....

Street: .....
Zip code: .....
City: .....

Fax: +49 351 4662 211

holztechnologie

IHD®
SCIENCE BY EXPERTS

Institut für Holztechnologie Dresden
gemeinnützige GmbH

Zellescher Weg 24
01217 Dresden
Germany

Phone +49 351 4662-0
Fax +49 351 4662-211
E-mail info@ihd-dresden.de

www.ihd-dresden.de

EPH®
SUCCESS BY QUALITY

Entwicklungs- and Prüflabor
Holztechnologie GmbH

Zellescher Weg 24
01217 Dresden
Germany

Phone +49 351 4662-0
Fax +49 351 4662-211
E-mail info@eph-dresden.de

www.eph-dresden.de