Services for Research and Testing of Coatings

IHD SCIENCE BY EXPERTS

EPH SUCCESS BY QUALITY

Inhaltsverzeichnis

Coating and Testing

Research priorities of the IHD in the field of coating of wood, wood-based or other material surfaces (composites, mineral substrates, plastics) focus on the functionalisation of surfaces or on the application of various coating technologies. They aim at providing the surfaces with special properties. These may be, for example, protective functions against microorganisms or to assure printability. The properties are characterised with the help of appropriate analytical and test technologies, also in various standardised methods.

Research priorities of the IHD in the field of coating

- Functionalisation of coating systems or surfaces to obtain antimicrobial properties or improved light protection and weathering resistance
- Application of various drying and cross-linking technologies to optimise the coating properties (IR, UV, UV-LED, electron radiation)
- Development of laboratory test methods and predictive models to prove the quality of coating properties
- Development of environmentally friendly powder-coating methods für several substrates for indoor and outdoor application

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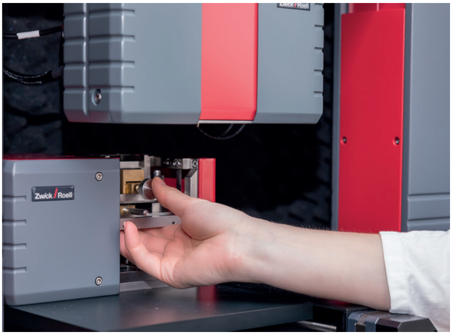
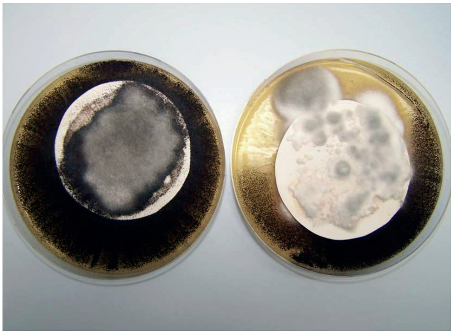
Service activities of EPH in the field of coating materials/surfaces

- Performing investigations and analyses for the quality assessment and evaluation of patterns of damage in various materials and products (REM/EDX, FT-IR,DSC/UV-DSC, GC)
- Characterisation of substrates e.g. wettability, conductivity, topography
- Determination of flexibility of coatings
- Tests on coating materials (e.g. content of VOC, in-can preservatives, pigments)
- Determination of the degree of curing
- Determination of safety properties (reaction to fire, slippery resistance, electrostatic)
- Migration behaviour of ingredients e.g. heavy metals
- Tests on resistance against mechanical loads and chemicals
- Determination of durability in relation to light fastness, climate and weather

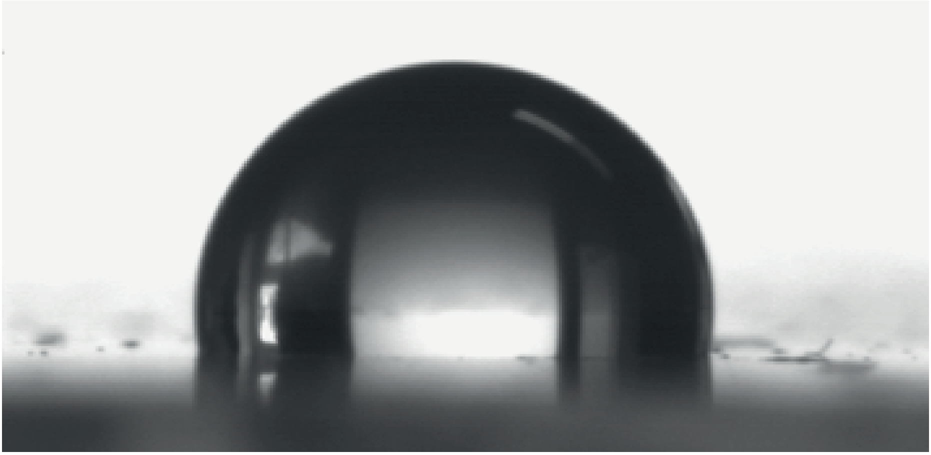


Determination of degree of crosslinking of coatings with nanoindentation



Testing of effectivity of film protection agents in coatings according to EN 15457

Examination of Binders and Adhesives



Binders and adhesives are subject to ageing too, depending on ambient conditions (temperature, humidity, UV radiation, exposure to chemicals). Such ageing may progress quickly due to unfavourable conditions and result in the loss of product properties. At the IHD, such ageing processes are analytically evaluated and reliable forecasts are deduced in various development and testing assignments.

Our competency/equipment

- Ageing in changing climate storage conditions, e.g. acc. to EN 12024, the AMK, RAL or VW guidelines, and/or by exposure to UV radiation (artificial lighting/weathering)
- Gathering and recording the changing properties by using chemical/physical methods, such as:
  - Microhardness (brittleness)
  - Surface energy (adhesive behaviour, chemical behaviour)
  - Infrared spectroscopy (structural composition and modification)
  - DSC (glass transition point)
- Deduction for durability and for recommendations for glued joints, for example

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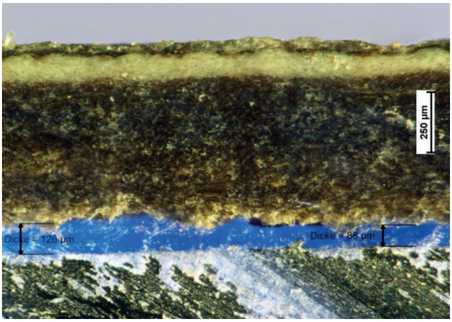
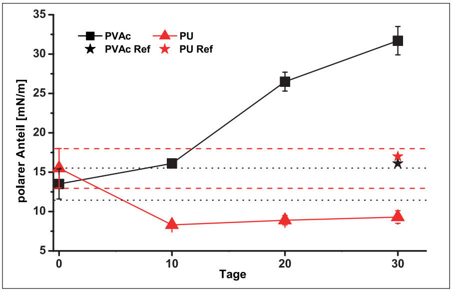


Typical layer of adhesive in hybrid materials (HPL/aluminium) (thickness approx. 100 µm)

Sample measurement with DSC

Ageing behaviour of dispersion adhesives

PVAc glue heavily brittles in defined ageing, while the microhardness of PU glue remains almost constant. Thus, the image reveals that PVAc and PU have similar polar parts and overall surface energies in the initial stage. The conclusion from a series of investigations is that, considering the surface energy and microhardness, the PU glue is the clearly more stable and ageing-resistant adhesive compared to PVAc, as it is less characteristically modified due to ageing impacts.



*Course of the polar part of the surface energy of PU vs. PVAc depending on the ageing in days: * referential points after 30 days without having aged, storage at 23 °C/50 % r. h.*

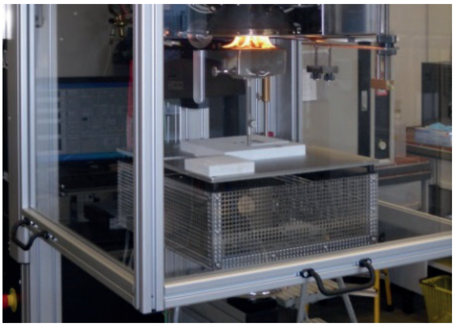
Evaluation of Surface Flammability

Development of products with flame-retardant properties

In case of fire, at the most the surface of products are first point of the attack of flames. Hence, flammability, the rate of flame spreading along the surface and smoke development are substantial safety-relevant product features. Therefore, the focus at the IHD is on the enhancement and evaluation of these properties.

Our competence/equipment

- Reaction to fire acc. to EN ISO 11925-2
- Reaction to fir acc. to EN ISO 9239-1
  - Floorings acc. to EN 14041, EN 14342, EN 14904
  - Lacquers, coatings on floorings
- Reaction to fire acc. to IMO Resolution MSC. 307(88) FTP Code 2010, Annex 1, Part 5 (Surface Flammability)
  - Wall/ceiling claddings
    - Adhesives, paints, lacquers, etc.
    - Solid coating materials (e.g., veneers)
  - Floorings
- Cone calorimeter acc. to ISO 5660-1
  - Time to ignition, heat release
  - Mass loss, smoke development
- Others (calorific value, non-combustibility)



Cone calorimeter acc. to ISO 5660-1

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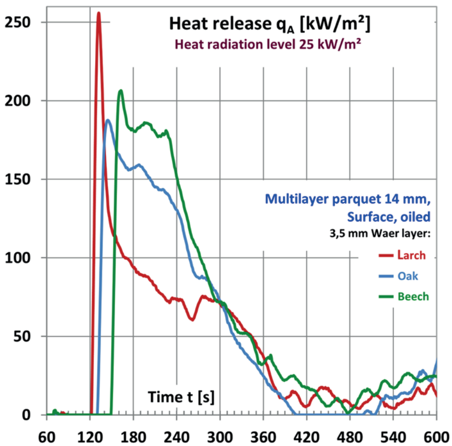
Focus of research

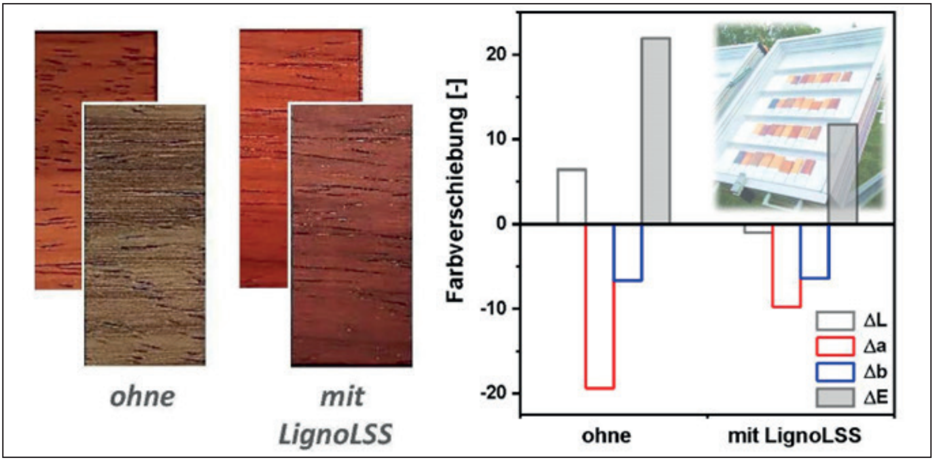
In continuing research on the development of low flammable multilayer parquets or wall/ceiling claddings for interior maritime use, the effects of coatings, adhesive and bonding agent additives and also impregnations, mainly for substrates or decorative surfaces of wood, are evaluated in the fields of fire testing and the development of fire-retardant products. Along with that, product-specific, but also test-methodological improvements are at the point of interest. This also includes the development of laboratory methods for screenings of optimising pre-treatment methods, material structure and formulae.



Heat release acc. to ISO 5660-1

Testing acc. to FTP Code 2010 for determining surface flammability (interior maritime use)

Light Protection Formulations for Wood Surfaces



Objective

The aim of this project was to develop light protection solutions for the colour stabilisation of photosensitive dark and colour-intensive woods based on wood extractives, as well as to develop adequate technologies for their application. The development was necessary because the abovementioned species could not be stabilised or could only be stabilised inadequately by means of common light protection agents and because there is a great demand for appropriate light protection systems for transparently coated wood surfaces, especially in the areas of high-quality furniture and interior design.

Approach

This development was based on investigations to clarify the chemical-physical mechanisms of the photochemically caused discolouration of the species concerned. For this purpose, photosensitive as well as lightfast accessory wood components were identified, isolated from the respective woods by means of extraction processes that are gentle on the active components, and their contribution to wood colour and discolouration was investigated. The obtained extracts or their fractions were characterised with respect to their chemical composition, their absorption behaviour in the UV/Vis range, and their photolysis stability in solution. Furthermore, the possibility of using cationic co-stabilizers to increase the light stability of wood extracts or dyes in solution was investigated.

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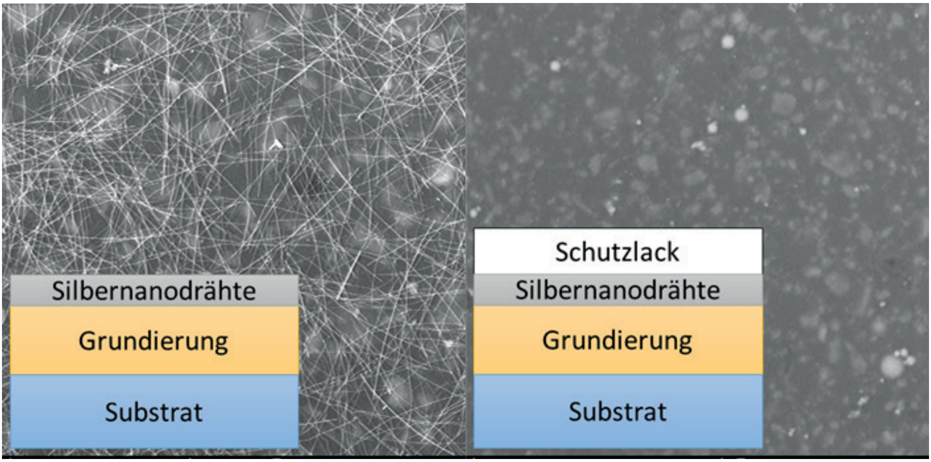
Results

The wood extracts required to produce the novel LignoLSS were obtained by cold extraction with polar solvents, especially water and ethanol, as well as by high-pressure extraction with mixtures of supercritical CO_2 and ethanol. The extract yields were between 3 % and 15 % depending on the wood species and the extraction conditions. The light-stabilising and colour-stabilising effect of the active substance-stabiliser mixtures was demonstrated both by means of xenon arc irradiation and simultaneous UV/VIS spectroscopic analysis of the solutions concerned and by their application in the form of aqueous or ethanolic light protection formulations on the surfaces of colour-intensive and dark woods. Thus, outdoor-tested wood surfaces exposed to daylight behind window glass and treated with LignoLSS showed a significantly lower wood discolouration than the untreated reference
variants.

The project has succeeded in developing light protection solutions based on stabilised wood extractives. These are mixtures or fractions of wood species-specific components or active substances, which are combined with special co-stabilisers. The latter can also be applied to wood without additional wood-specific extractives in order to stabilise the colour *in situ*. The formulations to be applied as primers have a wood species-specific effect and must be adapted to the respective wood species to be protected. LignoLSS are an environmentally friendly alternative to conventional light stabilisers.

Infrared-reflecting Surfaces



Objective

The objective of the research project was to develop coatings for indoor surfaces, especially for textile and wooden surfaces, which reflect thermal radiation in the range of mid-infrared radiation. The project was expected to demonstrate the feasibility of such IR-reflective coatings. Furthermore, not only the reflectivity of the coatings was to be determined, but also the processing and application aspects as well as the cost effectiveness of these surfaces were to be considered.

Approach

One of the approaches was to introduce such microstructures, the IR reflexivity of which was known or to be expected, into organic coating formulations. These were microstructures, such as glass particles, hollow microspheres or nanowires. The project was to be finalised by developing a demonstrator that was capable of verifying the IR-reflecting surfaces resulting from the project by measurement in a practice-simulated application.

Result

Modelling of electromagnetic wave propagation within microstructured layers of fibre layers and coatings with air inclusions yielded the conclusion that structures of a size of 10 µm can be expected to have broadband reflections in the MIR range.

Nonwoven mats of good reflective properties could be produced using classical nonwoven

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production methods such as the needling process or calandering.
By introducing metallised glass spheres and platelets into coatings, reflectance levels of up to 30 % were achieved. The use of silver nanowires required the development of a coating system, as the silver nanowires were not present as free particles but were created as a separate layer in a chemical process. The structure of the basecoat plus Ag nanowire layer enabled reflection levels of up to 80 %, while the structure with a clear varnish to protect the sensitive silver nanowires a reduction in the reflection level went along. The wood character of the substrate was preserved due to the semi-transparent character of the Ag nanowire layer.
Good IR-reflective surfaces could also be achieved using an aluminium-based IR pigment. The advantage of this pigment was its robustness, so that no protective topcoat was required.

Digital Printing on Surfaces of WPC

Objective

Products from wood-polymer composites (WPC), such as terrace decking, façade elements or partitions, enjoy widespread popularity. In the search for unique selling points, manufacturers fall back on several measures to give WPC surfaces a rather natural appearance. Primarily for cost reasons and an increase in product variety, manufacturers and processors of WPC endeavour to exploit the benefits of digital printing for themselves. Therefore, the research project aimed at applying digital printing for the sake of individualisation and of structuring the coatings re-quired for printing and protecting the décors in such a way that their outdoor use becomes possible.

Approach

Printing had to be preceded by the respective preparation of the WPC surface. Apart from the mechanical processing to remove the pressing skin, the fitness of physicalchemical pretreatments was investigated to the same extent as liquid coating. In that respect, the appropriate composition of WPC or inks had to borne in mind. The suitability of the ink was examined for the subsequent printing process that could be carried out in the single-pass or multi-pass mode. UV inks proved to be suitable and, therefore, accompanied all fur-ther investigations until the project was finalised. The structuring of the layers was top-coated by a protective lacquer eventually expected to protect the printed décor against weather impacts and to be mechanically stable.

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Result

The challenge to use WPC as a printing substrate is due to the inhomogeneity of its surface properties, i.e., to the non-polar character of the polymer matrix, on the one hand, and the mainly hydrophilic character of the wood fibres, on the other. The properties of the polyolefins reduce the adhesion of ink to the WPC surface decisively.

Plasma treatment and flame treatment with a precursor turned out to be the most promising physical-chemical pretreatments. However, liquid coatings can also act as adhesion promoters for decorative printing if their composition is matched to the existing polymer matrix. UV-curing inks offer the greatest potential for printing on WPC. The protective lacquer coating must be accorded with the polymer matrix of the WPC and the chemistry of the printing ink or its subsequent treatment.

PUR Binders for Clearcoat Applications

Objective

In the case of high-gloss and transparent wood coatings, (reactively) flame-retardant coatings based on polyurethane binders often show haze, discolouration or loss in gloss. Due to the bans on classic halogen-containing flame retardants (FR), there is a need for alternative halogen-free flame retardants acting in situ in order to continue to meet the high flame retardancy requirements for interior products.

The objective of the project was to develop (a) flame-retardant Si/N-containing bonding-agent components (especially polyols) for (b) novel, hardly flammable transparent 2K-PUR coating systems including technologies/synthesis regulations for (c) the presentation of bonding-agents (or components thereof) and (d) their formulation in coating systems as well as the application and curing of these systems.

Approach

At the start of the project, referential systems (clear coats) were characterised and property profiles drafted. The syntheses planned for a large amount of Si polyols initially led to the extensive generation of side products, but could be accomplished in the course of the project. Five clearcoat systems were formulated using the presented Si polyols and initially characterised by TGA (Fig. 1).

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Result

It became evident that structurally varied silicon compounds differ in efficiency in terms of the flame-retardant effect, but that for all systems an increasing silicon content is linked to an increasing combustion residue. In a nutshell, it can be stated that the presented Si polyols are well suited to formulate transparent PUR clearcoats. Coating produced with two of the developed compounds yielded significantly improved flame retardancy, which could be demonstrated by means of both TGA and cone calorimetry. These investigations show the potential of silicon-containing structures in polyols with regard to improved flame retardancy in transparent PU coatings.

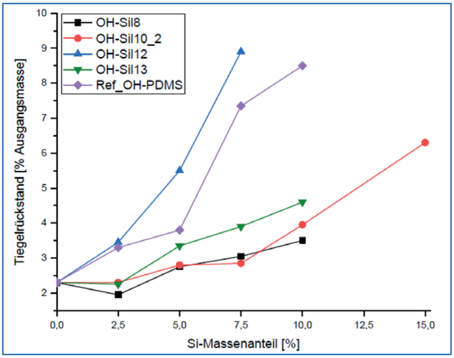

Figure 1

Fast-curing, Organic-based Polyurethane Bonding Agents

Objective

Coating systems based on regenerative raw materials (NawaRo) are still a niche product. In the field of isocyanate-free polyurethanes (NIPU), this project aimed at creating conditions for making organic-based poly(hydroxy) urethane binders (PHU) competitive over conventional polyurethanes (PU). The goal of the project was to advance knowledge on classic and hybrid NIPU binders based on sustainable resources that cure as quickly as already established isocyanate-based PUR systems.

Approach

For that purpose, six synthesis routes for multifunctional cyclic carbonates were initially developed and carried out, and the products were characterised structurally. From among them, three systems immediately proved to be over-reactive, so that too many side reactions occurred during synthesis. Out of the three remaining ones, two were selected that resulted in a rigid/aromatic and a flexible/aliphatic dicarbonate ("TDC" and "ADC", respectively). In the course of the project, the syntheses for TDC and ADC have been further optimised, so that methods are now available that lead to high yields and sound purity.

Furthermore, extensive polymerisation tests were performed to gain better understanding of the reaction behaviour of the NIPU systems. The systems and methods developed allowed to obtain fully cured coatings in application tests at room temperature without further addition of curing agents or hybrid curing mechanisms. The primary goal of the

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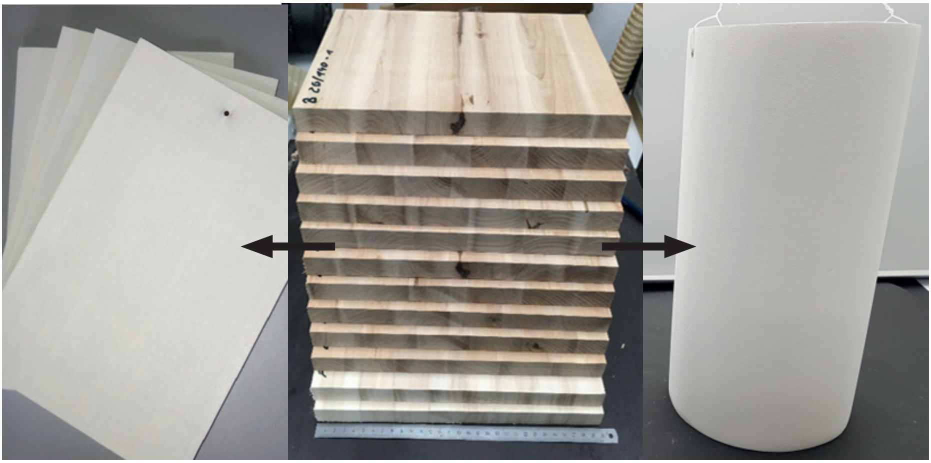
project was achieved by that. Furthermore, hybrid NIPU binders were to be developed that could be cured at room temperature. In the project, all three goals/systems were accomplished, and the curing behaviour of these systems was evaluated with reference to non-modified NIPU.

Result

It can be summarised that the development of NIPU coating systems curing at room temperature was achieved and that the potential of hybrid NIPU systems as coating agents for the three tested variants (epoxy, silane, unsaturated NIPU) could be proven. This has created a broad basis for development work close to the market.

Durable Powder Coatings



Objective

Compared to liquid coating, powder coating is considered to be sustainable as it is free from VOC, and powder residues can be returned to the process again. Applied with native wood, however, the high process temperatures required for melting and cross-linking pose a drawback, as they lead to the offgassing of wood ingredients or moisture, thus negatively impacting the coating quality. Therefore, it was the goal of a research project in cooperation with the TU Dresden to develop new wood substrates from fast-growing domestic species. For that purpose, the various timbers were to be compressed in such a way that substrates allowed enhanced powder coating. In order to additionally keep their exposure to thermal load low, radiation cross-linkable powders were intended to be applied. The goal was to develop coating systems on wood substrates that were able to sustain weathering conditions in outdoor use.

Approach

Initial investigations were followed by selecting birch and poplar as fast-growing wood species. Special attention was paid to the pore distribution and the total proportion of pores in the wood mass. . For enhancing the dimensional stability, investigations were carried out on the thermal post-treatment of the compacted woods. Tempered wood substrates were conditioned or primed before powder coating. Ionic liquids or conductive additives were used as primers. Differences that occurred in pore size had a disturbing effect

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on the coating, so that the influence of the fibre flow of the panels on the coating result was also investigated. Ultimately, the wood substrates and powder coatings evaluated in the laboratory as suitable for their coating were used in trials by industrial partners.

Results

Causes of coating-layer inhomogeneities were uneven pore sizes on the substrate surface, which meant that moisture acceptance during conditioning or coating with conductive additives could only take place unevenly. The optimisation of parameters and the technology optimisations as well as the application of two-layer coating then yielded improved coatings. Systems without and with pigment were used with the UV powder coatings. Both LED-UV and broadband UV cross-linked the powder coatings applied in one layer too quickly, so that rising offgassing could no longer escape. Preliminary cross-linking of a first coat with a subsequently applied and cross-linked topcoat improved the quality of these coatings. Cross-linking the UV powder coatings with electron beams produced coatings of better quality, as no additional heating during cross-linking led to coating defects.

The NT powder coating with special primer could then be applied to the new wood substrates in an industrial trial, yielding best results. There was very good coating-layer adhesion. Artificial weathering caused hardly any loss in gloss or changes in colour.

Novel Flame Retardants for Wood Coatings

Objective

The objective of the project was to synthesise novel host-guest complexes (Cplxes) of native or chemically modified cyclic oligosaccharides (cOS) and organophosphorus compounds (POV). The complexes are expected to be applied as environmentally friendly and high-performance, largely organic-based and water-soluble flame retardants (FSM) for flame retardancy of aqueous wood-coating systems or as flame retardant impregnations for lignocellulose-based materials.

Approach

Emphasis of this project was on:

- the development of methods for the synthesis of cOS derivates and Cplxes;
- the investigation of the structure-property relations of the cOS derivates und Cplxes, into their flame-retardant effect and into the underlying mechanisms of such effects;
- the development of Cplx-modified, flame-retardant aqueous impregnations and formulations for wood-coatings and
- the application of Cplx-modified coating materials and the identification of the thermal behaviour and reaction to fire of the materials equipped with Cplxes.

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Result

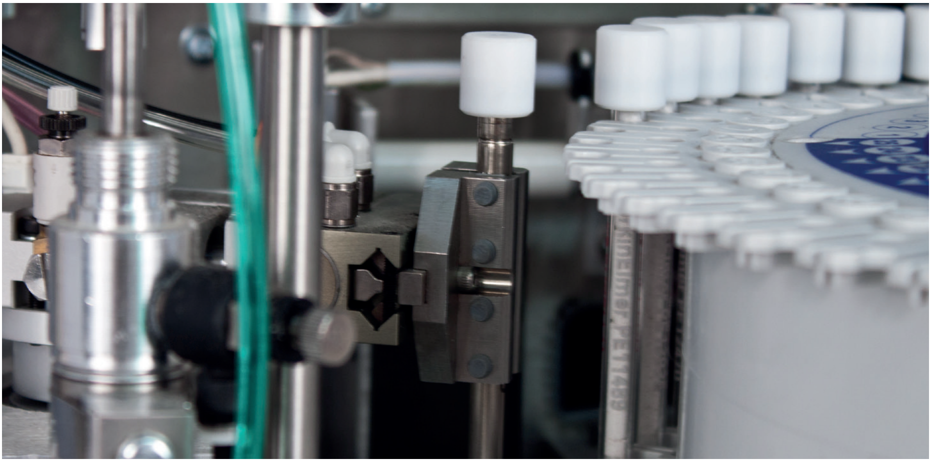
The project was able to provide proof of successfully generating host-guest complexes out of entirely organic-based cOS with aryl phosphates and aryl phosphonates. It could be shown that

- the water solubility of the non-polar POV is significantly improved by complexation with cOS, thereby clearly enhancing their formulability in aqueous polyacrylate dispersions;
- an increase in the efficiency of the POV with regard to their flame-retardant effect is achieved through synergistic interaction of them with the cOS matrix in the Cplx.

Therefore, in contrast to non-complexed POV and compared to conventional flame retardants (such as ammonium polyphosphate, APP), Cplxes show enhanced effectiveness. In addition, Cplxes that contain large shares of regenerative raw materials represent a sustainable solution for coating materials or wood surfaces/veneers that need to be equipped with flame retardant properties.

For their flame-retardant functional groups and guest compounds, the complexes cause significant improvement in the reaction to fire of Cplx-modified waterborne wood coatings, of appropriately impregnated or coated veneers or veneered material composites.

Testing of Ingredients and VOC Content



VOC-content

The Regulation for the limitation of the emission of volatile organic compounds through restricted marketing of solvent-borne lacquers and paints (ChemVOCFarbV) prescribes the observance of maximum contents of VOC for their use in building products. The laboratory for chemical analysis of EPH performs related measurements using the test methods quoted in appendix III of paragraph 3 section 2 of the ChemVOCFarbV. Depending on the solid content of a sample different methods are used.

- Gas chromatographic procedure acc. to EN ISO 11890-2
- Gravimetric procedure acc. to EN ISO 11890-1
- In-can-procedure acc. to EN ISO 17895 for dispersion paints

These procedures contain the following working steps

- Determination of non-volatile portion acc. to EN ISO 3251 (02/2008)
- Determination of density acc. to EN ISO 2811-1 (Pyknometer method)
- Determination of water content acc. to ISO 760 by coulometric titration acc. to Karl Fischer (in case of DIN EN ISO 11890-1)

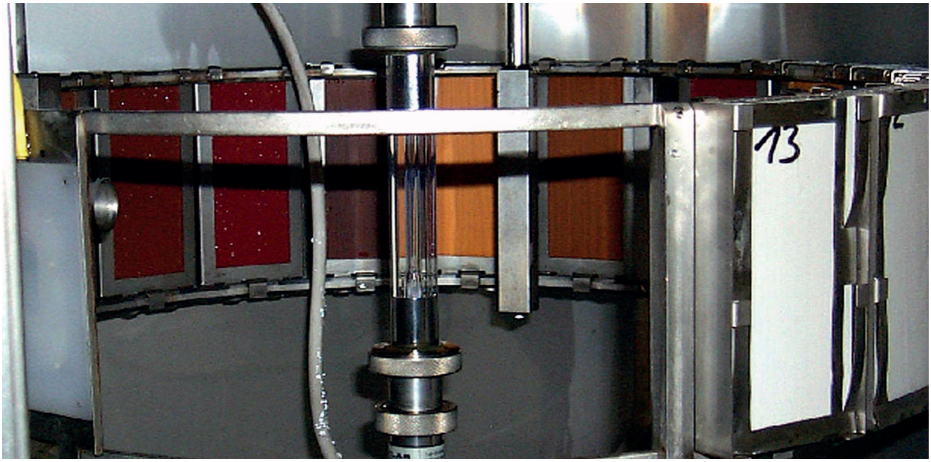
EPH is accredited by DAkkS acc. to EN ISO/IEC 17025:2005 for testings acc. to the named methods.

Monomeric acrylates and photoinitiators of UV-coatings

Along with other indicators, the content of monomers, low molecular compounds, photo-initiators and their fragments defines the quality of coating materials. After hardening, these compounds can be hazardous in respect to health and environment and their contents are subject to minimization. Some producers of coated wood products stated quality standards (like IOS-MAT 0066) and the suppliers have to pay their attention to minimize the respective contents of ingredients. Furthermore, preservatives added to paints and lacquers underlie restrictions. These substances and the respective limit contents are classified according to the regulations for toxic, harmful or toxic to reproduction substances (REACH or EU Directive 67/548/EEC). The following analyzation techniques are available in order to determine the content of such ingredients in coating materials, paints and lacquers:

- GC/MS, GC/FID, Headspace-GC (e.g. photo initiators, monomers, fragments)
- HPLC (e.g. MIT, BIT, OIT, CMI, IPBC, Bronopol, Pyrithiones, Bisphenoles)
- ICP/OES (e.g. determination of heavy metals)
- GPC (e.g. determination of molar mass distribution, proof of low molecular compounds)

Testing and Assessment of Surfaces for Indoor Use



The end consumer is mainly choosing the furniture because of its appearance. He expects that this appearance remains as long as possible. For the assessment of the processing properties of coatings, appearance, environmental properties, durability and wear resistance you can use the know-how of EPH.

Testing of processing properties, adhesion and appearance of surface

- Determination of ability for post forming and deformability of foils and laminates
- Determination of adhesion with cross cut and tension test
- Determination of colour, gloss and 2D/3D-surface structure

Determination of abrasion resistance

Testing of wear resistance of surface

- Determination of abrasion, scratch, micro-scratch and impact resistance as well as hardness
- Determination of resistance against dry and wet heat
- Determination of stain and pollution resistance

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Testing of temperature, climate, light and ageing resistance

- Determination of water and water vapour resistance
- Determination of temperature resistance (e.g. changing temperature tests)
- Determination of climate resistance (crack, colour, gloss and dimensional stability at constant or changing climate tests)
- Determination of colour fastness (dark yellowing, fastness to light and rubbing)

Testing of environmental and healthy properties

- Determination of spittle and perspiration fastness as well as migration behaviour of heavy metals
- Determination of emission behaviour of substrates, coatings and components

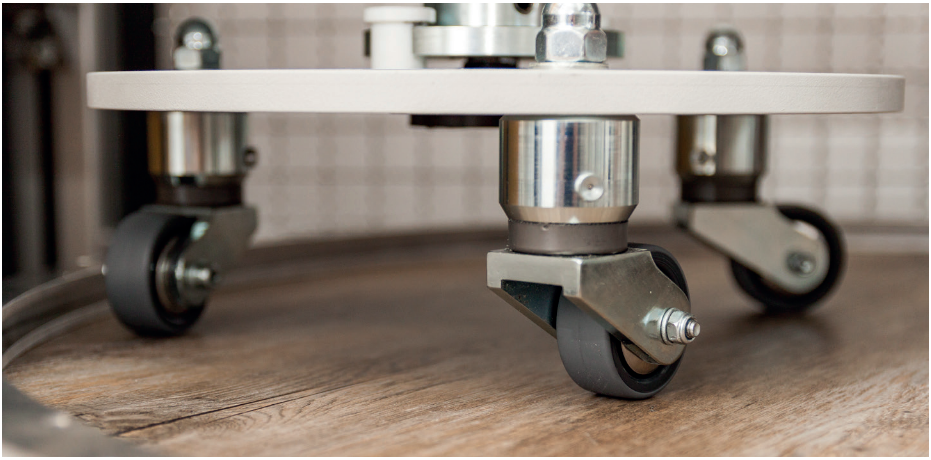
Examples for tests and assessments for different product groups

- CEN/TS 16611, EN 12720 - EN 12722, EN 15185-15187 (furniture surfaces)
- EN 438 T. 1 – T. 8 (HPL surfaces)
- EN 14322 – EN 14323 (Melamine faced surfaces)
- IOS-MAT 0066 (IKEA requirements)
- AMK guidelines for kitchens

Determination of resistance to changing climates

As results of tests or investigations you will get reports of our laboratory which is accredited according to EN ISO 17025. As conformation of quality properties we issue test certificates and you can use our quality labels. Additionally an external control of your products can be agreed.

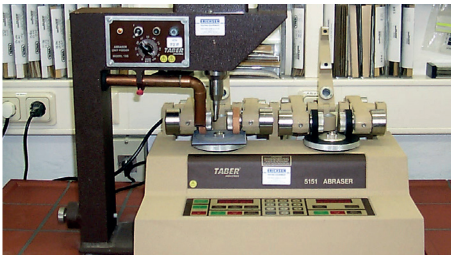
Testing of Flooring Surfaces



The customer selects floorings after the appearance and he aspects that this appearance will be preserved as long as possible. You should use the know-how of EPH for the evaluation of properties of flooring surfaces. You can use the extensive range of standard test methods and specific IHD standards.

Testing of the processing properties and adhesion of coatings as well as characteristics of the appearance

- Determination of the adhesion with cross cut and pull off methods
- Determination of colour, gloss and surface structure



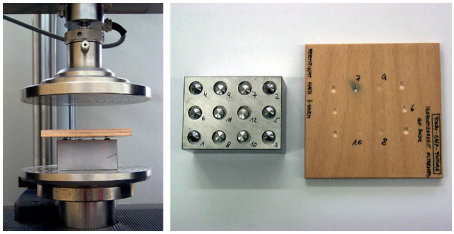
Determination of the abrasion resistance with Taber Abraser with integrated Grit Feeder (falling sand-method)

Wear resistance

- Determination of abrasion, scratching and impact resistance as well as hardness and elasticity
- Determination of the resistance to cigarette burn, castor chairs and moving of furniture legs
- Determination of the resistance to stainings and pollution

Temperature, climate, light and ageing resistance

- Determination of the resistance against water and water vapour
- Determination of the light fastness, determination of the resistance to changing temperatures
- Determination of the resistance to changing climates (crack, colour and gloss stability) as well as dimensional stability at changing and constant climate tests



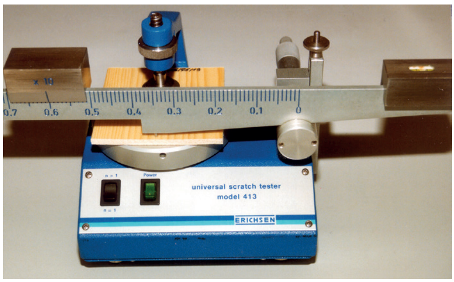
Determination of the elasticy of coatings

Indoor air conditions und safety relevant properties

- Determination of the resistance to saliva and sweat and migration behaviour
- Determination of the emission behaviour and the odour of substrates, coatings and panels
- Determination of the electrostatic behaviour
- Determination of the slippery resistance with sliding measurement pendulum and ramp devices

Examples for testing and evaluations according to product standards

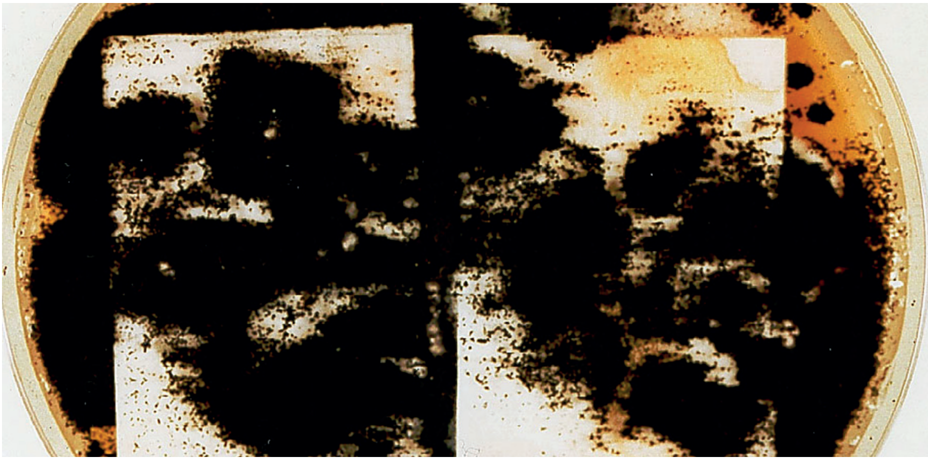
- EN 13696, EN 1534, EN 1910, ÖNorm 2354, IHD-requirement profile (wood floorings and coatings for stairs)
- EN 14354 (veneered floorings)
- EN ISO 10581-82, ISO 10874, EN 12104, EN 13845, ISO 20326 (resilient floorings)
- EN 16511 (MMF-floorings)
- EN 13329, EN 14978, EN 15468, ISO 14486, ISO 24334 – 24339, EN 438 – T.5, (laminate floorings)



Determination of the scratch resistance

For the conformity evidence the according to ISO 17025 accredited test laboratory (EPH) issues test certificates with which you can demonstrate the fulfillment of specific quality features or the extern control of your manufacture.

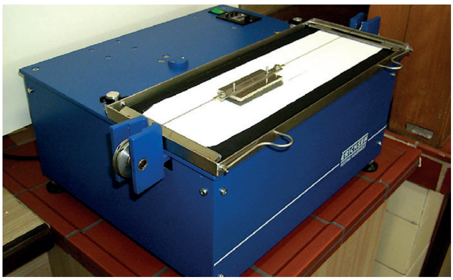
Testing of Dispersion Paints



The testing laboratory of EPH is accredited according to the criteria of norm EN ISO 17025. It has efficient test equipments and analysis techniques for the testing of dispersion paints for interior and exterior use at it's disposal. But also special investigations for developments, structural analysis and inquiries in cases of damages and claims are possible.

Mechanical-physical testing

- Processing qualities
  - Determination of the process characteristics and opacity (wet and dry)
  - Assessment of the appearance of the coated area
  - Determination of productiveness, splashing inclination, run inclination
  - Assessment of the cleaning of the work device
- Usability
  - Determination of the wet abrasion resistance (testing according to ISO 11998 Pt. 8.2/assessment according to EN 13300)
  - Determination of the contrast relationship;



Determination of wet abrasion resistance

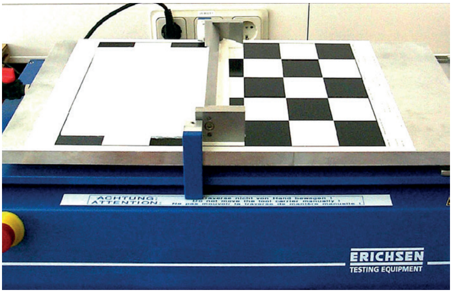
testing according to ISO 6504-3 with the recommended application quantity/assessment according to EN 13300
  - Determination of glass transition temperature with DSC
  - Artificial weathering/irradiation according

to EN ISO 16474-2

- Assessment of water vapour permeability according to EN ISO 7783 and water resistance according to EN 1062-3

Biological testing

- Testing of durability of coating materials against algae, bacteria and mould (using IEC 60 068-2-10, EN 15468)
- Testing after leaching (EN 84)



Coating with automatically working film drawer (Assessment of cover capability)

Chemical testing

- Testing according RAL UZ 102 (Low emission wall paints)
- Determination of volatile organic compound content (VOC-content, In-can method) according to EN ISO 17895: 2005
- Determination of volatile organic compound content (VOC-content) according to DIN ISO 11890 part 1 and 2
- Determination of formaldehyde concentration in waterthinnable dispersion paints and related products according to VdL-guideline 03
- Determination of the content of biocides (MIT, BIT etc.)

Determination of VOC-content by Headspace GC/FID

As result of the tests carried out you get a test report. In case of product conformity, EPH can issue test certificates as documentary for marketing.

VOC-emission of Building Products

General technical approvals/Voluntary DIBt expert opinion

Coatings, treatment materials and adhesives for wood floors and underlayments for laminate floor coverings and parquets require a general technical approval issued by the construction supervising authority (abZ). Basis for granting an approval are the "Principles for Health-Related Evaluation of Building Products for Use Indoors" (Principles of the DIBt - Deutsches Institut für Bautechnik – Center of competence in civil engineering) which include the AgBB-scheme.

Approval Procedures – Course of Events

- Manufacturer/retailer apply for approval at DIBt
- DIBt confirms the application and notifies the data and information required for the product/product group (product description, material specification sheets)
- Applicant forwards data and information
- DIBt sets up test program
- Applicant arranges that tests are conducted at an approved testing body like EPH
- DIBt evaluates results and, after positive evaluation, grants approval issued by the construction supervising

Emission Testing – AgBB-Scheme

- Determination of the VOC- and SVOC-emissions acc. to ISO 16000, Sections 3, 6, 9; EN 16516 using respective test chambers
- Evaluation using the program "ADAM"
- Product-specific and emission-dependent test period up to 28 days
- Voluntary experts opinions of DIBt are based on VOC measurements acc. to EN 16516

Determination of Odour Emission of Building Products

EN ISO 16000-28

In Germany, the evaluation of emissions from building products is based on the AgBB scheme (AgBB: comittee for Health-related Evaluation of Building Products). Since its introduction in 2002, it has been foreseen to include a sensory assessment in this evaluation scheme. Therefore, a methodical approach for testing and assessment of odour emissions was developed within the last years which is the base of EN ISO 16000-28:2012-12 (Indoor air – Part 28: Determination of odour emissions from building products using test chambers). Depending on the task different parameters such as perceived intensity, hedonic, or acceptance can be determined.

In the near future, the assessment of odour is intended to be included in the AgBB scheme as well as in the awarding basis of the Blue Angel environmental label. Therefore this test will be combined with the determination of VOC and formaldehyde emissions.
In the framework of the Finnish M1 classification, odour acceptance is determined according to EN ISO 16000-28 and assessed in accordance with the M1 requirements.
The Entwicklungs- und Prueflabor Holztechnologie GmbH (EPH) has the appropriate technical equipment and has established the test method in a special odour laboratory.

In the EPH, a panel of 16 persons elected from a large number of employees were trained and according to strict criteria as appropriate examiner selected.

EPH and TÜV PROFiCERT-product Interior Label

A Cooperation for an independent product label

1. What is TÜV PROFiCERT-product Interior?

TÜV PROFiCERT-product Interior is an independent quality label for products for interior use, concerning emission and optionally further quality features. The programme offers a strict separation of testing and surveillance from the certification procedure, taking divided between two independent companies. The TÜV PROFiCERT-product Interior brand is available as Standard and Premium variant.

2. How does the cooperation between EPH and TÜV work?

Within the TÜV PROFiCERT-product Interior programme, EPH GmbH is – along with TFI Aachen GmbH – responsible for the testing and surveillance. The certification decision is made by TÜV Hessen on the basis of results of both testing and surveillance, in accordance with the criteria for the allocation of the TÜV PROFiCERT-product Interior brand.

3. For which products is the Label TÜV PROFiCERT-product Interior label available?

The TÜV PROFiCERT-product Interior label can be claimed for all interior products, e.g. floorings, wall or ceiling coverings, wood based panels, concrete coatings.

4. How do I get a TÜV PROFiCERT-product Interior label?

Inquiry (EPH)
- Quotation
- Contract

↓

Testing and Surveillance
- Initial testing
(With or without quality features)
- Initial surveillance

↓

Certification (TÜV Hessen)
- Once in 3 years
- Entitles to brand usage
- TAB expert opinion (option)

↓

Testing and Surveillance
- Annual surveillance
- Annual testing
(With or without quality features)

After having placed an inquiry for testing, surveillance and certification of your product(s) at EPH, we will ask you for the specification of the product features in order to form collections (if necessary). Subsequently you will receive a tailor-made quotation including all the features you are interested in. By signing the quotation, you place the order, and a contract between your company and EPH is closed.

Following this, the initial testing and surveillance of your product(s) is made. The results are sent to the Certification Body, which issues one or more certificates which are valid for three years.

The regular surveillance of the factory or factories, including sample drawing and testing, take place at least once a year.

5. What does PREMIUM mean?

All products branded with the Standard TÜV PROFiCERT-product Interior label fulfil the criteria according to AgBB, French VOC-Emission Class A, Belgian Regulations on VOC emissions from construction products, LEED v4 as well as BREEAM International New Construction, General Level.

The PREMIUM label is available only for products which fulfil harsher criteria regarding the emissions. Following criteria are fulfilled in the PREMIUM-variant:

General Criteria:

- AgBB, February 2015/AgBB 2018
- MVVTB, Annex 8 (ABG)
- Emissions Class A+ according to the French VOC Regulation „Décret n° 2011-321 du 23 mars 2011"
- Belgian Regulations on VOC emissions from construction products „8 MEI 2014. — Koninklijk besluit tot vaststelling van de drempelniveaus voor de emissies naar het binnenmilieu van bouwproducten voor bepaalde beoogde gebruiken"
- LEED v4 (outside North America; LEED v4 for BUILDING DESIGN AND CONSTRUCTION, April 5, 2016)
- BREEAM International New Construction 2016 (Technical Manual SD233 1.0), Exemplary Level
- Finnish M1-Classification for construction products, version 15.11.2017 (the criteria according acceptance and ammonia are not included, accept of ammonia emission from smoked oak parquet).

In addition for parquet and wood flooring, laminate floor coverings, MMF floor coverings:

- RAL-UZ 176 (Blauer Engel), January 2013
- Austrian environmental label, guideline UZ 07, wood, wooden materials and wooden floor coverings, version 9.0, January 1, 2019

In addition for resilient floor coverings:

- DE-UZ 120 (not for PVC-floorings), February 2011
- Austrian environmental label, guideline UZ 42, elastic floor coverings, version 4.0, January 1, 2019 (The requirements for odour are not included)

In addition for textile floor coverings:

- GUT/PRODIS (Gemeinschaft umweltfreundlicher Teppichboden e. V.) (The requirements for odour are not included.)
- DE-UZ 128 (Blue Angel) February 2016 (The requirements for odour are not included.)
- EU-Ecolabel for textile floorings (2009/967/EC)
- Austrian environmental label, guideline UZ 35, textile floor coverings, version 4.0, January 1, 2019 (The requirements for odour are not included.)

In addition for underlays for installation, flooring installation materials:

- Emicode EC1^{Plus}, 18.04.2018
- DE-UZ 113 (installation materials), June 2011
- DE-UZ 156 (flooring underlays), February

In addition for coated and uncoated wood materials:

- DE-UZ 76 (Blaue Engel)
- Austrian environmental label, guideline UZ 07, wood, wood-based materials and floor coverings made of wood, version 9.0, January 1, 2019

6. Is it possible to make changes in the certificate within a certification cycle?

Yes, you can apply for a change in your certificate (expansion/amendment, e.g. for changes in the product names) at EPH GmbH directly, which informs after checking the certification body the TÜV Hessen.

7. Which quality features can be certified?

All features included in the product standards can be tested and certified. Please contact EPH for a detailed offer.

Test reports/certificates in the frame of TÜV PROFiCERT surveillance can be used for voluntary expert opinions as proof for fulfillment of requirements according to MVVTB (Annex 8, ABG). The TÜV PROFiCERT certification programme was accepted by an European TAB organisation which can issue this expert opinion.

Testing and Assessment of Surfaces for Outdoor Use

Appearance and durability are the main criteria for choosing of coatings for wood in exterior use.

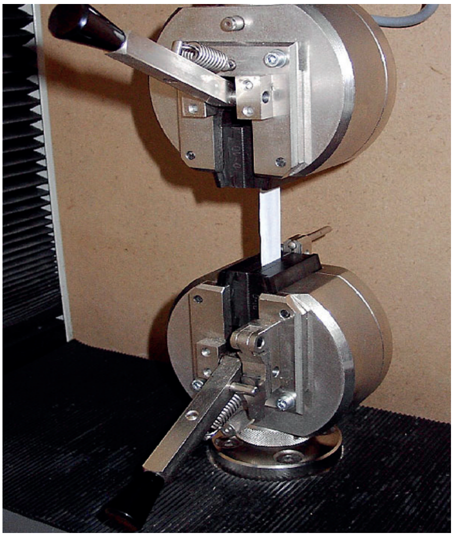
We offer you a wide range of tests and know-how on all related questions.

Assessment of processing properties

- Determination of rheological properties
- Determination of spreadability, splashing and dripping properties of DIY products
- Determination of wettability

Determination of coating properties

- Adhesions properties (cross cut, tensile method)
- Microhardness (martens hardness, visco-elastic properties)
- Water and water vapour permeability acc. to EN927-4/EN 927-5 and water vapour resistance acc. to EN 12572
- Resistance to caking and sealing profiles
- Resistance against chemicals (cement,



Determination of ultimate elongation

Contact person: Dipl.-Ing. Simone Wenk · +49 351 4662 227 · simone.wenk@eph-dresden.de

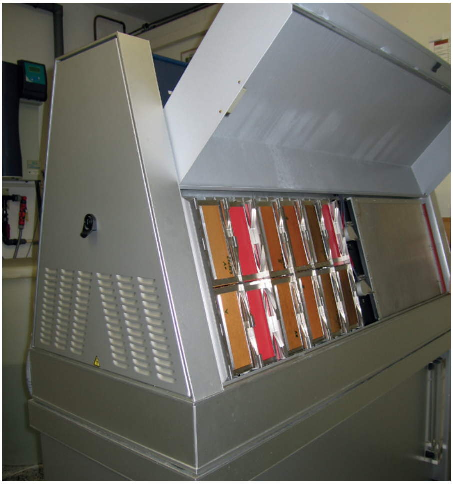
cleaner)
- UV- transmissibility and transparency
- Elasticity and elongation

Determination of aging behaviour

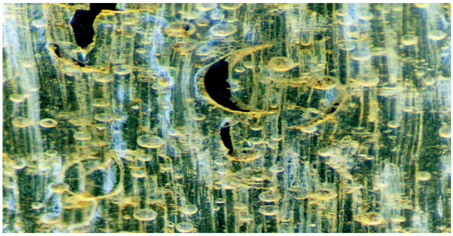
- Behaviour at artificial weathering in QUV and xenon test devices
- Behaviour at outdoor weathering acc. to EN 927-3
- Chemiluminescence investigations, DSC, FTIR, microhardness

Damage analysis

- Determination of penetration depth, layer thickness (also for decopaint-guideline) and wood humidity
- Macroscopic and microscopic image recognition of damages
- Detection of fungicides and wood destroying or discolouring fungi



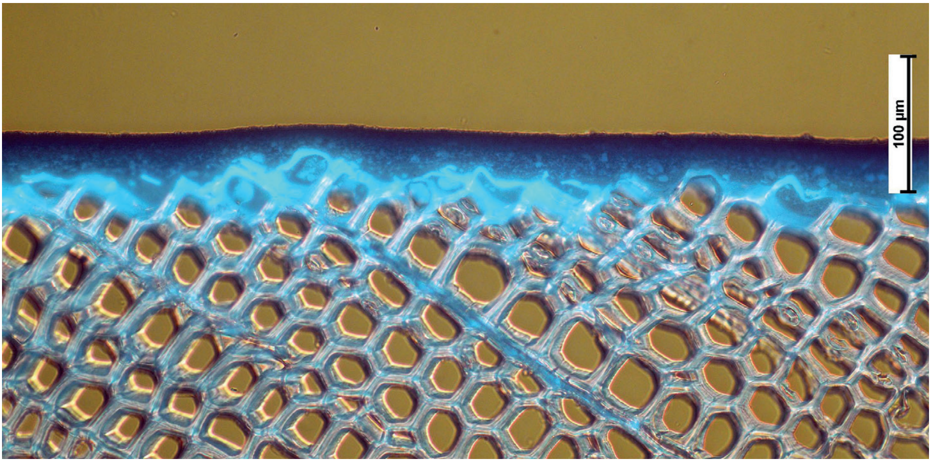
QUV test device



Microscopic picture of a damage caused by hailstorm

As results of tests or investigations you will get reports of our laboratory which is accredited according to EN ISO 17025. As conformation of quality properties we execute test certificates and you can use our quality labels. Additional an external control of your products can be agreed.

Biological Testing of Coating Materials



Biofilms may affect the aesthetic appearance and the function of coatings and indoors they can cause a health risk. In the production process and in containers, microorganisms result in quality degradation or fouling. The risk of attack by microorganisms can be minimised by preservatives or surface modifications. The effectiveness of such measures can be tested in the accredited laboratory Biological Testing of EPH by standardised methods.

Material resistance/Effectiveness of biocides (in-can preservation and film protection)

- Anti-mould effectiveness
  - EN 15457, ASTM D3273 (film preservation)
  - Storage test with repeated inoculation (IBRG-method PDG 16-007.2, in-can preservation)
- Effect of algicides in coatings
  - EN 15458
- Antibacterial effectiveness
  - ISO 22196, EN ISO 846
- Anti-blue-stain effectiveness of wood coatings
  - EN 152
- Simulation of environmental exposure
  - Leaching exposure
  - Artificial accelerated weathering: Xenon test, QUV
  - Field weathering

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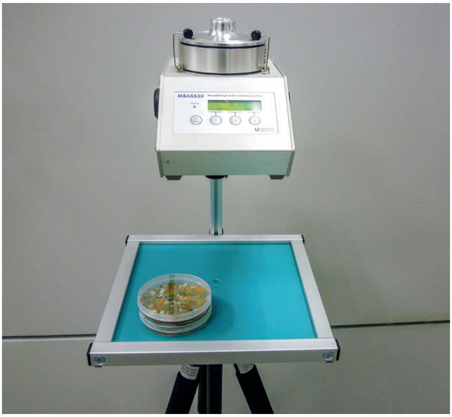
Hygiene of production processes

- Hygienic design
- Hygienic monitoring
- Development of methods for microbiological monitoring

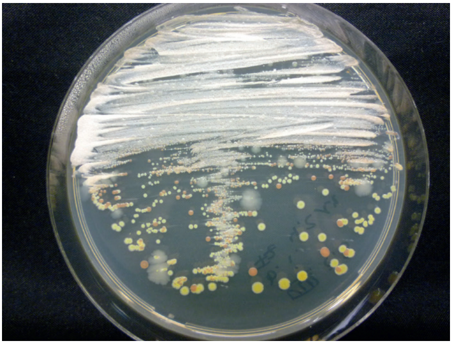
Investigations on damages

- Identification of microorganisms
  - Microscopy, DNA analysis
- Damage expertises
  - Investigation of damage causes
  - Recommendations for restoration measures
- Microscopy
  - Coating thickness measurement

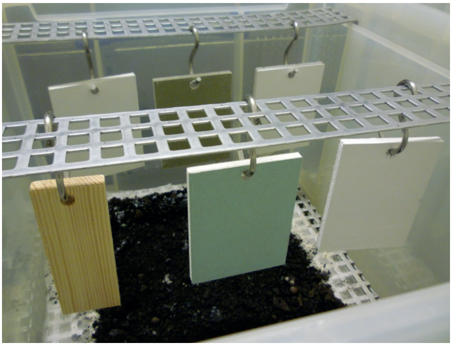


Microbial air sampling (hygienic monitoring)

  - Paint adhesion testing
  - Interface examinations



Streak on agar



Mould resistance test according to ASTM D3273

Emissions test chamber

The determination of formaldehyde and VOC emissions from wood-based materials, construction products and furniture is a core competence of the EPH for many years.

As accredited test body for emission testing, the EPH provides not only professional know-how but also technical equipment in terms of emission test chambers and gas analysis systems.

These test systems are especially characterised by an easy operability and a layout adapted perfectly to customer`s needs as well as by an attractive price. Among others, the systems are established in the wood-based materials, binder- and furniture industry and at testing institutes. Emission testings can be conducted according to several test procedures.

We are pleased to support you on your tasks, to validate your system by appropriate comparison tests and to train your laboratory staff.

System PK-ES (stainless steel)

- Interior volume 100 l/225 l/1.0 m^3
- Electrically polished interior
- Digital display and recording of test parameters temperature and rel. moisture; volume flow optional acc. to customer requirements

System PK-GS (glass)

- Interior volume 100 l and 225 l
- Digital display and recording of test parameters temperature and rel. moisture; volume flow optional according to customer requirements

Applications

- VOC and formaldehyde emission testing according to national and international standards

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Surface test devices

The test devices offered are based on test-methodological research of the IHD or long-term test practise of the EPH. The impact resistance device for laminate floorings according to IHD-W-425 (now EN 17368) was developed together with EPLF in course of an IHD research project. The other impact resistance devices are based on the long-term technical testing experience in normative testing of flooring. The equipment for pollution resistance according to IHD-W-477 was developed by IHD in the EUROPARQUET-research topic for the testing of non-film forming coatings on wooden floors.

Impact resistance test devices for floorings:

- Impact resistance device according to EN 17368 for laminate floor coverings
- Impact resistance device according to EN 438-2 (big ball)
- Impact resistance device according to NALFA for laminate floor coverings

Devices for testing of surface durability

- Test appliance for determining the pollution resistance acc. to IHD-W-477

Determination of impact resistance acc. to EN 17368 for laminate floor coverings

Quality and Conformity Marks

- Conformity Mark (CE mark) European Notified Body

- EPH Quality Mark "Quality proven" with external surveillance

- TÜV PROFiCERT-product Interior

Publisher:

Last reviewed: March 2023

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