Title of presentation

Purbond is a joint venture between Collano and Henkel

Developments in Polyurethane Adhesive Systems for Structural Timber Applications

Wood Manufacturing 2010

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Overview

- Background
- Ecology & Health
- Technology Features & benefits
- Performance
- Developments in Applications
- Projects Gallery
- Summary

Adhesive systems for engineered wood

Background
Engineered Wood Products
Examples of where Polyurethanes (1C-PUR) used…

<table>
<thead>
<tr>
<th>Finger jointed beams</th>
<th>Log beams</th>
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<td>Glulam</td>
<td>I-Beams, I-Joists</td>
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<td>Cross- / Duo- &amp; Triobeams</td>
<td>Special elements Cross Laminated Timber</td>
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Development in Adhesives and Timber Product Standards

- 1C-PUR introduced into EWP by Purbond in 1980’s
- Standards then were “designed” for phenolic – aminoplastic adhesives
- Testing at major timber research institutes, third party approval bodies & EWP producers proved the technology suitability.
- Advancements in adhesive technology, research and collaboration with regulatory authorities, evolved change in global Standards to classify use of 1C-PUR for modern structural applications
- Today global performance based Standards allow for faster, cleaner, safer modern EWP production enabling innovation
Increased Health and Environmental Awareness

- Stricter regulations for indoor air quality: i.e. limiting Formaldehyde and Volatile Organic Compounds (VOC's)
- Increasing demand for more *green* and *sustainable* products
- Third party Certification schemes can help producer differentiate and add value.
  Examples of voluntary Environmental Quality Seals:
  - Natureplus
  - GREENGUARD
  - JAIA F****
  - CARB (P1 & P2)
Formaldehyde – WHO Press Release

International Agency for Research on Cancer

PRESS RELEASE
N° 153

WHO
15 June 2004

IARC CLASSIFIES FORMALDEHYDE AS CARCINOGENIC TO HUMANS

(http://www.iarc.fr/ENG/Press_Releases/pr153a.html)

Engineered wood products have to fulfill modern environmental requirements

“Old” requirements:
• E1 (Europe)
• F**** (Japan)
• IARC-classification (World Health Organization)

“New” requirements:
• CARB (California)
• IOS-MAT-0003 (IKEA)
• EPF-S (Europe)
Formaldehyde Free

**1C Polyurethane adhesives are free of Formaldehyde.**

i.e. PURBOND® adhesives are JAIA certified.

Formaldehyde Standard: (Japan Adhesive Industry Association) Independent Control Standard against Indoor Air Pollution.

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IKEA HZB 2.Feb. 2008

Ikea und »Große 5« einigen sich bei Formaldehyd

Schwedische Laminatplatten mit geringem Formaldehydgehalt
Formaldehyde free 1C PUR adhesives meet the growing movement toward zero Formaldehyde and low VOC emission levels for in-use products and in the work place.
Advantages and Benefits for the EWP Manufacturer (1)

- 100% polymer, unique rheology - reduced spread rate
- improved mileage
- cleaner production
- Cold curing - reduce energy costs
- no heating equipment
- less space required
- Fast curing system (from 4 min to 3 hour cure) - enable cont. in-line process
- improved productivity, faster QC
- No mixing - simpler more reliable process
- No cleaning cabinet - reduced cost
- less space required
- No waste water - reduced cost
- no pollution
- Minimum quantity of adhesive residue at the unit - efficient use of resources
- clean production line application
- simple disposal of residue
Advantages and Benefits for the EWP Manufacturer (2)

- No odour - pleasant working environment
- Wide application range - single adhesive in process
- Bond hardness similar to - longer tool life / improve Wood machining
- Moisture curing - ability to bond Green timber innovative processing EWP
- Non Flammable system - reduce OH&S - reduced fire risk - lower insurance premiums
- Toxicologically harmless, - No Formaldehyde emissions during use, chemically stable equivalent to natural wood:
  Frauenhofer Institute for Wood Research, Germany

Advantages and Benefits for the End-user (Building Owner / Inhabitant)

- Clear, transparent bond - aesthetically appealing - similar to natural wood
- No harmful emissions - No environmental issues for thermal disposal at the end of the life cycle
Performance

Certified 1C-PUR adhesives have been tested for the same structural end use applications as PRF/MUF adhesives in several countries, to fully comply to National standards.

Strength
- Ductility and brittleness of a bond line are important parameters. Research has shown more ductile adhesive glue line such as PUR exhibit higher shear strength but with lower fiber failure than brittle adhesives. Uniform stress distribution actually increases load bearing capacity and service life.

Durability
- Over 25 years exposure and long term creep testing has proven suitability for structural timber applications.

Thermal Stability
- Certified 1C PUR adhesives tested in heat and fire, that resist temperatures up to 220c.
Correct Application and handling of PUR adhesives ensures quality and value.

**Advantages:**
- Suited to both lug and batch FJ processes
- Lower spread rate, reduced unit costs
- Proven reliability of the adhesive joint
- Reduced handling time & costs (no mixing), cleaning of gluing equipment
- Increased productivity
- Auto purge, operator friendly
- Safe, Clean and low waste
Benefits of contact free application

- Innovation
- Precise application (bead application, control of position and amount)
- Reduced house keeping
- Virtually zero waste

Finger Jointing via Contact Free

The adhesive is applied contact free via nozzles transverse to the profile laid. Purbond invented the KEBA-system, certified by MPA, Stuttgart.

*Advantages:*
- Clearly less contamination of equipment
- One-side application
- High process security
- Improves productivity
Edge Gluing

**Advantages:**
- Fast application
- Increased productivity
- Safe, Clean workplace
- No sunken glue line

Face Gluing

**Advantages:**
- Aesthetics
- Consistent, Fast application
- Increased productivity
- Safe, Clean workplace
- No sunken glue line
Special Applications

- Frame construction
- Large Format Panels
- Special Elements

**Advantages:**
- Custom-made products
- Small pressing power (vacuum press)
- Fast, safe and efficient

Manual Applications

**Advantages:**
- Movable applicator – long length application possible.
- Simple application
- Custom requirements specified applicator head
- Easy to maintain
Developments in Application
UV Detection System – Purbond Security System (PSS)

PSS ensures complete process control and traceability in adhesive application for finger-jointed products.

- Easy operation by F/J team.
- Records production data, images of every joint and measures adhesive area coverage.
- Reduces down-line rejects to an absolute minimum
- Increases efficiency without extra labour.
- Stores production images for future inspection
- Develop security for contact free & comb

- Can be adapted for Glulam production.
- Detection control of each individual adhesive bead by the computer totally digitally Automated.

Development in PSS Finger Jointing

2003: Camera System

Development in PSS Finger Jointing Comb

2009: PSS for Comb

Batch or lug joint adhesive detection of the PURBOND adhesive with matrix frame (visualisation at display)
GREEN → Okay
RED → not Okay, not enough adhesive

Other Developments in bonding of wood elements used in load bearing constructions

Combination of Wood, concrete and steel
• Composite systems
• Glued Connectors and rods

✓ 2C-PU adhesive system in use and DIN 1052 certified
Wood – Concrete – Composite systems

Wood - Steel – Glued Connection
Wood Manufacturing 2010

Projects Gallery

Adhesive systems for engineered wood

Projects

DOKA Formwork I-beams

I-beams since 1997
Projects

Single Family House, Austria

Spruce
KLH-elements
PURBOND® HB 110
Year 2003

Salt Storage, Deusa, Germany

Spruce
Finger jointing and Face gluing
PURBOND® HB 110 and HB 530
Year 2004
Projects

“Wave” Railway Station in Berne, Switzerland

Spruce
Face gluing
PURBOND® HB 181
Year 2005

Projects

Road-bridge, Switzerland

Spruce
Face gluing
PURBOND® HB 181
Year 2006
Glulam future projects at work

- Crossrail station Isle of Dogs, London
  Special roof construction – connectors bonded in place with certified 2C-PUR

Murray Grove Tower, London, UK 2009

9-storey building in wood KLH elements
Summary

✓ 1C-PUR + Wood = Excellent fit
✓ Proven to fulfill the modern requirements for engineered wood products
✓ Safe application systems
✓ Improved OH&S
✓ Reduced energy and environmental impact on production
✓ Lower costs in production
✓ Product Excellence via 1C-PUR technology can give the finished product an environmental, technical and commercial advantage

Thank you for your attention.