All Division 5 World Conference

Forest Products and Environment -
A Productive Symbiosis

Taipei, 29 Oct. - 2 Nov. 2007

Light Weight Panels: Summary of a New Development in Europe

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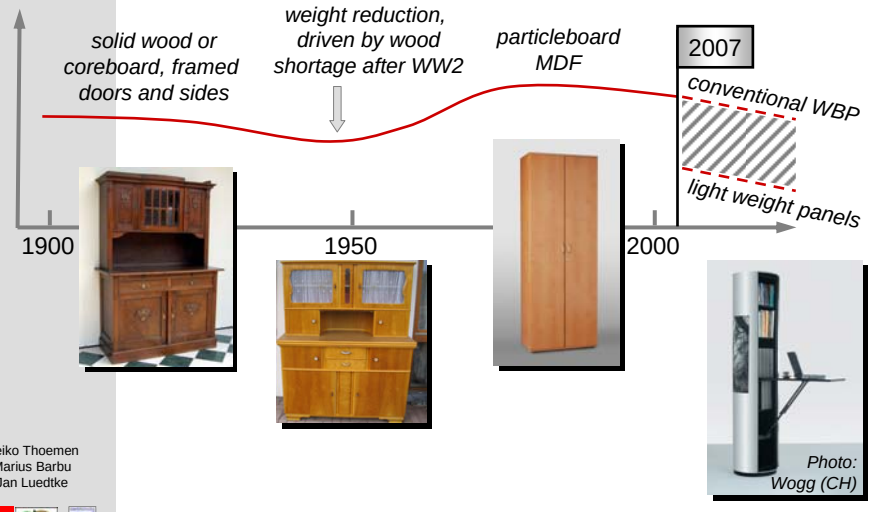
Weight of furniture



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Jan Luedtke

Content

1. Introduction and motivation
2. Sandwich structures with paper core:
   New concepts for an old idea
3. Foam core panels:
   A new process technology
4. Conclusions and outlook

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Motivation for light weight construction *)

- Improve functionality

  Mass reduction to reach required functions (e.g.: Aviation and aeronautics)

- Reduce costs

  Mass reduction to save material costs

- Reduce ecological impact

  Mass reduction to reduce energy consumption (e.g.: Fuel)


Pelican (left), bone of a bird wing (right)
www.vobs.at/borgl/bionik.htm

Solis viaduct in Switzerland:
Main arc with six "sparing arcs"

3-liter Volkswagen

**) following Wiedemann 1986*

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Situation in European furniture manufacture and interior construction

- Improve functionality
  Required function: Easy to handle
  - Customer (Take-away furniture, "modern nomades")
  - Within the company (Production, trade)

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Situation in European furniture manufacture and interior construction

- Improve functionality
  Required function: Easy to handle
  - Customer (Take-away furniture, "modern nomades")
  - Within the company (Production, trade)

- Reduce costs
  Saving of material costs (particularly for thick panels)

- Reduce ecological impact
  Only auxiliary motivation

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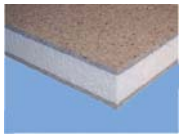
Classification of light weight wood panels

- Low densification of the material (e.g.: Low Density Fiberboard)
- Use of light wood species or other plant fibers (e.g.: Hemp)
- Tubular boards
- Sandwich panels ...
  - ... with a homogeneous core (e.g.: Foam)
  - ... with an in-homogeneous core (e.g.: Paper structures)



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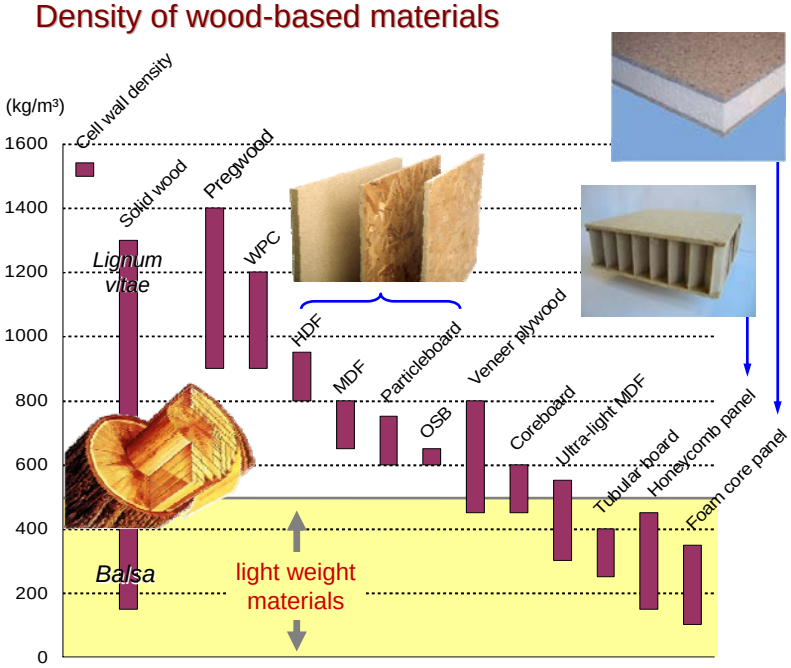
Density of wood-based materials



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Two paper core panels established in the market

1. **Frameless panels with corrugated core**
   - Special applications, e.g., caravan or boat building
   - Prices considerably above those for particleboard

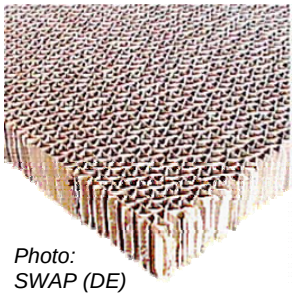

Photo: SWAP (DE)

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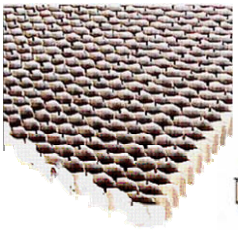
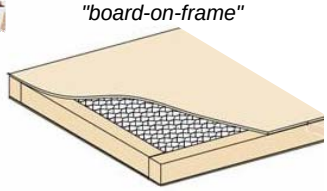
Two paper core panels established in the market

1. Frameless panels with corrugated core
2. **Panels > 25 mm with internal frame and expandable honeycomb core**
   - No difficulties regarding
     - Edge lamination
     - Fittings
     - Mechanical properties
   - Material cost savings compared to particleboard





"board-on-frame"

IKEA LACK

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Two paper core panels established in the market

1. Frameless panels with corrugated core
2. Panels > 25 mm with internal frame and expandable honeycomb core

Intensive R&D activities: **Combination of types 1 and 2**

⇨ Development of a frameless panel with a low-price core

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Evolution of panels with expandable honeycomb core

Stage 1

Board-on-frame

Stage 2

Frameless panels with thick surface layers (> 4 mm)

Stage 3

Frameless panels with thin surface layers (< 4 mm)

Motivation:

- Weight decreases
- Material costs decrease
- (Flexibility increases)

Challenges increase:

- Fittings
- Edge connections
- Edge lamination
- Mechanical properties
- Dimensional stability
- Machinability
- Consumer perception (regionally different)

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Evolution of panels with expandable honeycomb core

Stage 1

Board-on-frame

State of the art

Stage 2

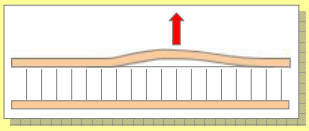
Frameless panels with thick surface layers (> 4 mm)

Stage 3

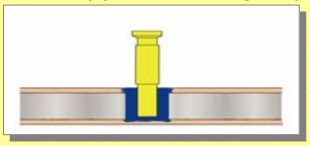
Frameless panels with thin surface layers (< 4 mm)

Example of a new development

Danger of delamination



Solution (by WoodWelding, CH)



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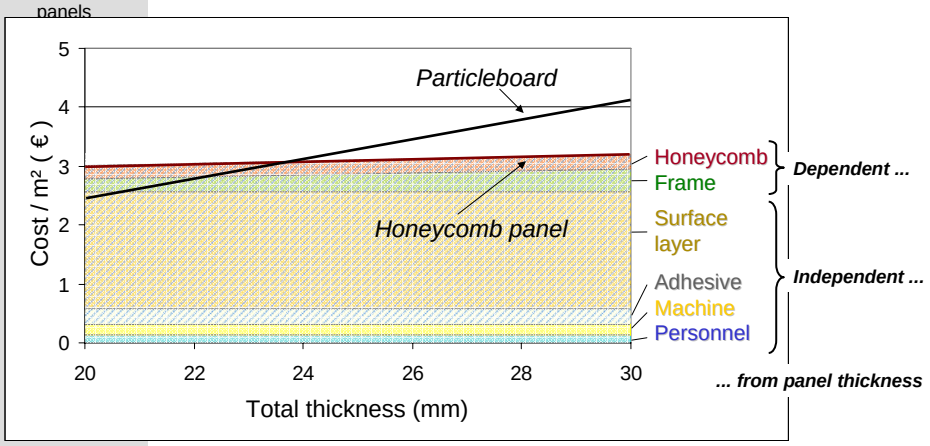
Production costs



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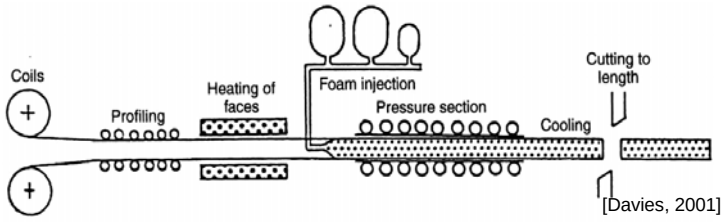
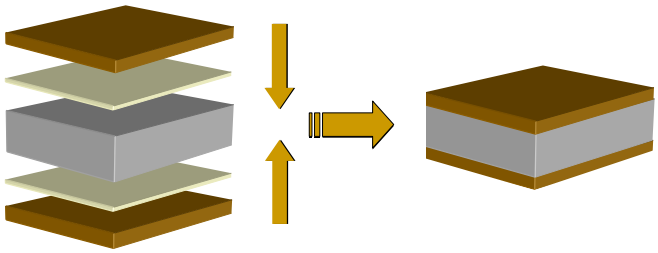
Continuous production of sandwich board

a



[Davies, 2001]

b



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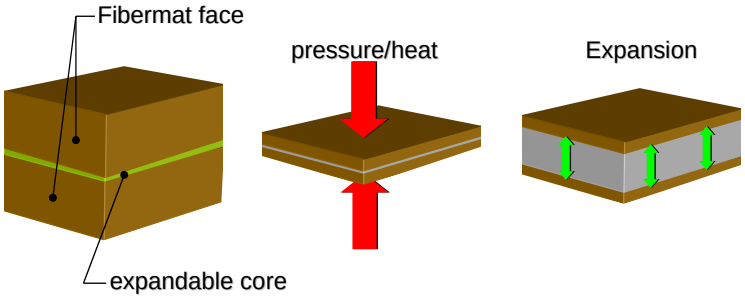
Principle of simultaneous production



Process:

- Hot press closing on the final thickness of both face layers
- Curing the face layers at final thickness
- Slowly opening of the press to the final board thickness
- Cooling under low pressure for a controlled solidification of the core

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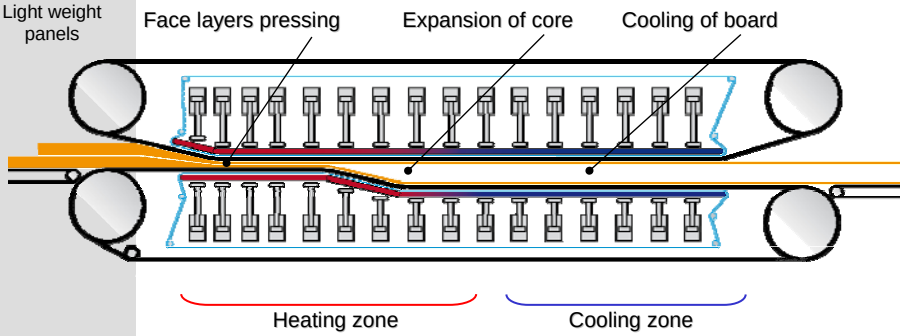
Continuous pressing process

Light weight panels



Demand on core material:
- able to expand
- pressure resistant in its un-expanded state
- free flowing
- activatable under heat

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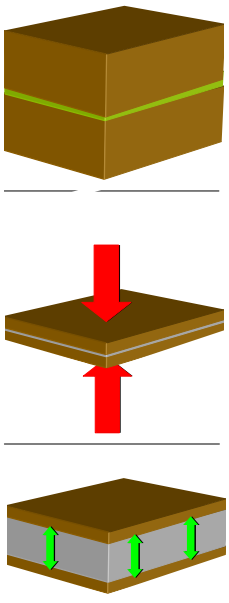
Lab pressing process



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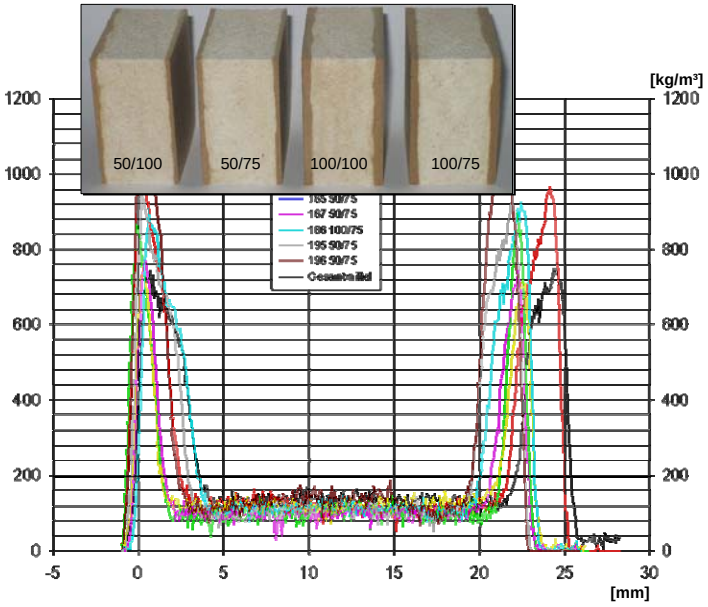
Density profile of the sandwich board



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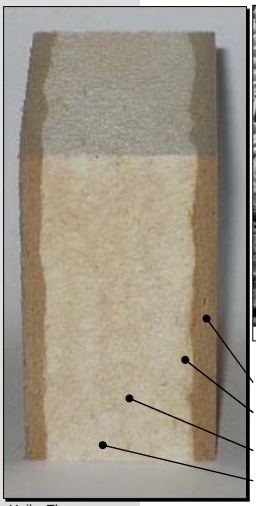
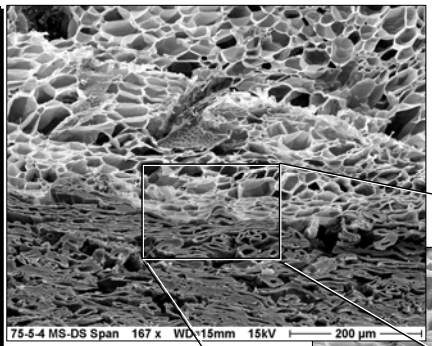
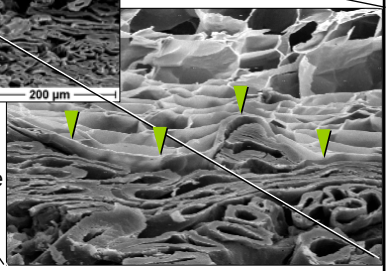
Structure of the sandwich board







Compaction the face layers
Connection betw. core and face
Formation of expanded core
Embedding of fibers in the core

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Conclusions and outlook

- Light weight panels can be expected to obtain much greater importance and dynamics in the future
- Driving forces for weight reduction are:
  - The growing market for take-away furniture
  - Need for savings by increasing raw material costs
- Honeycomb sandwich panels are well established for panels > 25 mm thickness and producers fitted equipment
- For standard thicknesses (15 ... 19 mm), light weight panels have not entered the market yet
- The mass products market will require a light weight panel with the following properties:
  - Thickness variance
  - Frameless
  - Available at low cost in large formats
  - Processable with conventional machines or slightly modified techniques (cutting, edge banding, surface finishing)
  - Easy to recyclable

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Light weight panels

Thank you!

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