
'Three Times is Enemy Action'

Wood Plastic Composites and the Future of Wood

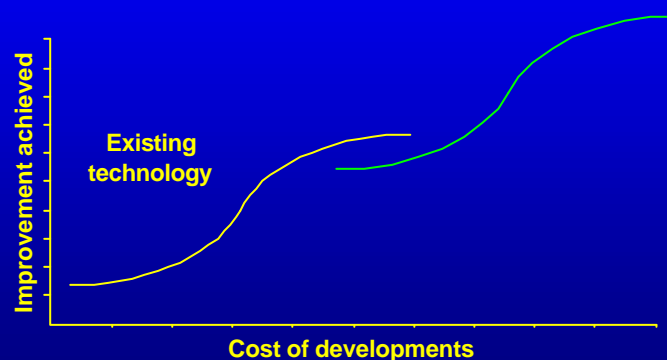
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Wood Plastic Composites and the Future of Wood



The New Materials





Wood Plastic Composites and the Future of Wood

What are WPCs?

'Wood plastic composite' is the name for a mix of:

Wood (as fibres, flakes, sawdust or flour) and

Plastics (as PE, PP or PVC)



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The New Generation

- **First generation: Recycled wood flour or chips and binders. Ideal for undemanding applications.**
 - **New generation: Recycled wood flour and plastics. A material that can be processed just like a plastic but has the best features of wood and plastics. High technology products for the most demanding applications.**
 - **True hybrid materials: Combine the best properties of both wood and plastics.**
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The New Generation

- **Use low cost and plentiful raw materials.**
 - **Wood from sawdust and scrap wood: no wood resources are depleted.**
 - **Plastic from recycled plastic bags and recycled battery case materials (in demanding applications new plastics materials are used).**
 - **Waste products become a valuable resource - recycling materials from short life cycle applications into long life cycle applications.**
 - **Wood waste and recycled plastics become assets instead of liabilities.**
 - **Profitable and ethical.**
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The New Generation

- **Competitively priced and are competitive with traditional materials such as timber, MDF and PVC-U.**
 - **Easily fabricated using traditional wood processing techniques**
 - **A broad range of finishes and appearances**
 - **Easily recycled after use.**
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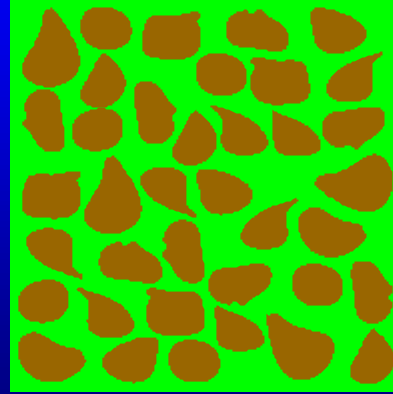


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The Structure of WPCs

The wood particles are completely coated with the plastic.

- Good stiffness and impact resistance.
- Dimensional stability.
- Resistance to rot.
- Excellent thermal properties.
- Low moisture absorption.



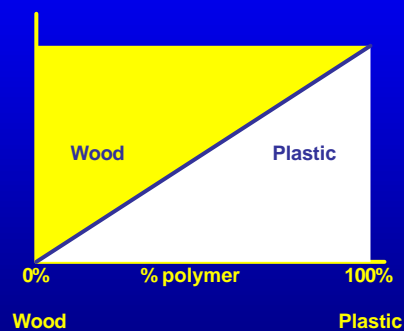
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WPC Properties

The properties of WPCs can be tailored to meet the product requirements.

Properties can be designed by:

- Varying the type of wood
- Varying the type of plastic
- Varying the ratio of wood to plastic.





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WPC Properties

'Lest there be any possible, probable, shadow of doubt, strength is not, repeat not, the same thing as stiffness.

Stiffness, Young's modulus, is concerned with how stiff, flexible, springy or floppy a material is.

Strength is the force or stress needed to break a thing.

A biscuit is stiff but weak, steel is stiff and strong, nylon is flexible but strong, raspberry jelly is flexible and weak.

The two properties together describe a solid about as well as you can reasonably expect two figures to do.'

J. E. Gordon, 'The New Science of Strong Materials'



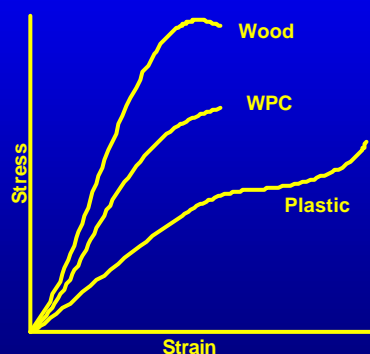
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WPC Properties

Stiffness and strength between those for plastic or wood.

Density is generally higher than either.

- **Stiffness is the slope of the stress-strain curve**
- **Strength is the highest value before failure (break)**





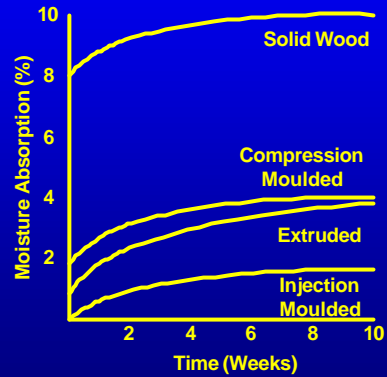
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WPC Properties

High moisture resistance of WPCs (water absorption of <4% compared to 17.2% for pine) is a direct result of the structure.

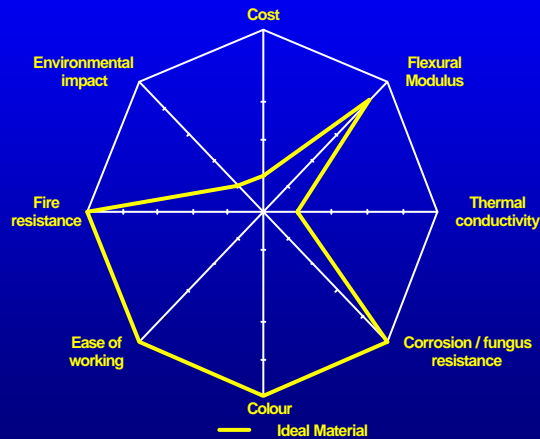
Moisture can only be absorbed into the exposed sections of wood and is not transmitted across the plastic boundaries.

WPCs are extremely moisture resistant, have little thickness swell in water and do not suffer from fungal or insect attack.



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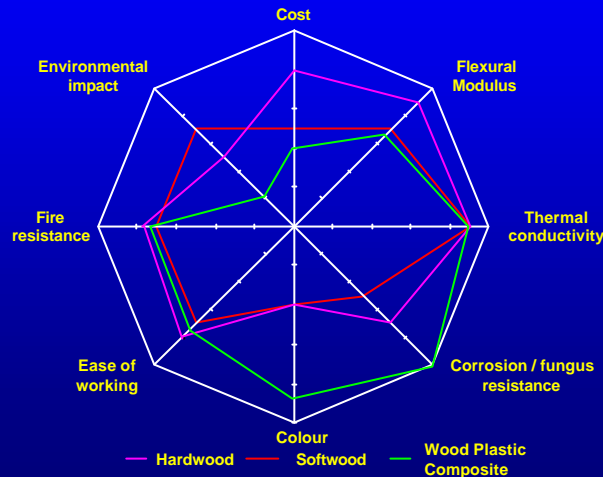
Assessing the Benefits of WPCs





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Assessing the Benefits of WPCs



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WPCs and fire

- WPCs have a fire behaviour similar to, or better, than that of comparable timber products.
- The plastic matrix appears to improve the fire performance of the wood component in WPCs. Many plastics, e.g. PVC-U, have good ignitability and spread of flame performance and this appears to be transferred to the WPC when they are used as the plastic component.
- WPCs show good results in ignitability tests and these are similar to the results for wood with similar density.
- WPCs show good results in spread of flame testing and the results can actually be better than those of wood with a similar density.
- The fire performance of WPCs can be modified and improved by the addition of flame and smoke retardants to the raw material before processing.



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Tuning the Mix

WPC properties and costs can be tuned to deliver the optimum combination by selecting different plastic components.

Property	PE-HD	PP	PVC
Price	1	2	3
Recyclate availability	1	2	3
Density	2	1	3
Stiffness	3	2	1
Creep Resistance	3	2	1
Operating Temperature	2	1	3
Weatherability	2	3	1
Flame Resistance	2	2	1



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Tuning the Mix

WPC properties and costs can be tuned to deliver the optimum combination by varying the amount of plastic component added.

	PE-HD	PVC
Base Polymer	24-60%	35-65%
Wood	40-70%	30-60%
Additives	2-6%	4-6%



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WPCs and the environment

There is negligible waste and any that is produced reused.

- WPCs contain no formaldehyde or volatile organic compounds.
- WPCs are recyclable and can be reground and reused after their service life.
- WPCs are considered non-hazardous waste and can be disposed of by standard methods. The basic material structure of WPCs means that leaching from WPCs is minimal to non-existent.



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Working and finishing WPCs

WPCs can be cut finished and fastened just like wood

Fastening	Machining	Finishing	Sealing & Filling
Nail	Turn	Prime	Silicone seal
Screw	Mill	Paint	Acrylic seal
Glue	Drill	Integral Colour	Wood Fillers
Staple	Sand	Emboss	
Dowel	Saw	Veneer Wrap	
	Mitre	Laminate	
	Rout	Varnish	
	Plane	Lacquer	



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Product design for WPCs

WPCs give finished shapes without the need for additional processing or waste.

- Extruded WPCs produce the final product in a single step.
 - Accurate net shapes from wood products without any waste. Fine control on profile dimensions means improved product performance and reduced material usage.
 - Exterior profile walls can range from 4 mm to 6 mm, interior walls range can range from 2.5 mm to 3.5 mm.
 - Possible to extrude intricate internal details to tolerances of less than +/- 0.2 mm.
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Product design for WPCs

- Profiles can include stiffening legs, internal hooks, internal dividers, snap fittings and internal strengthening walls - all the features of plastic design.
 - Profile weight (and cost) can be reduced.
 - Profiles can be designed with connectors for product systems to be developed.
 - Designers can add value to wood products by using precisely formed products.
 - The possibilities of wood products can be expanded.
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WPC applications

Wood plastics composites have been extensively used in the USA and around the world.

Door frames	Fascias, soffits and barge boards
Window frames	Decking, docks and railings
Exterior cladding	Dado rails
Skirting boards	Planking and pre-finished floorboards
Stairs and hand rails	Shelving
Coving	Cable trunking
Balustrades	Fencing and fence posts
Kitchen cabinets and worktops	Office furniture
Work tops	Garden furniture



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The future for WPCs

- WPCs are a new era in materials development that combines the old with the new to deliver an exciting new option for the end user.
- The range of materials being developed is wide and exciting and progress is rapid. The new WPC materials cover a wide range of polymer matrix types as well as a wide range of fillers and stiffeners.

The future for WPCs is bright, but is this 'enemy action' for the woodworking industry or a golden opportunity?