

PANEL FUTURES

A special 30th anniversary for the BioComposites Centre was the background for this year's International Panel Products Symposium (IPPS) in Wales



The BioComposites Centre team at IPPS were celebrating the 30th anniversary of the centre

The Victorian seaside town of Llandudno in Wales was the setting for the International Panel Products Symposium (IPPS) once again.

This year's event from October 7-9, the 17th conference to be held, returned to the location of the first IPPS – the Imperial Hotel. An amazing 600 technical papers have been presented in IPPS's history on a vast range of subjects pertaining to the wood based panels industry.

Research and development news are a big feature of the conference and once again panel producers and industry suppliers were present in force to learn about the latest developments.

And it was extra special as 2019 is also the 30th anniversary of the BioComposites Centre (BC), the conference organiser.

Rob Elias, BC director told about 70 delegates that the centre has exciting plans for the future, with a £1.6m new facility planned to house its pilot scale plants, extrusion technologies and fibre recovery, as well as new meeting rooms.

"In terms of meeting future demand we will be better placed to help the industry," he said.

FEEDSTOCK FUTURES

Keynote speaker Marcel Vroege of consultant Indufor Asia Pacific Ltd, kicked off proceedings by giving an overview of future availability of feedstock for the global wood based panel industry.

"In my view we are facing some key challenges over the coming years," said Mr Vroege. "The industry has grown massively over the years."

He said increased production of LVL and other engineered wood products was a factor in increased demand for wood.

India's determination for economic growth and "to be another China" will be a key driver for the continual growth in demand for wood based panels.

Today about 900 million m³ of roundwood equivalent is used by the global wood-based panels industry.

"Can we double it?" asked Mr Vroege. "Can we go to 1.7 billion m³ of fibre used by our industry? I do not think so."

He added that about 2 billion m³ of fibre was used today for all forest-based products, including pulp.

"In the future more fibre will come from plantations but we do not have enough land

for the plantations. Demand for good land where you can grow food on is increasing to service population growth. So we need to look at ways of using our fibre better."

Other new demands on wood fibre include bio energy. An estimated 40 million tonnes of wood pellets are currently produced annually, with the figure set to grow to around 60 million tonnes in 2038 – or 110 million m³ of roundwood equivalent.

The trend for mass timber buildings using engineered wood products such as cross-laminated timber (CLT) is another growing use of wood fibre.

And, Mr Vroege added, there were threats to the fibre resource such as beetle infestation, natural disasters, deforestation and climate challenges.

The damage impact of the mountain pine beetle in Canada was estimated at 752 million m³ of pine by 2017, while forest fires in recent years have accounted for 8.5 million hectares in Russia and 906,000 hectares in the Amazon.

"We need to do more with less," said Mr Vroege. "We need to extend the lifecycle massively and make products that can last longer, as well as re-use products."



IPPS was back at The Imperial, Llandudno for the first time since the first conference back in 1997

VOC AND RESIN DEVELOPMENTS

A number of speakers covered developments on the subject of VOC emissions.

Martin Ohlmeyer, of the Thünen Institute, stated that VOCs have the smallest impact on human health indoors “yet we are regulating against them”.

“Building materials have the smallest impact on human health yet we are regulating against them,” he added.

Different regulation systems were in operation in Germany and France, he added. In Germany itself, the state of Baden-Württemberg has a different rule from the other states, while France has a classification system.

“How does this fit together in Europe – we do not know.”

Mr Ohlmeyer said people were hoping for a harmonised European standard on VOCs.

“But the problem is that we regulate the products but do not look at the temperature and climate indoors,” he added.

He cited research which showed VOC emissions increase in the summer and reduce in the winter.

“The temperature of the ambient air in a house has a much greater effect on the emissions than the material itself. We must look at physics rather than just at the material itself.”

Combining different materials in houses also has an impact on VOCs.

“For me it does not make any sense [that we only look at board composition],” he said.

Mr Ohlmeyer concluded that product emissions would one day be part of CE Marking.

Friederike Mennicke, also of the Thünen Institute, then shared a derived method quick assessment of VOC emissions for wood based panels.

A rapid test method was based on a microchamber with 15mm thick OSB3 samples conditioned at 23°C and 50% RH for several weeks.

Standard testing to DIN EN 16516:2018-01 is in an emission test chamber for 28 days which is very time-consuming. Development of a rapid test method is the result of several studies to get faster and reliable results.

The testing results showed high coefficient of determination for terpenes, and the rapid test method can be used to derive the 28-day value of the reference method. However, no correlation was found for results of secondary emissions, so further studies will need to focus on that.

BIO-ADHESIVES

Interest in natural “bio” adhesives has been growing to replace synthetic adhesives due to environmental and health concerns over the latter, particularly those based on formaldehyde.

Bruno Gorrini, of Arauco in Chile, shared lab results demonstrating the potential of radiata pine tannin and nanocellulose to reinforce amino resin for wood based panels.

Mr Gorrini said the challenge was achieving the same performance and similar or lower cost as synthetic adhesives.

Arauco used its own wood to produce tannins from pine bark and added crosslinking agents glyoxal and tris hydroxymethyl nitromethane to make particleboard and MDF.

Results showed that the bio adhesives reached similar performance to commercial wood adhesives based on phenol and formaldehyde. Addition of citric acid promoted the reaction between tannins and crosslinkers, increasing solids content by lowering viscosity.

The internal bond strength of boards satisfied European norm standards.

Using homogenized cellulose fibres (H-CNF) and ground cellulose nanofibres (G-CNF) to reinforce UF resin in particleboard



Above left: Keynote speaker Marcel Vroege covers the challenges of securing future feedstock for the panels industry

Centre: Dr Mark Irle on recycling waste fibreboard

Above right: Graham Ormondroyd speaks on trends in European timber and biomass

allowed a 10-20% reduction in resin consumption, with the same adhesive strength improvement and also suggesting a reactivity increase.

In MDF, internal bond strength was increased when adding 1 wt% G-CNF to UF resin, improving pressing times.

"I think in the future that many companies will be using environmentally-friendly adhesives and it will make for a better environment," said Mr Gorrini.

Use of UK-sourced tannin from Sitka spruce was the focus for Dave Preskett, of the BioComposites Centre.

Spruce bark from BSW Timber in Newbridge, Wales was dried then hammer milled through a sieve plate before extraction work at the BioComposites Centre and then finally resin formulation and testing by Hexion.

The material was used at a 20% substitution rate of phenol to produce a lab batch of phenol formaldehyde resin to make seven-ply 10.5mm-thick birch plywood sheets.

Results showed bond strengths on the test boards were better than normal control boards and mean wood failure was lower. Future tests will look at higher phenol substitution rates.

"There are lots of opportunities for biophenols, not just in the resin industries," said Mr Preskett. "It can be used to substitute petro chemicals and produce bioethanol and for applications in the pharmaceutical industry."

Magda Dias of the University of Porto shared testing of paraffin use in particleboard to improve its water resistance and MDF boards made using MUF resins.

Results in 24-hour testing showed incorporation of 0.85% paraffin solids led to a 28% decrease in swelling compared to standard particleboard, while 1.2% paraffin solids led to a 41% decrease. Paraffin used only in the core layer also brought benefits – reducing swelling by 16%. Swelling thickness increased by 3% with paraffin only in the surface layer.

However, EN321 testing for three weeks showed that the samples did not reach the test target – achieving a thickness swelling of less than 13%. But overall, emulsions of paraffin are the most effective method to improve particleboard water resistance, the research concluded.

INNOVATION AND PERFORMANCE

David Murray of MEDITE SMARTPLY highlighted the need for panels sector innovation, sharing the company's value-adding products such as its Ultima OSB4 and Propassiv OSB with integrated vapour

control and air barrier properties, plus MEDITE TRICOYA EXTREME modified MDF.

As part of the company's recent €60m investment focused on a new Contiline press, it also installed an R&D pilot press.

But, Mr Murray said, it was the fire issue that was currently the big issue and he predicted that very soon all products will need to be Euroclass Reaction to Fire "B" Class.

MEDITE SMARTPLY's own FR product, he added, had the benefit of fire retardants added in the board manufacturing process, not on the surface, thus giving fire retardancy throughout the board.

Another innovation, highlighted by RFIDirect, was development in Radio Frequency Identification (RFID) technology in the wood industry.

Its RFID Smart Wood project has led to a patent application for its bespoke passive chip-set "making unique identification at individual item level" possible.

RFIDirect's Mouna Ghorbel and Frits van Caker said wood industry companies struggled with tracking components and orders, which dragged down efforts to capitalise on Industry 4.0 – the digitalisation of the factory.

The RFID Smart Wood project has led to the design of a chip-set designed to overcome two major obstacles using RFID technology embedded in wood products – potential physical damage to the RFID tag due to wood swelling and shrinkage; and backscatter antenna frequency due to wood properties, external factors and ageing.

The technology, it says, meant no need for manual interference, automatic capture of digital performance data, quality assurance and reverse product traceability.

Meanwhile, at the Technical University of Dresden, research on using an adhesive free paper honeycomb core for environmentally-friendly lightweight panels was shared. The hexagonal shape paper core uses interlocking paper strips instead of adhesive.

Results showed a reduced compressive strength compared to conventional expandable paper honeycomb core, while no machinery currently exists to connect the paper strips. However, the university is developing a solution together with industry partners.

EMERGING THEMES

The BioComposites Centre's Graham Ormondroyd tackled European trends in European timber and biomass, saying there was a "raw material squeeze".

Competitors for wood included the biomass energy and bio-based chemical sectors. Currently, 60% of woody residues in



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the EU-28 went into bio-energy.

"We are a small fish in a big pond," he said.

In 2017-2018, some three million tonnes of material went into wood energy.

"The panels industry is being squeezed to just 10% of total wood use," added Mr Ormondroyd. "There is now a case for sorting, grading and using post-consumer wood waste."

Wood based panels' contribution to greenhouse gas abatement in modern methods of construction was covered by Dr Morwenna Spear, also of the BioComposites Centre.

Its study on different housing archetypes using different materials showed the effect of using timber frame to displace masonry systems was to reduce embodied carbon for all designs. Wood based panels accounted for up to 27% of the stored sequestered carbon within timber frame houses, while the figure was up to 40% in timber framed apartment buildings.

"We are going to have consider construction materials a lot more in buildings," said Ms Spear.

She told delegates that Environmental Product Declarations (EPDs) were important and that this data would be used in building design and decision making processes.

STANDARDS

In the realm of quality standards, a look at the UK wood-plastic composites (WPC) market was provided by Janet Sycamore of the Timber Decking & Cladding Association (TDCA).

The WPC decking market has boomed in recent years due to the product's durability, low-maintenance and colour-fastness. Several examples of product failure and problems were recorded in the market's infancy when hollow profiles were prevalent. A product recall in 2015 at a big UK retailer created ripples in the market.

In response to the product's popularity, the TDCA set up a WPC Quality Scheme this summer to ensure products were fit-for-purpose. Applicants need to demonstrate slip-resistance, falling mass impact tests, flexural properties, boiling tests, moisture resistance and fire performance, while product marketing material and warranty information are also scrutinised. The DeckMark accreditation label can be used by successful applicants.

The overall intention is to drive up quality, ensure transparency, investigate poor performance, develop a generic information resource and for the TDCA to act as an independent authority.

One scheme application has already been made, with other WPC companies currently

reviewing their data and testing before applying for the DeckMark accreditation.

The issue of fire is never far away and, says consultant Jerry Quayle, the situation is not made easier by confusion and misunderstanding over the terms 'fire resistance' and 'reaction to fire'.

He said there were very few directly applicable standards to help the industry, specifiers and the public understand the fire performance of timber-based panels.

"Grenfell has focused the whole world on combustible products," he said.

Catastrophic events like the fire at Grenfell Tower on June 14, 2017, change the landscape after about five years. "We have three years to go since that horrific event," said Mr Quayle.

"Some changes have been made to the regulations surrounding cladding and composite (plastic) fire doors, the rest is to come," he added.

Jussi Ruppenen, of Palonet Ltd in Finland, presented ionic liquid as a fire retardant for veneer-based panels, quoting Class B-s1, performance. The research by Palonet and Aalto University aimed to find a low-cost solution for fire-retardants with wood based panels.

The testing – to Japanese standards – saw a 3mm veneer treated with Palonet F1 comprising an aqueous solution of bisphosphonate acid, an alkanol amine and optionally an alkaline agent with water as a solvent.

The veneer was applied to one surface of LVL panels and the product subjected to a 30min combustion test. Results indicate the charring rate of F1-treated LVL was reduced by 39% compared to non-treated LVL.

Tests on particleboard where the surface layer chips are treated with Palonet F1 before MUF resin spreading revealed that

bending strength and modulus of elasticity both increased, while the time before ignition increased fourfold.

Another project focuses on birch plywood and spraying both surfaces with Palonet F1.

Further testing will focus on charring rates under real fire scenarios and on optimising the composition and concentration of F1.

A further fire-focused study by Sergej Medved of the University of Ljubljana, Slovenia showed that it is possible to make three-layered particleboards where fire retardant is used only in the surface layer. Fire retardant Burnblock was used in experiments.

The final presentation of the day was from Mark Irle of Ecole Supérieur du Bois, France, who tackled recycling waste fibreboard.

Currently, there is practically no commercial recycling of MDF.

There is also the issue of using agricultural residues, with Mr Irle suggesting small-scale biorefineries could be the answer.

An estimated 55 million m³ of global waste MDF (39 million tonnes) was generated in 2018, compared to 100 million m³ of global annual MDF production capacity annually. The waste, Mr Irle said, represented "a significant resource for conversion to other products".

The Flexibi project focused on mixing tomato plant waste (usually wet and degrades quickly) with MDF – to make the material stay dry and last longer, as MDF has a relatively low moisture content.

The aim of the research is to see if moisture can be transferred from agri-wastes to waste MDF chips and whether this can stabilise the storage of the combined wastes.

"We can definitely use waste MDF to solve this agricultural waste problem," said Mr Irle.

A second experiment using 2019 crop wastes is planned. ●



Above left: Jussi Ruppenen explains the benefits of ionic liquid based fire retardant

Above right: Rob Elias, director of the BioComposites Centre, concludes the conference