IPPS comes home

The International Panel Products Symposium (IPPS) returned to Llandudno, UK, on the North Wales coast, where the first annual event was held in 1997. Delegates from around the world attended and Mike Botting was there to bring a flavour of what they learned

Venue Cymru is a purpose-built conference centre

Introducing the 15th annual edition of IPPS (formerly EPPS), Rob Elias, director of organisers the BioComposites Centre, Bangor, looked to future challenges for the panel industry globally.

He pointed out that the economic crisis was still a significant factor. He also said that the document *Europe 2020*, in which the European Commission proposes five measurable targets, offered key challenges and new initiatives, including energy and climate targets, in which the industry can become constructively involved.

Dr Elias also announced that the BioComposites Centre had recently received funding of two million pounds from the Welsh Assembly government, which will enable the organisation to expand, taking on four new staff and spending half a million pounds on new equipment for its research facility on nearby Anglesey Island.

"A key challenge for our sector is to boost research and innovation," said the director. "Market demands for new products are changing and we must recognise that these bring new market opportunities. If we fail to act on these opportunities, other materials and products will satisfy these demands."

Session 1 was about 'Processing' and the first paper, given by Clemens Seidl of Andritz, Austria, was entitled *Pressurised refining: New methods to improve the production of fibres to save energy and be eco-friendly*.

"The swing door [on the refiner] is our kind of trademark, as are our spiral plates, but today we are concentrating on how to save energy," said the speaker. He pointed out that in the MDF production process, refining and drying consume the most energy and are thus the areas in which to make savings.

He offered 'centre steaming', in which steam is injected into the centre of the pre-steaming bin and digester as well as the periphery. Mr Seidl also spoke about the new plug-screw feeder with pressure seal to maximise water removal from the fibre before refining to reduce the drying heat required later. He said Andritz had made the maintenance of the plug screw easier with its 'Compression Housing with Integrated Spool Piece' which is said to lead to steam, and therefore dryer, savings.

Finally the speaker discussed Andritz's Constant Feeder to reduce load peaks and to improve fibre quality control.

The next speaker, and a familiar figure at IPPS, came from New Zealand. Kelvin Chapman of MDF Tech Ltd spoke about *Improved resin performance in MDF through development of the blowline blending process*.

Looking at the history of this type of blending, Dr Chapman said it was originally adopted with UF resin, in spite of increased resin consumption, to overcome resin spots found with dry fibre blending brought from the particleboard process.

"Mass and energy flows in the refiner determine the flow in the blowline and it is necessary to determine these if the blowline is to be optimised to minimise resin requirement," explained the speaker. "Once the flow in the blowline is established, the blowline sizes can be selected." He pointed out that controlling flows to keep blowline velocities as high as possible is the first step in improving blending performance.

He also pointed out that the design of the nozzle is important to the droplet size sprayed in; smaller droplets improve resin performance but only where the blowline flow is controlled to maximise steam velocity.

A Twin Fluid steam atomising nozzle has been developed to give reliable operation in the blowline, said Dr Chapman.

Hauke Kleinschmidt of Electronic Wood Systems (EWS) of Germany spoke about *How latest measurement technology can improve online evaluation of panel characteristics*. He illustrated this by talking about advanced blow detection and online calibration methods.

Mr Kleinschmidt, whose father founded EWS 15 years ago, spoke about the Conti-Sound ultrasound system, which produces a 'sound colour' picture of the panel under inspection on the computer screen, using a non-resonance system, to detect blows in the panel. Uniquely, he said, this system has no-load auto-calibration. This occurs in a split second, in a panel gap, and includes compensation for sensor pollution and temperature drift.

Electronic Wood Systems offers three systems: Conti-Sound with reflection receivers below the panel; Blow-Scan without these extra receivers (both systems for composite panels); and Ply-Scan for plywood where only "blow/no-blow" indication is required and only two on-screen colours needed.

Session 2 was devoted to 'Novel feedstocks' and the first paper concerned the use of kenaf in panels under the title *Kenaf MDF panels: A statistical approach in parameter selection*.

In the unavoidable absence of one of the authors from the University of Auckland, New Zealand, Morwenna Spear of the BioComposites Centre gave the presentation.

The paper said that kenaf is a good source of cellulose fibre and has a wide range of adaptation to climate and soil types and has been used in the pulp and paper industry to substitute wood fibre.

To avoid issues of formaldehyde release, the team used soy based bio-resins and found that they gave comparable panel characteristics to those panels made with UF resins.

The particular focus of this paper, however, was on the powder coating of the kenaf/bio-resin panels. The quality of coating depends on the electrical conductivity of the panel and the team wanted to investigate the practicality of using conductive fillers, such as carbon black, within MDF to enable uniform electrical conductivity and thus uniform surface coating during powder coating, without compromising the panels' mechanical properties.

They found that they could successfully produce kenaf fibre boards and that panels with 7% bioresin, 1% triacetin and 5% carbon


Rob Elias


Clemens Seidl


Craig Bartlett


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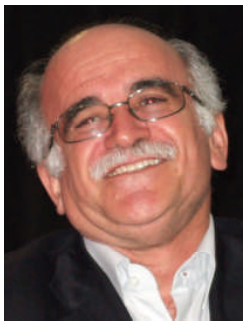
Jahan-Latibari

black exhibited the best overall properties. Carbon black gave up to 75% more conductivity. The triacetin was used as a compatibiliser to retain/improve the fibre-matrix interfacial bonding in the presence of the carbon black filler.

Cotton stalks are another abundant form of fibre in some countries and associate professor Jahan-Latibari of the Islamic Azad University of Iran presented: *The performance of cotton stalks in MDF production*.

The planting of cotton in Iran is set to increase, said the speaker, while wood availability in the country is very limited.

The team made sample MDF panels using cotton stalks and 10% UF resin and found that both strength and thickness swelling of the panels produced were acceptable and that it represented a suitable raw material for the manufacture of MDF.

The final paper in this session focused on the use of modified MDF. Marek Grzeskiewicz of Warsaw University, Poland, presented *Physical and mechanical properties of thermally modified and densified MDF*.

"Sometimes the impact resistance of standard MDF is not good enough," explained the speaker. His team carried out laboratory-scale research on thermally modified MDF and on thermally modified MDF that has been densified by cold pressing.

They concluded that thermal modification of MDF at a temperature of 180°C for half an hour in hot air reduces thickness swelling and thermal conductivity.

Thermal modification of MDF in hot air with densification by cold pressing reduces bending strength and modulus of elasticity.

The team also found that MDF densification after thermal treatment using a cold press causes micro-structural defects.

The speaker added that bathroom panel manufacturers, for instance, may appreciate reduced thickness swelling.

Session 3 covered 'Fundamentals and visualisation'.

Plywood gets less attention than composite panels in most conferences but the first paper redressed the balance with a presentation by professor Mark Hughes of Aalto University, Finland, on *Peeling checks and their effect on phenol formaldehyde bonded birch plywood*.

Aalto University was formed in 2010 by the merger of Helsinki University of Technology, Helsinki School of Economics and Helsinki School of Art and Design, explained ex-pat Briton Mr Hughes.

During the rotary peeling of veneer for plywood, checks or cracks are formed in the veneer whose depth can be up to 70 or 80% of the final veneer thickness, he said.

Under shear, these checks open up and the veneer 'rolls off' the adjacent veneer, he explained, and this is known to affect the properties of plywood or LVL.

The team found that check depth, not unsurprisingly, has a large influence on measured shear strength of the panel, while the strength of samples with checks pulled 'open' or 'closed' is mainly affected by the depth of the peeling checks. Whether the bond is pulled 'open' or 'closed' has a dramatic effect on the wood failure percentage.

"These findings not only highlight that in order to retain product properties, peeling checks should be minimised, but also that caution should be exercised when applying EN-314-1:2005 in the measurement of shear strength," concluded professor Hughes.

A Russian student studying at Ecole Supérieure du Bois, Elena Tikhonova, presented *A study of fibre morphology with a view to the manufacture of layered fibreboards*.

There were two main aims to the research: to economise on raw material use; and reduce environmental impact. The fibre came from rejects from a corrugated cardboard factory and a newsprint factory.

The research concluded that fibre morphology is dependent on pulping method and fibre origin and this morphology can have a strong effect on panel properties. Consequently it could be used as a characteristic for predicting fibreboard properties and manufacturing parameters.

Paper rejects contain small fibres but could be introduced into the core layer of layered fibreboards, said Ms Tikhonova.

Mark Irle, *WBPI* contributor and research director of Ecole Supérieure du Bois, France, presented *The transversal compression and strain of mature wood strands pressed at high temperatures and pressures* – a joint study with the Copperbelt University, Zambia and TRADA Technology, UK.

"Panel stability is a major factor still to be addressed," said Dr Irle. "Panel properties


Elena Tikhonova


Erik Vangronsveld


Hauke Kleinschmidt


Jorge Martins


Kelvin Chapman


Marc Prüsman


Marek Grzeskiewicz


Mark Hughes


Mark Irle


Max Britzke

vary across a daylight of a press due to varying temperature, vapour pressure and moisture content."

The team observed single strand compression behaviour and concluded that: "Data is now available on the MOE and cell wall collapse potential for computer models of pressing cycles".

Session 4 was on Recycled feedstocks and began with another presentation by Dr Irle on *A study of methods that could improve the cleanliness of recovered wood for particleboard manufacture*.

"Recycled wood is usually from an unknown source so its content has to be analysed to check that it is within industry-wide agreed acceptable levels of arsenic, chromium and copper," said the speaker. "The cleaning method must be cheap, not create other problems and not reduce the particle size considerably."

Samples of recycled wood were chemically cleaned with oxalic and sulphuric acid and heat. This was found to significantly reduce metals across all fractions of material but damaged the wood. Work is ongoing.

The final presentation of day one was by Craig Bartlett of MDF Recovery Ltd, UK, entitled *Innovative wood fibre recovery – how not to get burnt*.

The object is to recycle waste MDF panel into reusable fibre for new MDF manufacture.

MDF Recovery's patented system employs ohmic heating as a "continuous and robust process" involving shredding, contaminant removal, grading, mixing with hot water, bespoke ohmic heating, de-watering and re-use in MDF manufacture, for thermal insulation, or as a horticultural medium.

Day two

Day two began with Session 5, on Resins, and was kicked off by professor Edmone Roffael of Georg-August-Universität, Göttingen, Germany, speaking about *The perforator method in balance*.

He concluded that: "Nowadays, the industry needs a method that is able to differentiate between boards with minute differences in their emissions. The results have been mostly unconvincing that the perforator method could [serve] this purpose".

Erik Vangronsveld of Huntsman Polyurethanes, Belgium, spoke about *MDI: EU classification; the impact of REACH; worker and consumer exposure – perception versus facts*.

Mr Vangronsveld pointed out that MDI, as well as being classified as a "hazard" itself is also attached to dust, so it is important to control dust in the production process.

He concluded that worker exposure [in a panel manufacturing factory] to MDI is significantly less than for both formaldehyde and wood dust and that keeping exposure as low as possible can be achieved mainly through press and wood dust emission controls, for example by enclosing conveyors, former and press areas and by using vacuum techniques, as opposed to blowing, for cleaning up dust. Efficient fume cupboards in laboratories must also be provided.

"Consumer exposure to MDI bonded boards can be considered as not relevant or extremely unlikely," said the speaker.

Sergej Medved of the University of Ljubljana, Slovenia, presented *Sorption and moisture resistance of liquefied wood bonded particleboards*.

The research employed de-polymerised liquefied wood as a bio-based adhesive, mixed in various ratios with melamine formaldehyde (MF) resin.

It was concluded that substitution of liquefied wood for MF resin at 20%, and in some cases 30%, resulted in better or comparable mechanical values to the MF bonded control board, while 100% liquefied wood bonded board showed very little resistance to water or moisture.

The next speaker was Marc Prüsmann of Sasol Wax, Germany, on *Small wax particles – the key to efficient hydrophobising*.

Mr Prüsmann explained that wax offered water repellence, provided lubrication to particles and reduced obstruction and maintenance along the panel production line and that it could be applied as molten wax, or as a water based emulsion.

The emulsion, he said, had a distinctly smaller wax particle size and gives improved wax distribution.

Availability of traditional paraffin wax is decreasing due to factors related to demand for oil and so synthetic Fischer-Tropsch waxes are likely to increase market share.

The speaker concluded that "Advanced extra-fine wax emulsions improve the efficiency of wax application". He opined that they will become the industry standard.

For the final paper in this session, Nádia Paiva of LEPAE, Portugal, presented *A study of the influence of synthesis variables on polymeric structure of melamine urea formaldehyde resins*.

The work looked at the differences in polymeric structure when the most important synthesis variables, such as $F/(NH_2)_2$ molar ratio (in first and second reaction steps), and feed rate of urea during the condensation reaction, are subjected to small changes.

Ms Paiva concluded that a small difference in some process variables of MUF synthesis results in significant differences in the properties of the final resins.

"The use of lower $F/(NH_2)_2$ molar ratios and faster rates of urea addition in the condensation step result in particleboards with lower formaldehyde content without detriment to internal bond strength," she said.

The sixth and final session concentrated on Lamination and laminated panels.

Olli Paajanen of Aalto University, Finland, spoke about *Experiences with a new veneer drying method*.

"Drying of veneer plays an important role in the manufacturing process of plywood products…[and] has a significant impact on the properties of the final product," began Mr Paajanen. He also pointed out that it is a high consumer of energy.

His team thus invented a contact drying system which consists of a hot upper plate, then the veneer, then a porous material followed by a metal wire grid and a cold bottom plate. There is also a vacuum inside the drying chamber of this mechanical press.

"The temperature difference in the press causes water in the veneer to evaporate and condense on the cold surface and the vacuum


Morwenna Spear


Nádia Paiva


Olli Paajanen


Robert Massen


Sergej Medved

speeds up the process," he explained.

Mr Paajanen declared the experiment, using a 1200 x 1200mm laboratory press, a success, with total drying time reduced by about 50% when compared with conventional convective drying.

Free water from the veneer can be removed four or five times faster and the moisture variation between different veneers, and within individual veneers, was found to be low. Veneer strength, meanwhile, was found to be comparable to that produced by conventional dryers. "This process has big potential when the method is further developed and the capacity issue must also be resolved," concluded Mr Paajanen.

Marek Grzeskiewicz returned to present another paper for Warsaw University entitled *Glue-ability of densified veneers bonded with waste thermoplastic materials*.

His team utilised waste plastics such as bags, bottles, films, etc, including polyethylene (PE), polypropylene (PP) and polystyrene (PS), in various ratios with urea formaldehyde, in making a three-layer plywood.

They found that densification of veneers significantly decreases their surface roughness, reducing glue uptake and increasing bond strength.

On the issue of using thermoplastic material in the resin mix, the team found that plywood bonded with waste PE showed much lower shear strength values than those glued with UF resin, while plywood made with waste PP or PS with a thermoplastic load of at least 160g/m^2 reached shear strength values comparable to that made with UF resin and conform with EN314-2.

Robert Massen from Baumer Inspection, Germany, is an expert in visualisation systems and told delegates how *Automatic physical and aesthetic patching of wood based panels saves wood resources*.

Mr Massen pointed out that natural wood surfaces on panels always show defects such as dead knots, resin pockets, open veneer joints, etc which cannot be tolerated in final products such as furniture or decorative floors.

Traditional hand patching is labour intensive and slow, leaves no record and usually remains very visible, while visual inspection tends to be too slow and too subjective.

He thus offered a system of automatic inspection and patching of panel surfaces by NC-controlled putty or dowel injectors.

"Such an inspection system uses multiple inputs and must be tolerant to contaminants, sound knots, non-flat panels, etc," explained the speaker. "It must have precise location of defects with a required accuracy of 0.5mm. Our multi-sensorial scanner detects, grades and locates defects and computes a repair strategy using a knowledge base of repairing rules. It then transmits this data to the XYZ working tool manipulator for carrying out the repair."

New technology on which Baumer is working is aimed at then making those patches virtually invisible to the human eye by using machine-learning principles to automatically learn the natural wood structure in the neighbourhood of a patch and, by linking to a carefully calibrated ink-jet printing system, to 'decorate' the patch with a computed local decor to make it almost invisible to the human eye, fully automatically.

Max Britzke, of Dresden University of Technology, Germany, gave a paper on *Three-dimensional formed sandwich parts for interior applications*.

Whilst conventional paper honeycomb material is well-known as a core material for flat lightweight panels, it cannot currently be used in panels which are required to be formed into three-dimensional shapes.

The scientists at Dresden have developed a modified paper honeycomb which can be formed in three dimensions. This has double- and single-thickness cell walls. pre-determined grooved folding lines are scored into the single cell walls, thus enabling 3-D forming.

Formable skin layers were produced from fibre reinforced composites or a special (Reholz) veneer.

"The development of a cost-efficient sandwich parts production process is therefore envisaged," concluded Mr Britzke.

Jorge Martins of Universidade do Porto, Portugal, presented the final paper of IPPS 2011. His subject was: *Low formaldehyde emission MDF overlaid with wood veneer: bonding problems assessment*.

Given the necessity for the MDF industry to reduce formaldehyde emissions from the finished board, urea has often been combined with a low formaldehyde-emitting resin as a formaldehyde scavenger. However, an increase in panel rejects due to veneer delamination has been reported, said the speaker.

His team tried a new sample configuration to assess the bonding quality of the wood veneer/MDF joint using ABES (Automatic Bond Evaluation System), using two different UF resins.

Among other conclusions, the researchers found that surface soundness of the MDF decreased with increasing pressing time, probably due to the presence of formaldehyde scavenger (urea in solution).

Rob Elias of the BioComposites Centre brought the symposium to a close by saying "This has been a good forum for us to find out more about what the industry needs and to go for further research funds from the EU.

"We are glad to return to the original venue of Llandudno and its successful format and we will continue to hold IPPS here in the future".

He announced that 2012 would see a 'master class' rather than a full symposium. This would be training and industry focused with a seminar approach, as trialled in 2010. The IPPS format will return for October 2013.

The attendance at this year's IPPS was understandably lower than in previous, non-recession, years but the international spread of attendees – both presenting papers and as delegates – was impressive. The number of attendees from panel manufacturing companies was also good to see.

The conference covered a wide range of topics and all attendees seemed satisfied with the quality of the symposium itself and the social/networking opportunities presented.

The scenery of this part of North Wales also never disappoints – come rain or shine. ■

The full papers presented at IPPS can be purchased from the BioComposites Centre: www.bc.bangor.ac.uk