

## TALKING TIMBER



## WHAT HAS WOOD SCIENCE DONE FOR US?

*Martin Ansell highlights some of the developments made possible by advances in wood science*



**The Wood Technology Society** publishes scientific and technical papers in the International Wood Products Journal. The WTS evolved from the Institute of Wood Science, established in 1955, which published the Journal of the IWS for more than 50 years and together with the IWPJ has made a major contribution to the understanding of developments in wood science. So what has wood science done for the timber industry since?

The structure-related properties of wood were initially investigated by the creation of wood libraries (solid rectangular specimens organised by species), the preparation of thin sections and the observation of microstructure with optical microscopy. From 1970 onwards the commercial availability of scanning electron and transmission electron microscopes was a revolutionary development, which enabled very high magnification images of wood microstructure to be captured. A rapid improvement in our knowledge of features such as porosity, the flow of moisture, the multi-layer structure of the cell wall, the growth of reaction wood and the growth of fungal organisms was achieved.

By the 1990s the SilviScan instrument was developed at CSIRO, Australia, which combines an image analyser, X-ray densitometer and X-ray diffractometer, enabling the variation in the density and porosity of wood across growth rings to be determined. The microfibril angle of the cellulose in the S2 secondary wood cell wall can also be measured, which determines the stiffness of the wood, a vital factor in timber selection. The information is of value to foresters and end users.

Developments in the grading of timber using mechanical methods, such as continuous lumber testing and non-destructive methods using X-ray and laser-based techniques, to detect knots and other defects, were introduced. Sawmill technology improved with the introduction of three-dimensional scanning and laser-guided circular saws. Kiln-drying procedures for sawn wood were refined to reduce distortion by twist, cup, spring and bow and accelerated by using methods such as steam injection.

Following on from the age-old manufacture of plywood, LVL in large structural lengths and thicknesses was developed, based on the lamination of thick veneers. Improved particleboards were introduced including OSB. Likewise, traditional fibreboards such as hardboard have been joined by MDF for widespread application in furniture and cladding. Long-term studies of the creep and fatigue of these materials under static and dynamic loading have been undertaken and laminated wood has been

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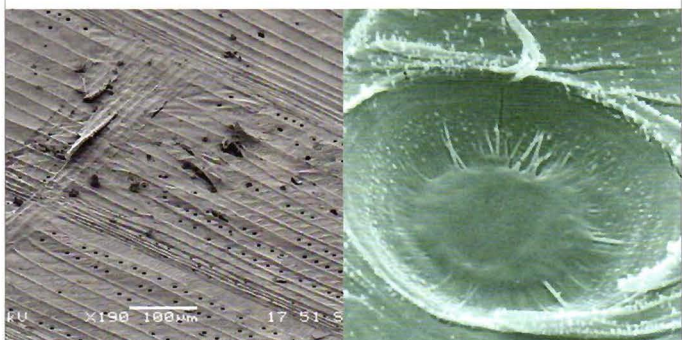
successfully used in the manufacture of wind turbine blades.

As well as panel products, the performance and durability of solid wood structural composites such as glulam have been further improved by the use of new adhesives. Formaldehyde-based adhesives such as UF, PF and MUF have been partially replaced by adhesives including polyurethanes and isocyanates. Wood chemists have also been instrumental in developing more environmentally acceptable preservatives for wood, replacing creosote and chromated copper formulations. Newer systems include borates and organic fungicides and insecticides. Acetylated and thermally modified wood are now successful industrial products. There have been similar advances in new fire retardant chemicals for wood.

More examples of innovation in wood science are legion. For example, the coating of wood with nano-materials can result in smart, self-healing, photocatalytic self-cleaning and UV light-resistant properties. Plasma treatment of wood produces protective and decorative coatings and improves adhesive bonding. Carbonisation and mineralisation of wood enables ceramic or metallic porous materials to be made for use in filtration, battery electrodes and heat sinks. The sky is the limit – what would we do without wood science? ■

*Below left: Electron microscope image of carbonised yew wood, radial-longitudinal plane*

*Below right: Electron microscope image of bordered pit in Scots pine*



**The Wood Technology Society**

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