In an earlier paper (Evans, Banks 1988) significant losses in wet tensile strength and toughness were observed in pine and especially in lime strips exposed to hot water. These changes in mechanical properties appeared to be associated with a change in fracture mode from intra-fibre failure to inter-fibre shear. Results here indicate that such failure probably results from ultrastructural and chemical changes in the compound middle lamella region of the cell wall. Both pectinacious polysaccharides and particularly lignin which were degraded by hot water (Tables 1 and 2) reach high concentrations in this layer and their removal probably results in a reduction in inter-cellular bonding.

Since weight losses observed following exposure to water at 60 and 70° C were similar in pine and lime it is suggested that the greater tendency of lime to fail by inter-fibre shear (Evans, Banks 1988) may be related to differences in the degradation of the cell wall polymers (Table 1). Over the 50 day exposure period pine specimens lost about 20%–21% of their hemicellulose and 13% of their lignin. In lime the corresponding losses were 19%–20% lignin and 11%–12% hemicellulose. Perhaps the higher lignin loss in lime is associated with greater weakening of the middle lamella layer. Therefore, following application of stress during tensile testing, failure occurs in the middle lamella region leading to inter-fibre shear. Ifju (1964) suggests that the tensile properties of wood are strongly related to the cellulose content with both strength and deformation being controlled by the behaviour of intramolecular bonds, especially secondary (hydrogen) bonds. The results here and those earlier (Evans, Banks 1988) suggest that the tensile properties of wood when wet and to a lesser extent when dry are significantly dependant on the bonding ability of matrix materials.

In the absence of decay by micro-organisms wood in exterior exposure undergoes slow physico-chemical degradation (weathering), (Feist, Hon 1984). Water plays a significant role in this process since cyclic changes in moisture content in wood over the hygroscopic range generate stresses leading to surface checking and splitting (Coupe, Watson 1967). Furthermore, the results here and those earlier (Evans, Banks 1988) suggest that given superficial solar heating, the presence of water may result in significant surface strength losses associated with hydrolytic degradation of the non cellulosic components of wood. On exposed natural or finished wood surfaces subject to direct solar radiation and periodic wetting such effects may occur over a period of years. In the absence of heating due to solar radiation slow hydrolytic degradation of the non cellulosic components of the cell wall due to the effects of water may also occur given greatly extended exposure periods; for example in ancient wood covered by anaerobic muds (Preston 1980).

4 Literature

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Berichtigung

Im Beitrag von S. Aicher: „Berechnungen zum Spannungs-Verzerrungsverhalten von Brettschichtträgern mit aufgeklebten Bau-Furniersperrholz-Platten bei Klimabeanspruchung" in Heft 2/90 unterliefen bei der Wiedergabe von Gl. (2) und bei Fußnote 3 leider Druckfehler. Gleichung (2) muß richtig lauten:

$$\frac{1}{E_y}\frac{\partial^4 F}{\partial x^4}+2\left(\frac{1}{2G_{xy}}-\frac{v_{xy}}{E_y}\right)\frac{\partial^4 F}{\partial x^2\partial y^2}+\frac{1}{E_x}\frac{\partial^4 F}{\partial y^4}=-\left(\alpha_x\frac{\partial^2 \Delta u}{\partial y^2}+\alpha_y\frac{\partial^2 \Delta u}{\partial x^2}\right). \qquad (2)$$

In Fußnote 3 fehlt: in den Gln. (5), (6) sind S, E_y in [MN/m] bzw. [N/mm^2] anzusetzen.