

could do better!

It is not as though we can't do beautiful clear finishes over wood! Think of varnished floors, polished panelling, and sumptuous piano finishes – but all of these are indoors. Take them outdoors and their beauty (and our technology) simply fades under the influence of the weather.

To understand why, one needs to look at the marvellous nature of the wood itself. Using mainly water and carbon dioxide as building materials (along with some nitrogen and a smidgen of catalytic and essential minerals obtained from the soil), the tree builds wonderful structures that can support columns of water tens of metres high and cantilevered boughs that seem to have no visible means of support.

The major structural element that the tree crafts is a very long, straight chained sugar called cellulose. These molecular chains bond, one with another (using the same electrical forces which hold water together as a liquid when logic says that it really should be a gas) to form tiny fibres. These fibres are then formed into long tubes (complete with a, more or less, one way valve system), using a variety of lower molecular weight sugars and the more aromatic material, lignin. These lower molecular weight 'binders' are somewhat water sensitive so the whole structure needs a waterproof raincoat provided by the lignin-rich bark.

Just a little more! During a year's cycle, a tree's growth is not uniform, putting on the most growth in the spring and tapering off in the autumn. This is reflected by lower density, larger diameter tubes in the spring wood and higher density, narrower ones in the latewood bands. Further, the tree only needs a few tens of millimetres of 'sap carrying wood' in order to supply its wants so, as fresh layers are created every year, the vestigial material morphs into more resin rich heart wood, which enhances a structural core.

So there you have it! A pretty sophisticated pillar made up of flexible annular laminates around a more rigid core.

As mentioned earlier, wood needs to be protected from the elements by its sheathing of bark. When this is removed, as when it is milled, the lower molecular weight binders become exposed and degrade under the influence of water and, especially, U.V light. The cellulose fibres become unbound and can be seen as a silvery grey mat upon the surface – or become the home for black mould!

Slower growing hardwoods typically show less seasonal variation along with greater durability.

(n.b. This memo refers to durability specifically in terms of resistance to water and U.V. light – not resistance to mould, fungi or insect attack).

The mode of failure of a good varnish film, over wood and exposed to the elements, is as predictable as death and taxes! Moisture is ubiquitous and, with the amount of U.V. light getting through the film, will degrade the binders holding the cellulose together. The first visible sign will be a slight lightening in colour as the film starts separating from the substrate. Invariably it will start on areas of spring wood and on flat sawn boards.

Very soon the separated film will crack, allowing more water and mould spores to enter this space. Degradation of the system proceeds apace, resulting in flaking. No matter how good the varnish, how much U.V. absorber one loads into it or how good the timber is under it, time is on the side of flaking.

Flaking is simply an unacceptable form of failure, primarily due to its patchy nature. Enormous effort is required to return the surface to the uniformity required before it could accept another clear finish and only a madman or a boatie would sentence themselves to a Sisyphean life of endless sanding.

It is well known that pigments are excellent at absorbing U.V. light along with most of the visible spectrum. Load up a varnish with such pigments and you get – well you get a paint actually and that is clearly not clear!

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And so, as is normal for the paint industry, the old 'C' word comes out – compromise. The concept was, and remains, to try to form a film of a binder (which was not too durable) combined with pigments that would have good U.V. absorption, used at a level which would not obliterate the grain and which would fail by simply powdering away leaving preparation for further recoating a relatively simple task.

The first such commercially successful 'stain' was made and marketed in New Zealand as Gold-X NF-11 and a nice little business it developed into. It was based on a formulation developed by the American Forest Products labs and was also known as the 'Madison' formulation. It consisted of pale boiled linseed oil, driers, white sprits, wax and various iron oxides protected with lashings of pentachlorophenol to stop the bugs feasting on the oil.

Freshly milled timber is not particularly porous (especially through the face of the board) and, initially at least, most of the oil sat on top of the board. The flat appearance created by the wax 'plating out' on the top of the film created the illusion of penetration. The coating failed fairly rapidly with the oil and wax weathering away, except for that portion protected under a pigment particle. As the structure aged and went through several iterations of weathering and re-staining, some degradation of the wood naturally occurred and some true penetration followed. Protected areas of the structure simply built up thicker (and stickier) layers of the stain.

The last 50 years or so have been spent trying to solve this conundrum: to provide a finish that will maintain (and embellish) the natural beauty of wood, provide reasonable durability and uniformity to all cardinal points and to avoid, at all costs, the dreaded 'F' word.

A major strategy has been to use low solids formulations that favour penetration over building up a film on the surface. They are often referred to as 'non-film forming' stains, which can be erroneous! Mineral oil, or old sump oil, is truly a non-film forming material but the majority of modern formulations are designed to form films within the first few microns of the wood rather than the surface. The two obvious restrictions with this ploy is that the typical application results in not a lot of surface protection, and, over time, even low solids preparations will build up measurable surface films in recoated protected areas.

The move to waterborne systems has added yet another layer of complexity due to the typically non-penetrative nature of dispersion polymers.

The challenge to change the durability of the wood itself by a field applied treatment continues. Chemists will continue to 'tweak' their formulations to achieve incremental improvements, with decking areas continuing to expose weaknesses. As stated in the title – 'Could do better!'



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