



VALUE ADDING WOOD PRODUCTS BY WOOD FINISHING

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Introduction

Wood finishing is one of the important elements required by the wood-based industry, especially furniture producers. Finishing may be defined as a process of coating or treating the wood surface for the purpose of protecting and/or decorating the product. The coating protect the products against biodegradation agents such as moisture, insect, weathering etc. It also intends to enhance the aesthetic value of wood products i.e., furniture, flooring, ceiling and others. After a certain period, wood products have to be refinished not only for aesthetic reason but also to provide protection at the jointing or glued area. Refinishing would ensure exterior wood products are continually protected and remain in good condition.

Since 1900's, coating industry are filled with synthetic binders. There are many types of wood coating available in the market. Five basic ingredients for wood coating are binders/resins, pigments, filler (extender pigments), solvents and additives. However, choosing the right coating is very important because the type of coating produce would depend on the end usage of wood products either for indoor or outdoor application.

For indoor application especially furniture, 3 types of coating materials i.e. nitrocellulose (NC), acid catalyst (AC) and polyurethane (PU) are commonly used and applied. In order to produce a good finishing, several steps have to be adhered such as sanding with different grit of sand paper and then followed by spraying coatings onto the wood surface.

The value of furniture would also depend on the finishing quality. There are many types of testing methods used to evaluate the quality of coating applied on the wood surface such as adhesion, scratch, abrasion, impact, heat resistance, chemical resistance test and etc. Several tests carried by the Wood Finishing Laboratory of FRIM are discussed in the following paragraphs.

1. Adhesion test (BS EN ISO 2409:2013 & BS EN ISO 4624:2003)

The adhesion for wood coating can be tested using two types of method namely cross-cut (BS EN ISO 2409:2013) and the pull-off test (BS EN ISO 4624:2003). Cross-cut test is the easiest method to determine the adhesion properties between wood and coating. A single-blade cutter is used to make lattice pattern on the surface. There are six cuts for each lattice pattern whereby the spacing between each cut is 2 mm as shown in Figure 1. Twenty five squares boxes of 2 mm × 2 mm each at 90° angle are produced. An adhesive tape is then placed onto the lattice area and removed after 5 minutes. The area is examined for detachment of coating and rated based on the standard. For good adhesion properties, the detachment of small flakes at the intersections of the cut must not be greater than 5% (Figure 2).



Figure 1 Cross cut test conducted based on BS EN ISO 2409:2013

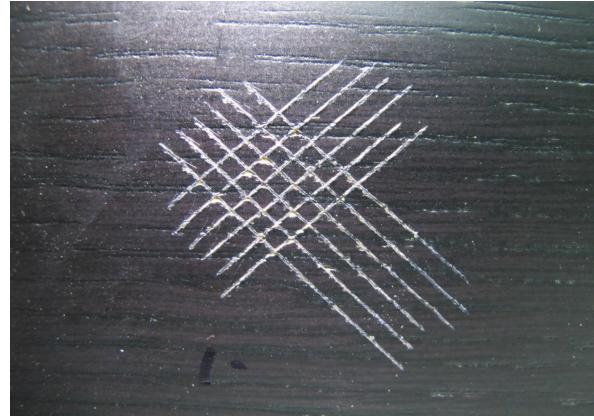


Figure 2 Examine the percentage of small flakes at intersections and boxes

Pull-off test is another method to measure the bond strength between the coating and wood substrate using portable pull-off adhesion tester (Figure 3). The test measures the force required to pull a specified diameter of coating away from wood surface as shown in Figure 4. In this test, the dolly (flat face of pull stub) is adhered onto the coating until the adhesive is cured. A coupling connector from the actuator is then attached to the dolly. Pressure applied at the actuator is slowly increased to pull the dolly out. The strength value is recorded either in N/mm^2 or MPa.

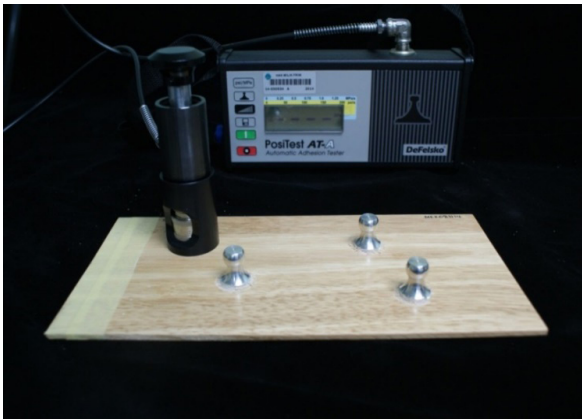


Figure 3 Pull-off test conducted based on BS EN ISO 4624:2003

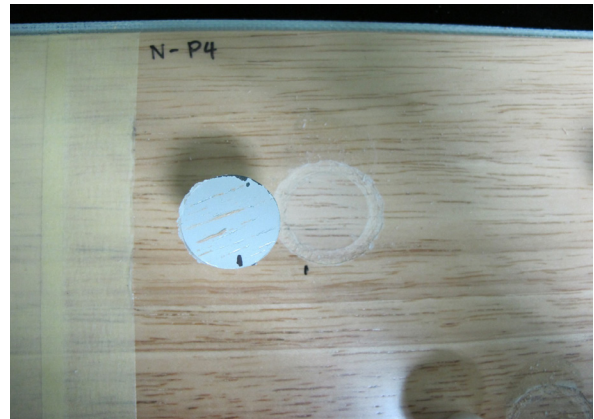


Figure 4 Coating is pulled off from the wood surface

2. Scratch test (BS EN ISO 1518-1:2011)

To ensure that the quality of finished wood products is prolonged, it is pertinent that the right finishing is used. For example, the type of coating used for dining table top must be more resilient than that used for chair. The strength of finishing material against scratching can be measured by using a scratch machine (Figure 5) based on BS EN ISO 1518-1:2011. In this test, the finished panel is clamped onto the panel holder before a set of weight are placed on the stylus. The weight start with a minimum load of 1000 g until it reaches a maximum load of 2000 g. The effect of the stylus on the coating is then observed (Figure 6), and the amount of load is recorded.



Figure 5 Scratch test machine

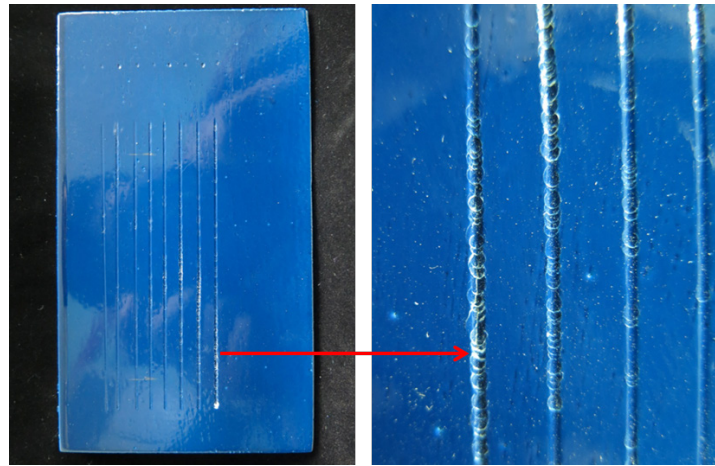


Figure 6 Scratch observed on the coated surface

3. Abrasion test (ASTM D 4060-14)

Abrasion of surface occurs when there is a friction between two surfaces which causes the surface to peel off or removed. The resistance of wood finishing against abrasion can be measured by using an abrasion machine (Figure 7) and based on ASTM D4 4060-14. The machine is equipped with an abrasion test wheel that rotates at a constant speed to determine the resistance of finishes to abrasion and wear. Figure 8 shows the schematic diagram for wheel rotation on the finished panel. When one abrading wheel rubs the panel outward toward the periphery, the other wheel would come inward toward the centre. Abrasion resistance is calculated based on loss in weight at specified number of abrasion cycles (Figure 9).



Figure 7 Taber abrasion testing device

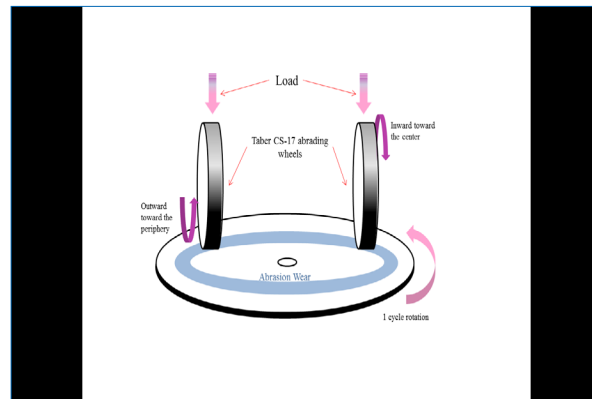


Figure 8 Schematic of the wheel rotation on the test panel



Figure 9 Effect of abrasion test after 2000 cycles

4. Ball Drop Impact test (BS 3962: PART 6:1980)

The resistance of wood finishes against impact can be determined using a ball drop impact test. This is done by using a steel ball of 19 mm diameter and weight of 28 g dropped on the finishing surface from a 2 m height (Figure 10). The quality of coating can be determined by evaluating the presence of crack or any defect on the surface area of the specimen. The effect of ball impact on the wood surface is shown in Figure 11.



Figure 10 Steel ball dropped from 2 m heights



Figure 11 Effect of ball impact test on the test panel

5. Heat resistance test (BS EN 12722:2009+A1:2013)

Heat resistance test is intended to determine the change in finishing quality of wood surface when exposed to heat for a certain period. An aluminium alloy block with a temperature of 100 °C is placed on the coated surface for 20 minutes and any change will be recorded (Figure 12). The temperature used is assumed to be a cup of hot coffee placed on a table top. Any fading, change in colour, surface swelling, cracking, burn or change in shape will be used as an indicator to evaluate the quality of wood finishing (Figure 13). Wood surface that shows no surface changes is categorized as good quality and attains the requirements as stipulated in BS EN 12722:2009+A1:2013.

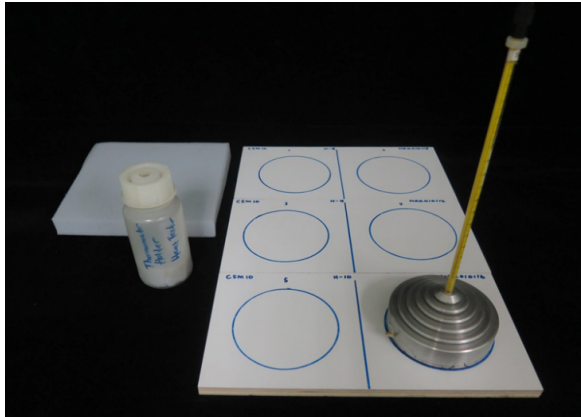


Figure 12 A steel block placed on the wood coating

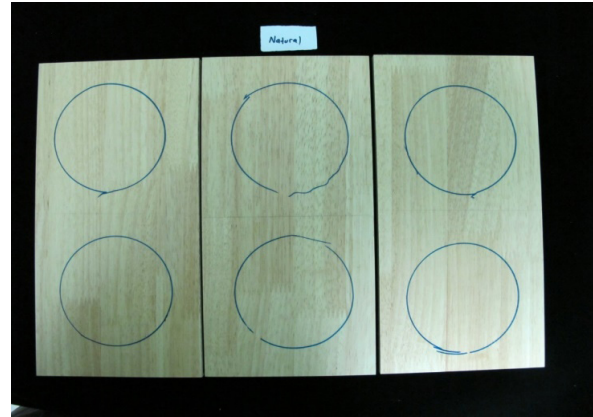


Figure 13 Observation of surface changes

6. Household chemical resistance (ASTM D 1308-02 (2013))

Household chemical resistance test is intended to observe the resistance of the wood finishing against domestic chemical and detergents that may spill onto the surface of wood. In this test, hot and cold distilled water, ethanol, acid acetic and another 12 reagents will be used to evaluate its resistance. These liquids are dropped on the finished surface and left for 16 hours (Figure 14). Any effect such as colour fading, dullness, blister, soft, swell or loss of attachment will be observed on the spot after it is cleaned.



Figure 14 Household chemical are placed on the finished surface and left for 16 hours

Conclusions

Generally, the method on how the products are being prepared and the finishing material used are important to enhance the quality of products produced. Meeting the basic requirement will increase the acceptance and demand of the product in international market. FRIM Wood Finishing Laboratory has obtained the ISO 9001 and ISO 10725 accreditation to ensure the test results are comparable and acceptable internationally.

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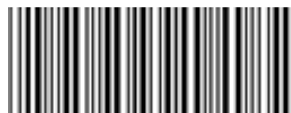
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