

Effect of Overlay Paper Properties on the Surface Quality of Laminate Flooring

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Abstract: In this study, the effect of overlay paper properties on the surface quality of laminate flooring was investigated. For this aim, only the upper surface of 22 gr/m² raw overlay papers impregnated with 53% melamine formaldehyde resin in the glue pool was sprinkled by corundum (Al₂O₃) in two different ratios (23 and 28 gr/m²) from different companies at 140-160 °C. In the drying ovens, the impregnated overlay papers with a final weight of 135 and 140 gr/m² and a humidity of 7.5% were produced. The panels obtained at the end of these processes were tested according to TS-EN 14323 and related standards, which are surface quality features such as surface abrasion, surface scratch and ash test. According to the test results, it has been observed that under the same pressing conditions, different corundum type and amount as well as laminate floorings covered with overlay papers with different final weights have an effect on the surface quality properties. It was observed that although the increase in the amount of corundum did not have a significant effect on surface scratching, it had a significant effect on surface wear values. According to the results of the ash test, it was observed that the amount of corundum increased and its distribution on the overlay paper surface was homogeneous.

KEYWORDS: OVERLAY, SURFACE QUALITY, LAMINATE FLOORING, FIBERBOARD, CORUNDUM

1. Introduction

The laminate flooring is an engineered wood composite consisting of three layers. The base layer is an impermeable layer, which improves the structural stability. The thick and core layer is a composite wood base [1,2]. The highest layer is the wear surface (overlay layer) and the decorative layer (Fig. 1).

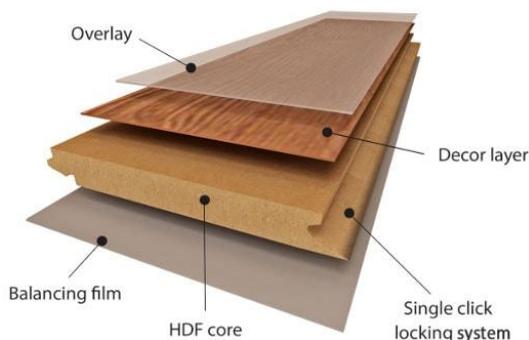


Figure 1. Layers of laminate flooring.

Decor paper is a special high-quality paper that is bonded to suitable substrates such as wood based panels using special synthetic resins. Papers impregnated with a resin have gained wide acceptance as facing materials for industrial grade particleboard. The base papers for the decorative films are alpha-cellulose papers, which are used exclusively. For impregnating, papers must have a high moisture resistance and the right porosity to accept the proper amount of resin. The surface print quality of the decor paper is essential for creating decorative designs by use of gravure printing process. Moreover, the paper shall be suitable for impregnation with applicable synthetic resins such as urea formaldehyde, melamine formaldehyde, acrylic and phenolic resins. The type of resin used for impregnation of decor paper influences the quality of substrate after the lamination. It is laminated under high pressure and heat with particleboard or other substrates. Quality of cauls, cleanliness, and temperature are key factors that influence coating or laminating quality [3].

In this study, the effect of overlay paper properties on the surface quality of laminate flooring was investigated. For this purpose, overlay papers were produced by using corundum types from

different companies in different weights (25-30 gr/m²) in the corundum pouring system only on the upper surface after the overlay papers were glued. It is aimed to obtain products that comply with AC3-AC4-AC5 criteria according to the surface quality class by comparing the test results made on laminate flooring test boards obtained by pressing decor paper under the same pressing conditions.

2. Materials and methods

2.1. Materials

In the production of HDFs, 50% pine (*Pinus nigra*) and 50% eastern beech (*Fagus orientalis*) woods used as raw materials in the production of high density fiberboards (HDFs). The HDF panels were produced from wood fibers dried to 5% and 9 wt% melamine urea formaldehyde (MUF, solids content 60 wt%) resin.

The HDF panels with dimensions of 8 mm x 2060 mm x 2650 mm and a density of 870 kg/m³ were produced at a press temperature of 200±20 °C, and a pressure of 3.5-4 N/mm². After conditioning for about 4-7 days depending on the season in the semi-finished warehouse, it was sanded to a net thickness of 7.3 mm ±0.1 raw thickness.

Two different ratios (80-85 gr/m²) of 100% melamine formaldehyde resin were impregnated on the lower and upper surfaces of these papers. Then, impregnated overlay papers with a final weight of 135 and 140 gr/m² in drying ovens at 100-160 °C by sprinkling corundum material Al₂O₃ in two different ratios (23-28 gr/m²) only on the upper surface, which improves the upper surface properties of laminate flooring. Produced.

Corundum (Al₂O₃): There are two types of alumina: α-type and γ-type. Naturally occurring α-alumina crystals are called corundum and are often found in different colors (usually blue or yellow to gray).

2.2. Methods

The test methods used in the investigation of surface properties of the overlay paper are given in Table 1.

Table 1. Test methods used in the experiments.

Tests	Specimen size (mm)	Standard no	Specimen number
Surface abrasion	100x100	TS EN 13329	8
Scratch resistance	100x100	TS EN 14323	8
Ash quantity	100x100		6

The equipments used in the determination of the surface properties are presented in Figure 2.



Figure 2. A. Surface abrasion test. B. Surface scratch test.

3. Results and discussion

The average values of the test results, in which the effect of overlay paper properties on the abrasion resistance of the surface quality properties of laminate flooring are given in Figure 1. The highest abrasion resistance values were seen in overlay papers produced with 28 gr/m² brand B corundum and 140 gr/m² final weight at 5000 rpm. The lowest abrasion resistance values were found in the overlay papers produced with 23 gr/m² brand A corundum and 140 g/m² weight at 4000 rpm. (Fig. 3).

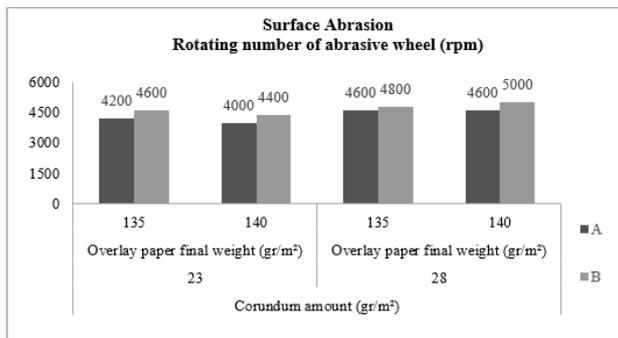


Figure 3. Abrasion resistance of the overlay paper

The highest scratch resistance values were seen in overlay papers produced with brand B corundum with a final weight of 140 gr/m² with 4 N. was determined that the test panels produced with brand B corundum at similar rates had higher scratch values than the test samples produced with brand A corundum. From the test results, it was understood that the color of the decor paper was different, the amount of glue, the final weight of the finished paper and the increase of the corundum ratio did not have an obvious effect on the surface scratch values.

According to these results, it is recommended that lower rates of corundum material can be used for the surface scratch values of overlay papers to be produced for AC3 and AC4 classes. The average values of the test results, in which the effect of overlay paper properties on the ash-burning test. As a result of the combustion test of overlay paper samples produced at the same corundum ratios, it was seen that brand B corundum was higher in % compared to brand A corundum, according to the remaining solid matter/ash amount.

In general, the wear resistance of overlays produced with brand B corundum was found to be better at the same corundum usage rates, while the opposite was the case with brand A corundum. According to these results, it was determined that in the overlay papers to be produced for AC3 and AC4 classes, it was possible to produce more economical overlay paper, especially with brand B corundum at lower rates (20gr/m²).

The average values of the test results in which the effect of overlay paper properties on surface scratching from the surface quality properties of laminate flooring are determined are displayed in Figure 4. This situation can be explained as the structure, shape, size, powder ratio and the rate of containing other elements of brand B corundum according to brand A corundum, having the desired properties and values. In this way, it has been understood that the bonding and distribution with the surface is more homogeneous during the sprinkling of brand B corundum on the overlay paper surface.

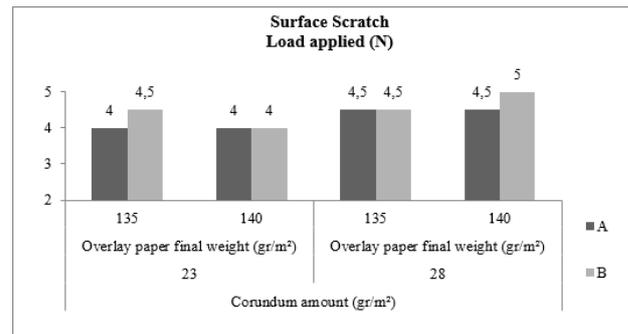


Figure 4. Scratch resistance of the overlay

In general, as the usage rate-amount increased in both corundum species, an irregular increase was observed in the amount of corundum material remaining after the ash test (burning test), albeit irregularly. It has been observed that this situation reflects the working set values of the corundum pouring system to the overlay paper surface (Fig. 5).

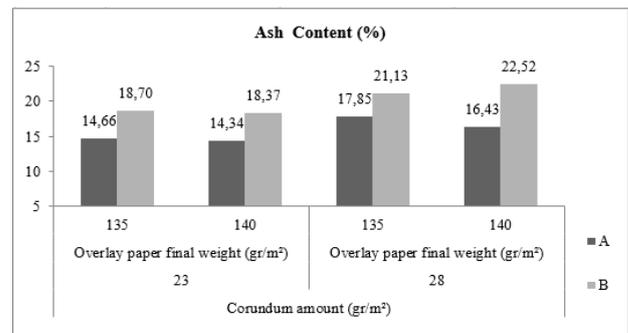


Figure 5. Ash content of the overlay paper.

The test result showed the highest amount of ash with 22.52%, 28 gr/m² brand B corundum and overlay papers produced with 140 gr/m² final weight. The lowest ash percentage was found with 14,34% in the overlay papers produced with 23 gr/m² brand A corundum and 140 gr/m² final weight.

4. Conclusions

Depending on the different pressing conditions, it has been determined from the test results of the produced coated boards that the surface wear and scratch values increase as the amount of the corundum and therefore the final weight of the overlay paper increases in the same pressing time.

In addition, from the ash test results, it was observed that the amount of ash as a result of combustion increased as the amount of B brand corundum increased. This can be explained by the more homogeneous and strong bonding of the corundum on the overlay surface. The surface quality of laminate flooring is a feature that can vary depending on the type, amount and weight of corundum as well as the surface quality of the board. For this. According to the surface wear, surface scratch and ash test results of the surface quality properties of the laminate flooring; It was determined that the best values were obtained as a result of using brand B corundum. In addition to its effect on overlay paper quality, it should be known that brand B corundum is 13.33% cheaper than brand A corundum in terms of cost.

As a result of the results of this study carried out for the laminate flooring surface quality, it was observed that all the values determined were within the desired standards. In order to be sure of this work, it should work at these values for a certain time and according to the test results to be done, it should be started to work at optimum values. It is possible to determine more economical productions by following the panel and overlay paper production conditions very well.

5. References

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