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A Better Measure

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WOOD WEAR TESTING WITH NANOVEA TRIBOMETER

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Introduction

Wood has been used for thousands of years as a building material for homes, furniture and flooring. It has a combination of natural beauty, durability and restorability, making it an ideal candidate for flooring. Unlike carpet, hardwood floors keep their color for a long time and can be easily cleaned and maintained, however, being a natural material, most wood flooring requires the application of a surface finish to protect the wood from various kinds of damage such as scuffing and chipping over time. In this study, a Nanovea Tribometer was used to measure the wear rate and coefficient of friction (COF) to better understand the comparative performance of three wood finishes.

Importance of Comparing Wood Finish Wear & COF

The service behavior of a wood species used for flooring is often related to its wear resistance. The change in the individual cellular and fiber structure of different species of wood contributes to their different mechanical and tribological behaviors. Actual service tests of wood as flooring materials are expensive, difficult to duplicate, and require long periods of testing time. As a result, it becomes valuable to develop a simple wear test that can produce reliable, reproducible, and straight forward.

Measurement Objectives

Equipment Featured

NANOVEA T50

Versatile Wear & Friction Tester

Multi-Module System

Speed Control from 0.01-5000 RPM

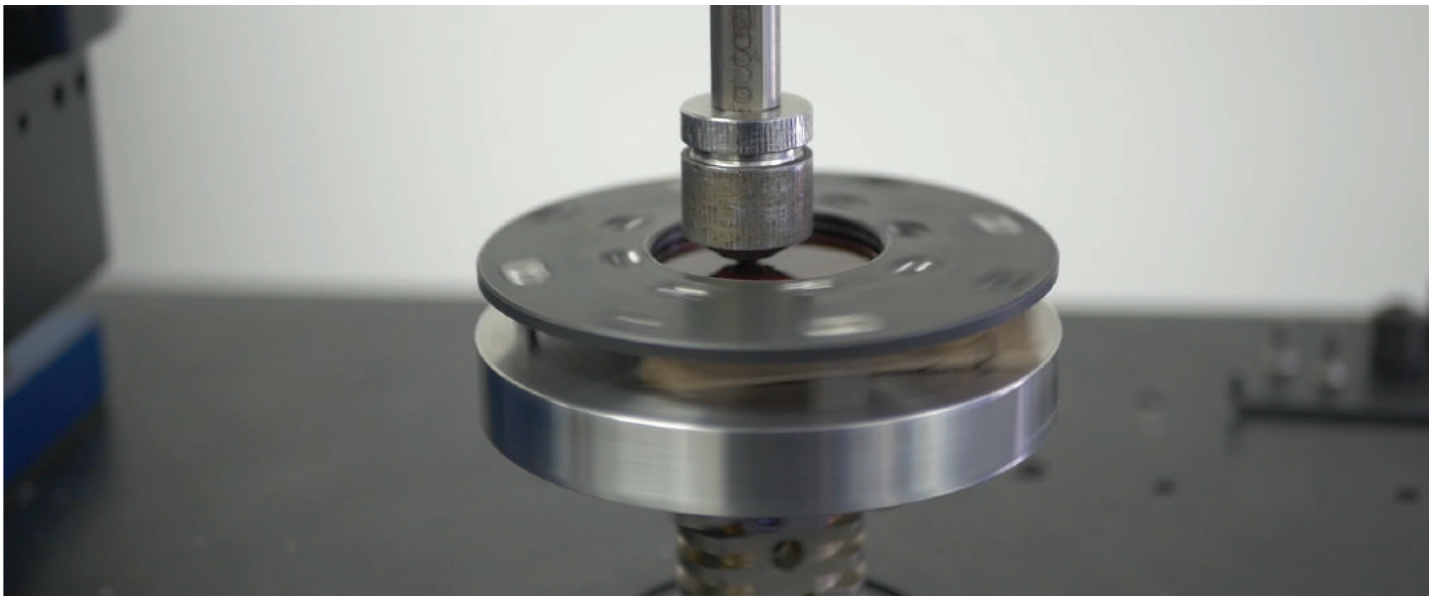
Robust with Open Platform

Wide Range of Environmental Conditions

Learn More about the T50

Measurement Objectives

In this study, we simulated and compared the wear behaviors of three types of wood to showcase the capability of the Nanovea Tribometer in evaluating the tribological properties of wood in a controlled and monitored manner.

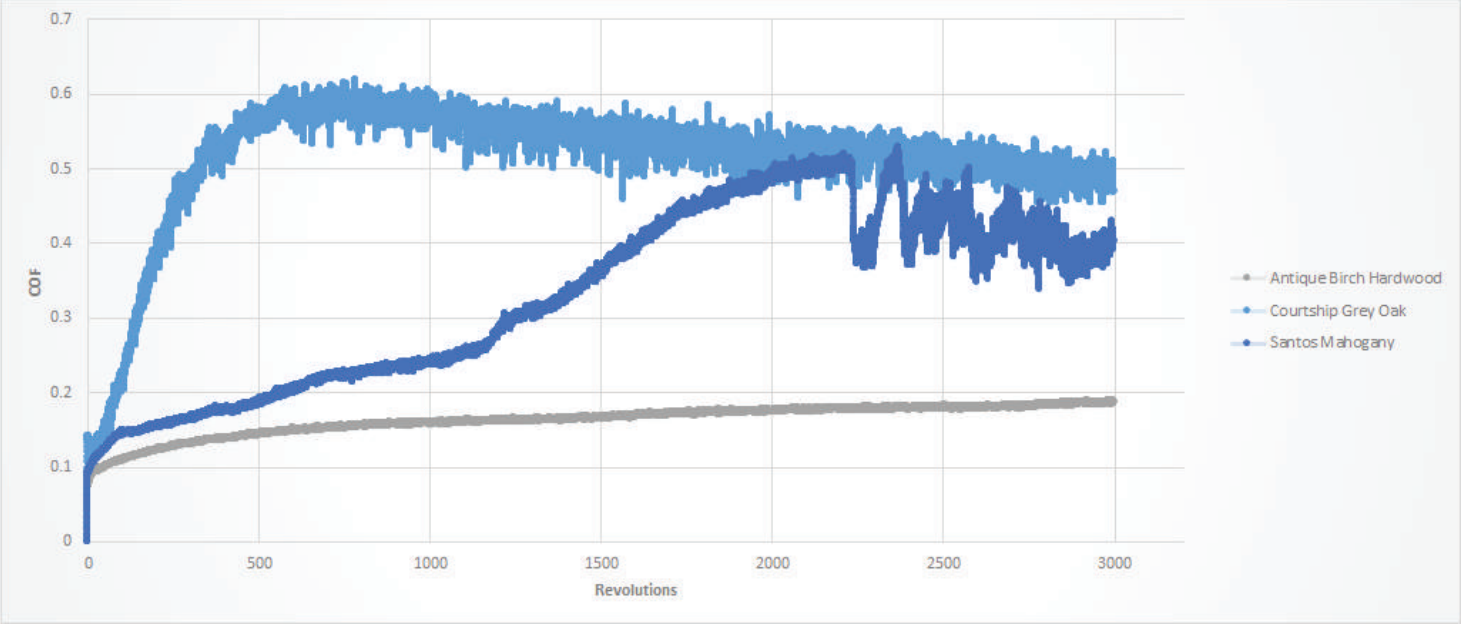


Tribology Results

Discussion

Sample Description: Antique Birch Hardwood has a 7-layer aluminum oxide finish, providing everyday wear and tear protection. Courtship Grey Oak, & Santos Mahogany are both laminate flooring types that vary in surface finish and gloss. The Courtship Grey Oak is a slate gray color, EIR finish, and low gloss. On the other hand, Santos Mahogany is a dark burgundy color, prefinished, and high gloss which allows surface scratches and defects to be more easily hidden.

The evolution of COF during the wear tests of the three wood flooring samples are plotted in Fig. 1. The Antique Birch Hardwood, Courtship Grey Oak, & Santos Mahogany samples all showed different COF behavior.



It can be observed in the graph above that Antique Birch Hardwood was the only sample that demonstrated a steady COF for the duration of an entire test. The Courtship Grey Oak's sharp increase in COF and then gradual decrease could be indicative that the sample's surface roughness largely contributed to its COF behavior. As the sample wore, the surface roughness decreased and became more homogenous which explain the decrease in COF as the sample surface became smoother from mechanical wear. The COF on Santos Mahogany displays a smooth gradual increase in COF at the beginning of the test and then transitioned abruptly into a choppy COF trend. This could indicate that once the laminate coating started to wear through, the steel ball (counter material) made contact with the wood substrate which wore at a quicker and turbulent manner creating the noisier COF behavior towards the end of the test.

Tribology Results

Measurement Parameters

Table 1:Test parameters for COF and wear measurements

Instrument	T50
Wood Samples	Antique Birch Hardwood, Courtship Grey Oak, & Santos Mahogany
Normal Force (N)	20
Wear ring Radius (mm)	6
Speed (RPM)	300
Duration of Test (minutes)	10

Samples Tested

Sample of Antique Birch, Courtship Grey Oak, and Santos Mahogany (left to right)

Antique Birch Hardwood

Sample of Antique Birch

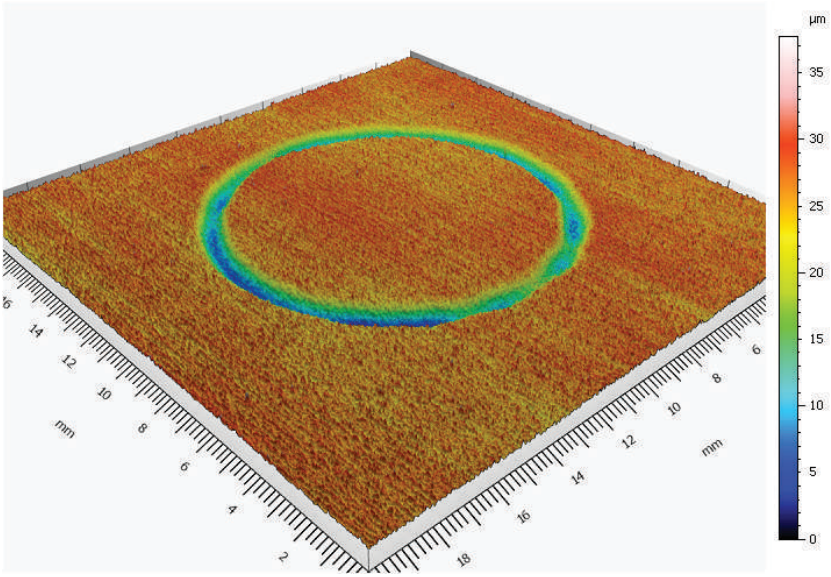
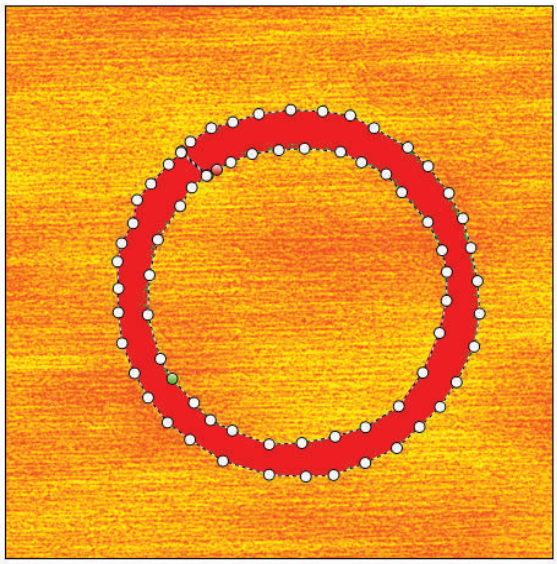


Figure 2: 3D view of scan taken for Sample Antique Birch Hardwood



Parameters	Unit	Hole
Projected area	mm²	44.68
Volume	µm³	419852848
Max. depth/height	µm	25.83
Mean depth/height	µm	9.397

Figure 3: Volume of a Hole

Courtship Grey Oak

Sample of Courtship Grey Oak

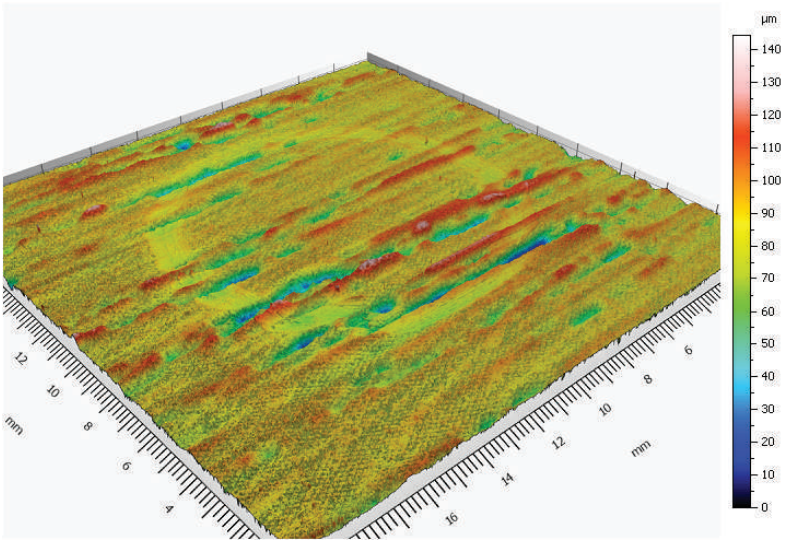
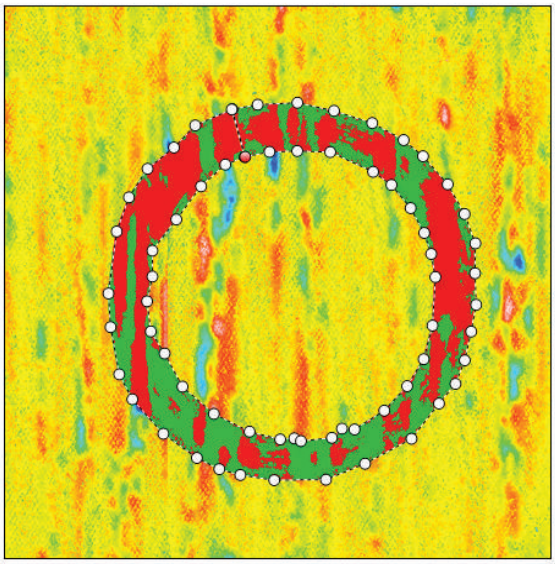


Figure 4: 3D view of scan taken for Sample Courtship Grey Oak



Parameters	Unit	Hole
Projected area	mm²	30.32
Volume	µm³	422305079
Max. depth/height	µm	84.65
Mean depth/height	µm	13.93

Figure 5: Volume of a Hole

Santos Mahogany

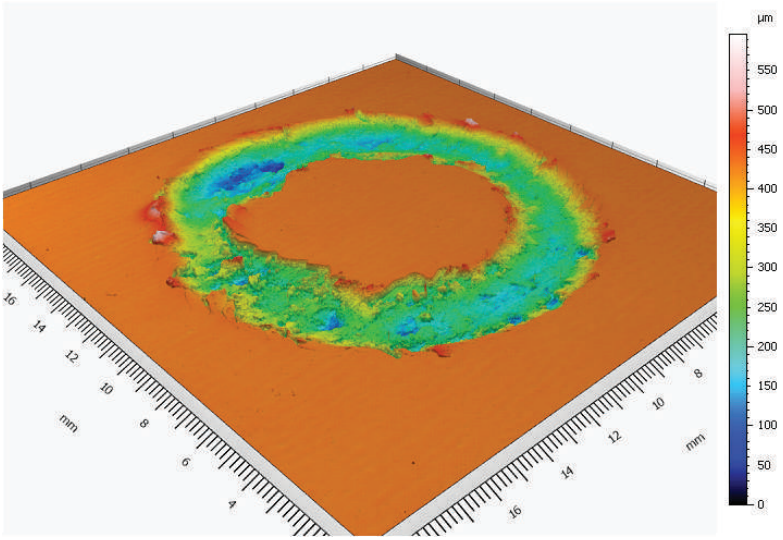
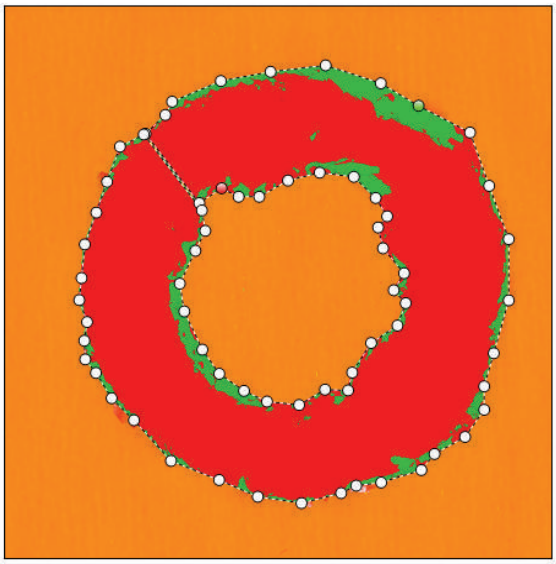


Figure 6: 3D view of scan taken for Sample Santos Mahogany



Parameters	Unit	Hole
Projected area	mm²	125.7
Volume	µm³	1.950068149e+10
Max. depth/height	µm	424.2
Mean depth/height	µm	155.1

Figure 7: Volume of a Hole

Results

Table 2 summarizes the results of the wear track scans and analysis on all wood flooring samples after the wear tests were performed. Detailed information and images for each sample can be seen in Figures 2-7. Based on the Wear Rate comparison between all three samples, we can deduct that Santos Mahogany proved to be less resilient to mechanical wear than the other two samples. Antique Birch Hardwood and Courtship Grey Oak had very similar wear rates although their wear behavior during the course of their tests differed significantly. Antique Birch Hardwood had a gradual and more uniform wear trend while Courtship Grey Oak showed a shallow and pitted wear track due to the pre-existing surface texture and finish

Table 2: Result Summary of the wear track analysis.

Sample	Volume Lost (μm^3)	Wear Rate $x10^{-5}$ (mm^3/Nm)
Antique Birch Hardwood	**419852848**	**18.58**
Courtship Grey Oak	**422305079**	**18.69**
Santos Mahogany	**1.95E+10**	**862.86**

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Conclusion

In this study, we showcased the capacity of Nanovea's Tribometer in evaluating the coefficient of friction and wear resistance of three types of wood, Antique Birch Hardwood, Courtship Grey Oak, and Santos Mahogany in a controlled and monitored manner. The superior mechanical properties of the Antique Birch Hardwood leads to its better wear resistance. The texture and homogeneity of the wood surface plays an important role in the wear behavior. The Courtship Grey Oak surface texture such as gaps or cracks between the wood cell fibers may become the weak spots where the wear initiates and propagates.

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