Comparison of Ridge Spacing and Wear Rate on 3D Printed Materials

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INTRO

3D printed material is gaining rise due to its ability to create a large variety of shapes and features without the use of time consuming input. 3D printing does have its limitations, however, such as in the lack of materials that can be used and strength of products. To understand how the quality of 3D printed materials can be improved, the Nanovea Tribometer can be used to conduct wear testing.

IMPORTANCE OF WEAR TESTING ON 3D PRINTED PARTS

To test the quality of the 3D printed material, wear testing can be used to estimate their lifetime and wear resistance. Creation of different surface features may be able to withstand external wear better. For this reason, 3D printed samples with different ridge spacing were used to give insight. The use of Nanovea's Tribometer is ideal for this type of testing since it is able to conduct linear reciprocating tests across the ridges. Being able to conduct anisotropic wear tests removes directionality as a variable.

MEASUREMENT OBJECTIVE

In this study, the Nanovea tribometer is used to wear into three 3D printed samples. Each sample is made of the same type of material, but varies in the spacing of its ridges. The samples are labeled from A to C with respect to the ridge spacing. Sample A has the largest spacing between ridges, while C has the smallest.

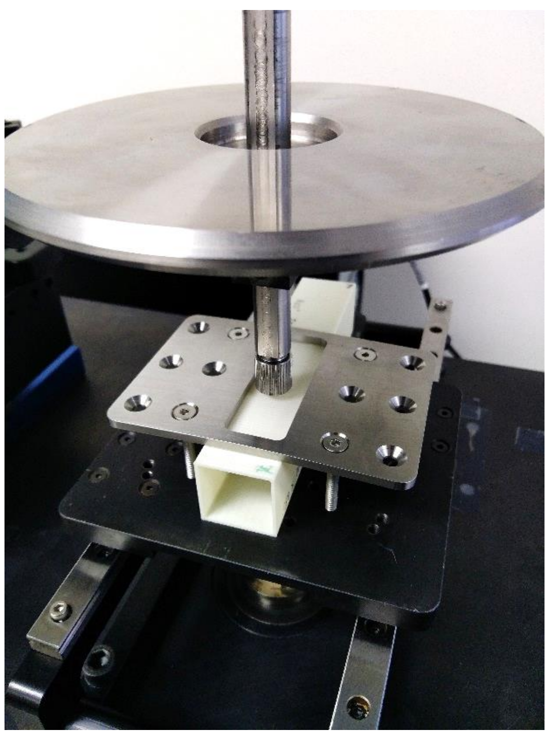

Figure 1: Tribology test setup for wear testing on 3D printed materials

TEST PROCEDURE

Test parameters	Value
Normal force	10 N
Rotational speed	200 rpm
Duration of test	10 min
Distance Traveled (m)	20.0
Atmosphere	Air
Temperature	24°C (room)
Wear track amplitude	5 mm
Ball Material	SS440C
Ball Diameter	6mm

Table 1: Test parameters for wear test on 3D printed materials

RESULTS AND DISCUSSION

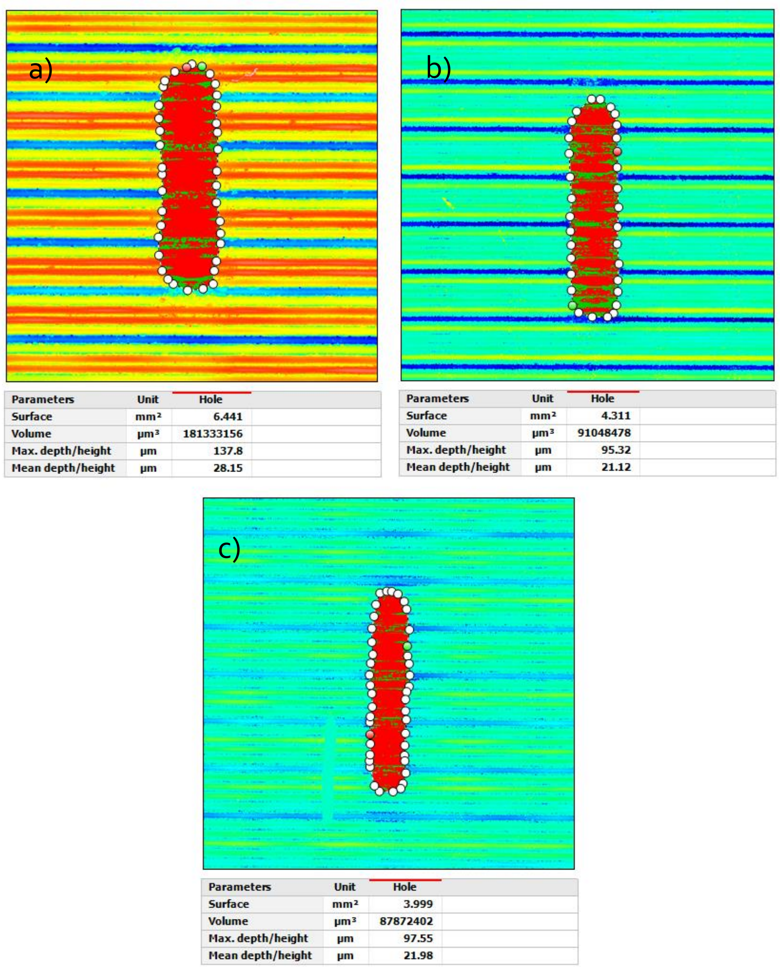

Figure 2: Volume of a Hole Analysis for a) Sample A, b) Sample B, c) Sample C

Sample	Wear Rate x10^{-7} (mm^3/Nm)
A B C	9085.589 4552.424 4393.620

Table 2: Wear rate for all samples

From the testing conducted, the wear rate appears to decrease as ridge spacing decreases. One reason this may be is due to more consistent contact area between the surface and the ball as ridge spacing decreases. The wear rate observed from the tests shows a large difference between Sample A and B but not between B and C. This leads to assume that there may be a point where minimizing ridge spacing will no longer influence wear rate and the surface will act as a smooth surface.

CONCLUSION

The effects between wear rate and ridge spacing were investigated with the Nanovea Tribometer. By using the instruments ability to reliably apply the same test parameters on three 3D printed samples, the wear rate can be compared. The volume of a hole was obtained using our 3D Non-Contact Profilometer. The 3D printed samples with smaller ridge spacing have shown to display a lower wear rate than the ones with a larger ridge spacing.

Nanovea Tribometer offers precise and repeatable wear and friction testing using ISO and ASTM compliant rotative and linear modes, with optional high temperature wear, lubrication and tribo-corrosion modules available in one pre-integrated system. An optional 3D non-contact profiler is available for simple in-situ depth measurements or high resolution 3D imaging of wear tracks in addition to other surface measurements such as roughness.

Learn More about the Nanovea Tribometer

MEASUREMENT PRINCIPLE

TRIBOMETER PRINCIPLE

The sample is mounted on a rotating stage, while a known force is applied on a pin, or ball, in contact with the sample surface to create the wear. The pin-on-disk test is generally used as a comparative test to study the tribological properties of the materials. The COF is recorded in situ. The volume lost allows calculating the wear rate of the material. Since the action performed on all samples is identical, the wear rate can be used as a quantitative comparative value for wear resistance.

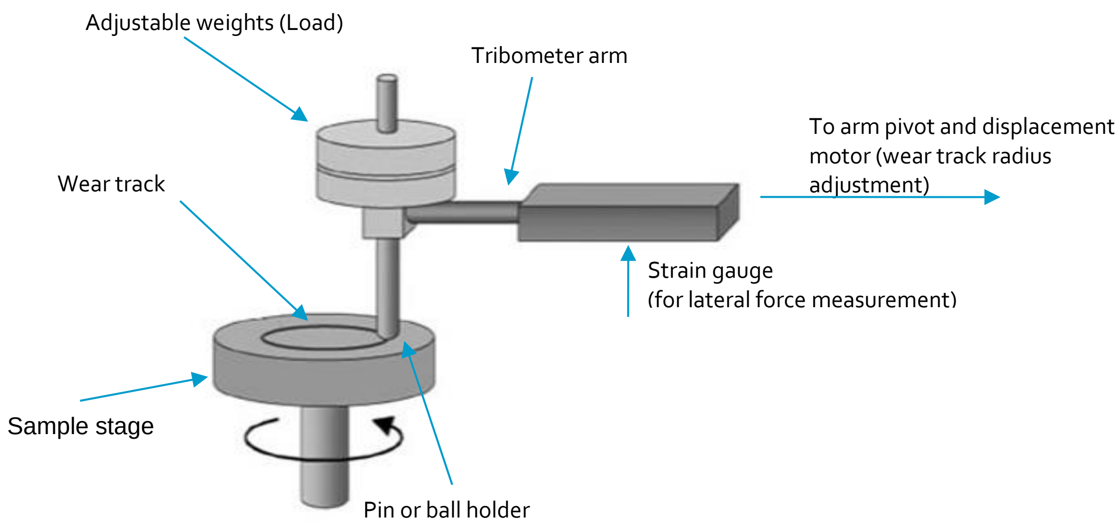

Fig. 1: Schematic of the pin-on-disk test.