TECHNIQUE

ScanningWear™

Measuring wear resistance at the nanoscale

HYSITRON®

Introduction

ScanningWear testing is a feature enabling research into wear resistance of coatings and films at the nanoscale. The capability is standard on all Hysitron **TS** and **TI Series** instruments enabling a complimentary technique to nanoindentation and scratch.

The wear patterns are created by raster scanning the sample with a given force, predefined by the user. A scan can consist of a single pass or multiple passes over the same area within one test.

By applying a known force and selecting the number of passes over which this force is applied, the amount of material that is removed during the wear scan can be measured post-test using the *in-situ* imaging technique.

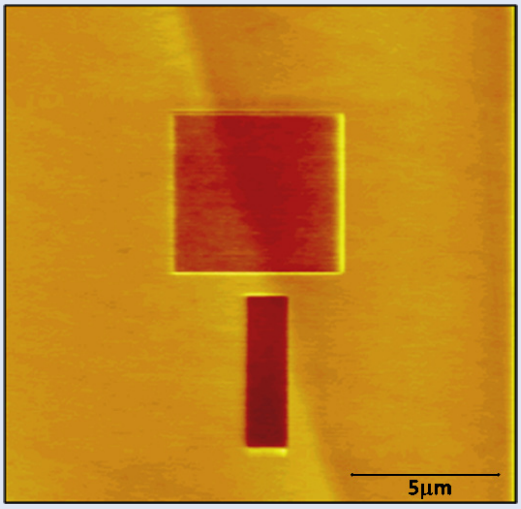

Figure 2. 5 µm × 5 µm square and 5 µm × 1.25µm rectangle less than 1 µm apart in LaO coating.

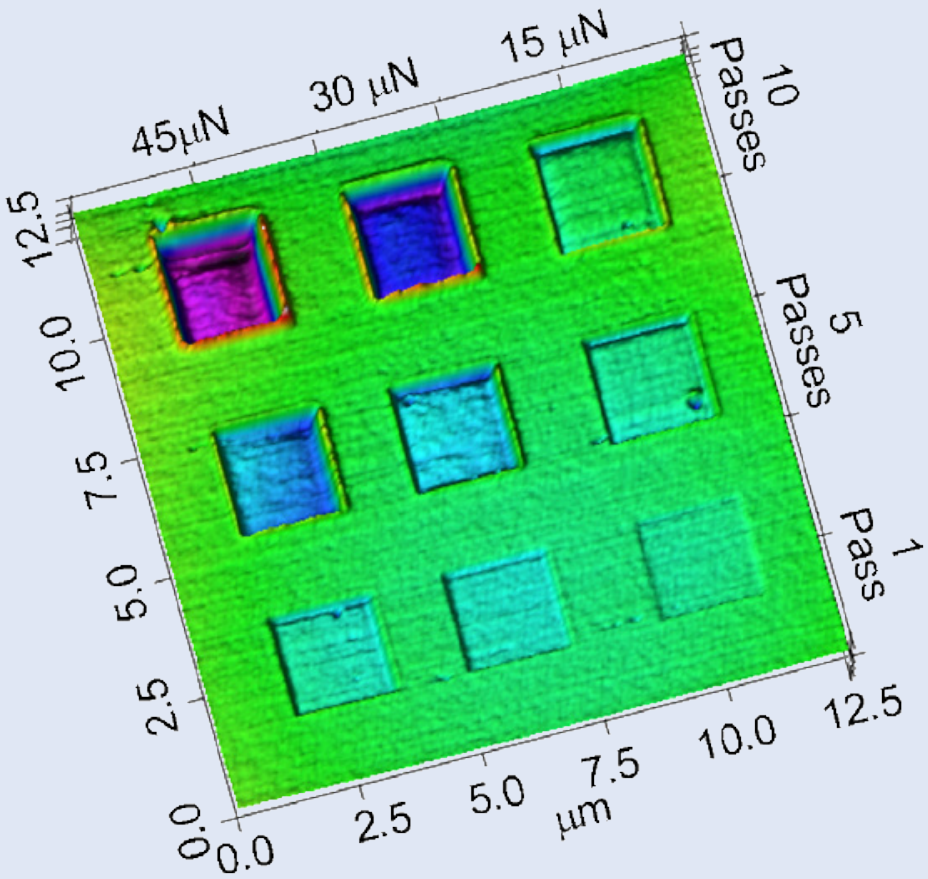

Figure 1. **ScanningWear** test on DLC (Diamond-Like Carbon) coating on a computer hard disk drive with 15 µN, 30 µN and 45 µN loads and 1, 5 and 10 passes respectively.

ScanningWear enables the ability to wear at different loads and carry out several wear experiments on one sample as show in Figure 1. This experiment involved several individual wear tests carried out at increasing loads and number of passes on a DLC film coating on a hard drive. The amount of material removed in each wear test was measured using *in-situ* imaging and is given in figure 3.

The precise positioning that *in-situ* SPM imaging provides also enables nano-machining and nano-patterning on surfaces as shown in Figure 2. In this study two wear patterns were nanomachined in Lanthanum oxide. One pattern consisted of a 5 µm x 5 µm square, the other a 1.25 µm x 5 µm rectangle. The patterns were placed less than 1 µm apart and resulted in removing the oxide layer to selectively reveal the substrate.

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ScanningWear Features

- Programmable forces for precise load control within a wear box
- Adjustable wear track size from <1 μm to 100 μm
- Single or multiple pass wear testing capabilities
- Wear volume easily measured using *in-situ* SPM imaging
- Roughness measurement utility as standard
- Sensitive enough to measure <1 nm of material removal
- Ability to test in fluid medium such as lubricants and oils.

ScanningWear produces wear tracks such as those in figure 1, however for reciprocating wear tests which enable wear along one single wear track over several thousand cycles, **TriboImage™** is a separate product available from Hysitron. For more details please refer to the **TriboImage** product sheet or visit the Hysitron website.

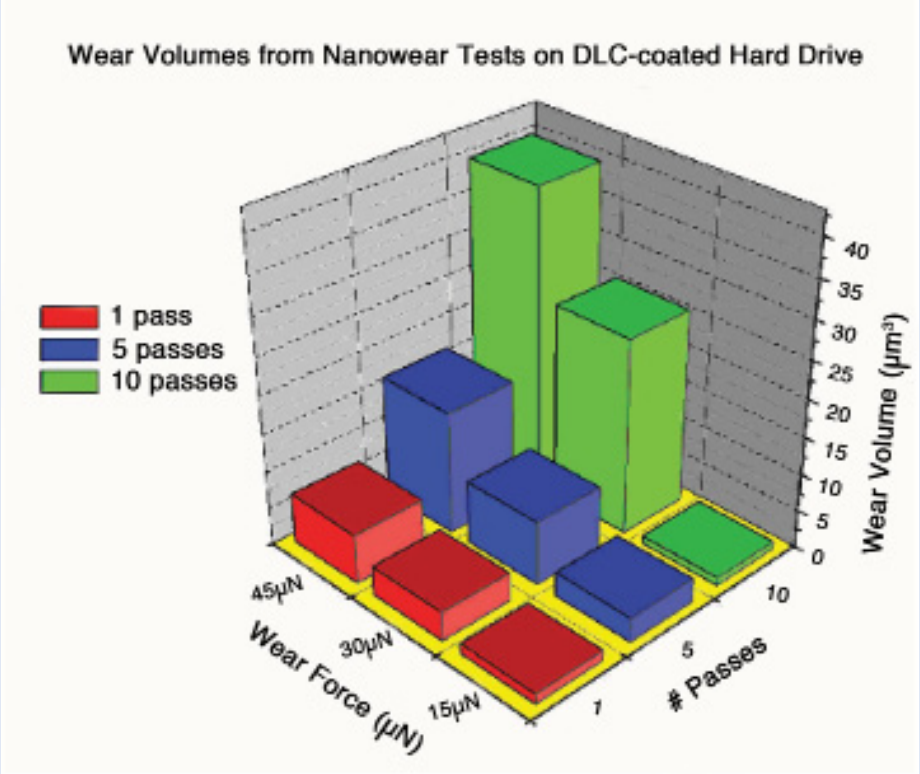

Figure 3. Wear volumes measured as a function of wear force and number of passes on DLC coating corresponding to *in-situ* image given in figure 2.

APPLICATIONS

- **Nanomachining**

  Mechanical contact machining with sub-micron accuracy

- **Lubrication**

  Wear characteristics can be studied on materials with and without lubricants for failure prediction

- **Additive Performance**

  Study the effect on performance due to addition of functional additives

- **Effects of Oxides**

  Wear of surface oxide layers studying the effect they have in protecting material surfaces

- **Sliding Contact**

  Unidirectional wear studies enable an understanding of sliding contact on material failure

- **Protective Coatings**

  Wear resistance of protective coatings can be studied as a function of cycles, load or both

HIGHLIGHTS

- **ScanningWear** is already included as standard with all **TS** and **TI Series** instruments
- No additional hardware or software is required