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# ANALYTICAL REPORT

Nanovea – TRB101217-30

**Method:** Nanovea Tribometer

**Sample(s):** Oxidized Steel, Carboxysilane Coated Steel

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NANOVEA
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# TRB TEST REPORT

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# PIN on DISK TRIBOMETER (TRB)

## Principle of pin-on-disk measurements

A flat or a sphere shaped indenter is loaded on to the test sample with a precisely known force. The indenter (a pin or a ball) is mounted on a stiff lever, designed as a frictionless force transducer. As the disk is rotated, resulting frictional forces acting between the pin and the disk are measured by very small deflections of the arm using a strain gage sensor. Wear coefficients for both the pin and sample are calculated from the volume of material lost during a specific friction run. This simple method facilitates the determination and study of friction and wear behavior of almost every solid state material combination, with varying time, contact pressure, velocity, temperature, humidity, lubrication, etc.

Figure 1 : Schematic of a tribometer test

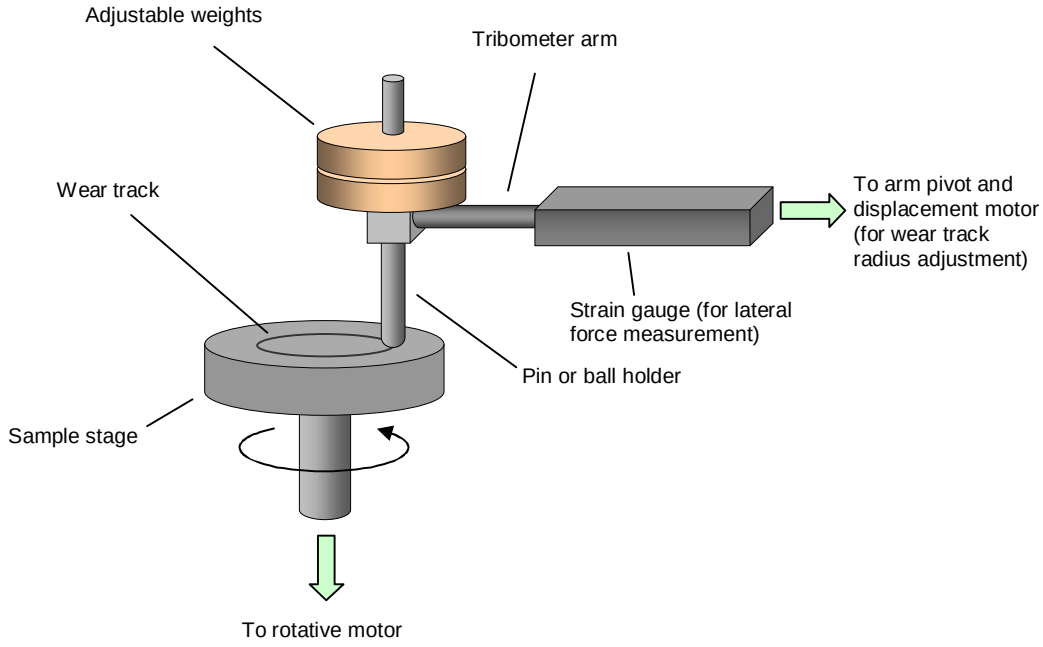
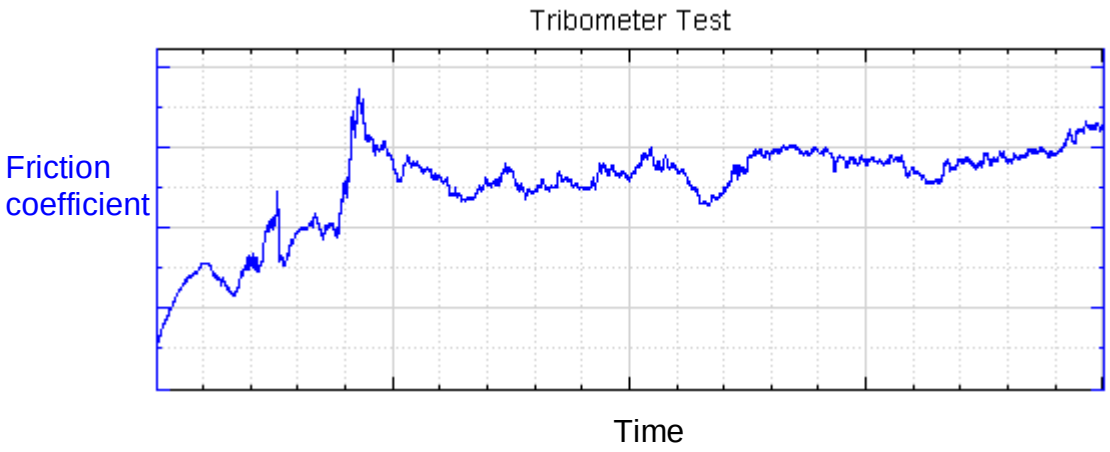


Figure 2 : Example of a friction curve in a tribometer test




## Test procedure and conditions

The instrument base is first leveled in the horizontal position by screwing or unscrewing the adjustable rubber pads at each corner. A ball-holder containing a 3 or 6 mm diameter ball is held in the load arm and placed at a height that allow the tribometer arm to be leveled horizontally when resting on the sample to ensure that normal load will be applied vertically. The arm is then balanced with counter weights to ensure that the arm and ball holder initially apply no force on the sample surface. Finally, weights corresponding to the load required for the test are finely placed on the arm over the ball holder. Through software, the test is then launched and the test is performed at a specified speed for a specified duration, and the frictional force is recorded over time.

## Test conditions

Test parameters

Testing was performed in accordance with ASTM G133, using the Nanovea Tribometer
Product Number: Nanovea TRB
Serial Number: T-10-0102

| Sample | Steel Coupon |
|---|---|
| Load | 2.0 N |
| Duration of test | 20 min |
| Speed rate | 80 rpm |
| Radius of track | 3 mm |
| Revolutions | 1,554 |
| Ball Diameter | 6 mm |
| Ball Material | SS 440 |

Environmental conditions

| | |
|---|---|
| Lubricant | n/a |
| Atmosphere | Air |
| Temperature | 23°C (room) |
| Humidity | 35% |

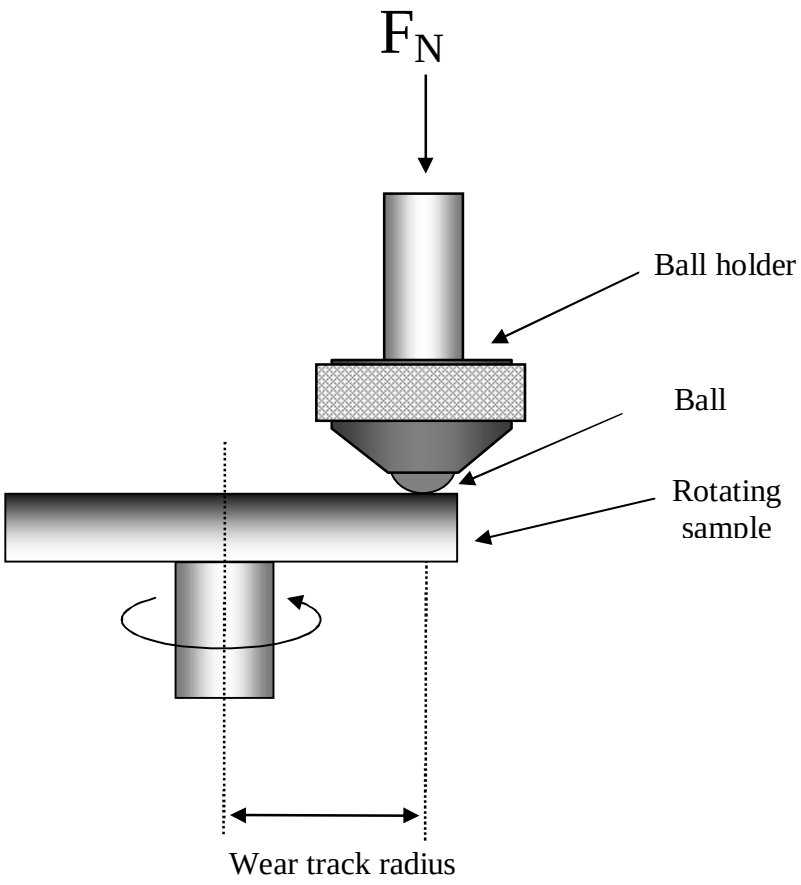



Figure 3 : Schematic of the contact on the sample

## Results

This section includes the following results:

- Summary table of the main numerical results
- Graphs of coefficient of friction over time

Coefficient of Friction Summary Table for: All Samples @ 2N

| Sample | Minimum Coefficient of Friction | Maximum Coefficient of Friction | Average Coefficient of Friction | Wear Rate [$x10^{-5}$ $mm^3$/Nm] |
|---|---|---|---|---|
| Oxidized Steel | 0.000 | 0.927 | 0.589 | 13.810 |
| Carboxysilane Coated Steel | 0.000 | 0.725 | 0.378 | 6.129 |

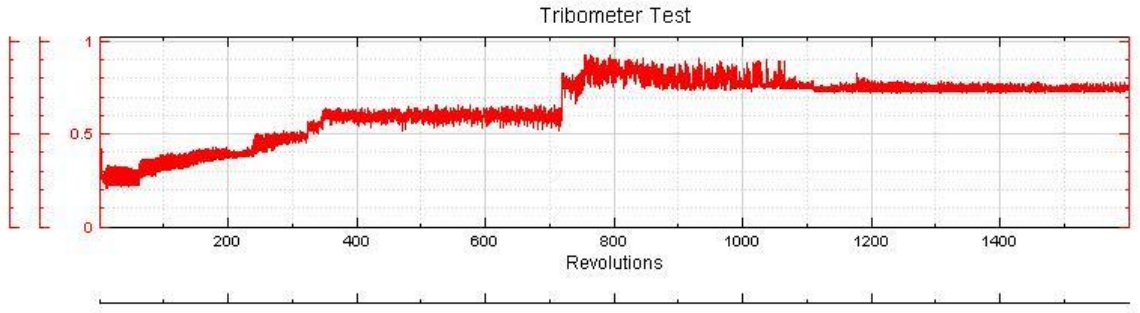



Figure 4: Graph of COF for Oxidized Steel

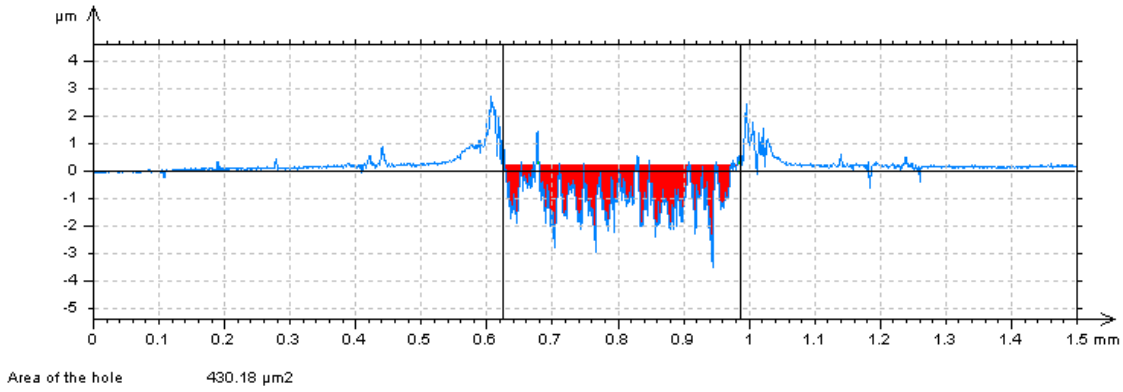



Figure 5: Area of the hole for Oxidized Steel

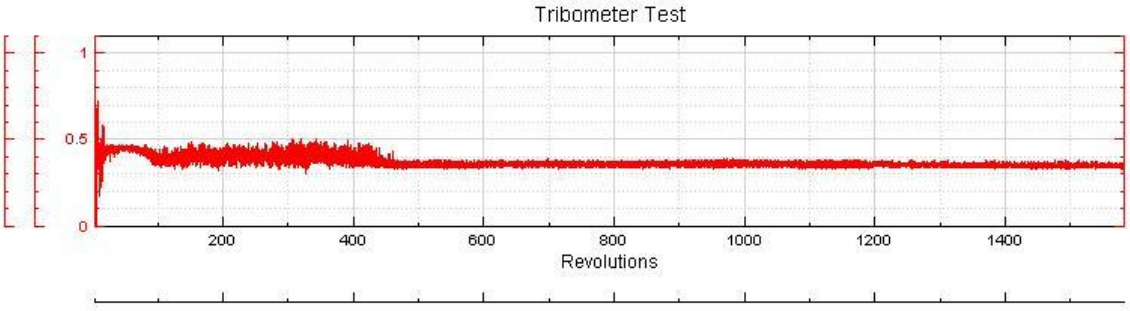



Figure 6: Graph of COF for Carboxysilane Coated Steel

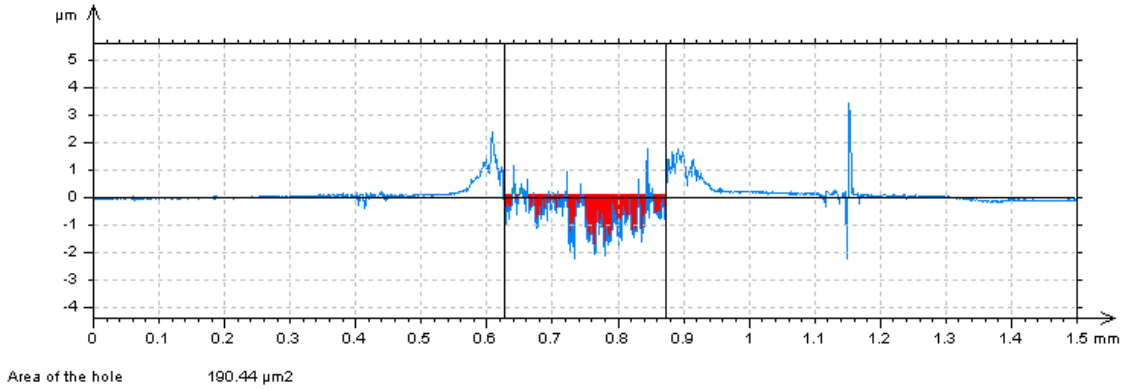



Figure 7: Area of the hole for Carboxysilane Coated Steel