

Scratch tester

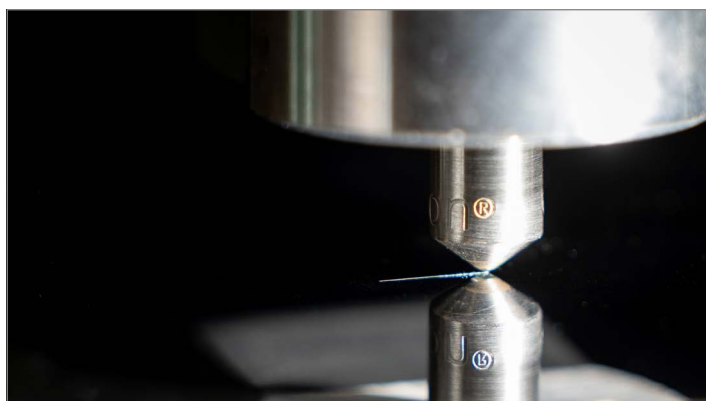


Figure 1: Scratch resistance evaluation: a diamond indenter traverses the sample surface with a continuously increasing load causing abrasive wear and plastic deformation.

Machine capability

Applied normal load range: 1 - 250 N.

Type of loading: constant or linearly variable.

Type of motion: single or repetitive unidirectional, reciprocating motion.

Friction force measurement range: ± 80 N.

Sliding speed: 0.1 - 45 mm/s.

Scratch length: 100 mm maximum in a single direction.

Indenter: Rockwell with nominal radius of 200 μm (other geometries are available).

Acoustic emission measurement.

Sample specification

Typical dimensions: 50 x 50 x 3 mm (other geometries can be accommodated).

Evaluation

In situ wear measurements.

Friction force: applied load vs displacement graphs.

Acoustic emission: applied load vs displacement graphs.

Wear scar profilometry.

3D optical imaging and SEM.

Description

The NPL scratch tester is used to determine the resilience of engineered surfaces, including coatings and surface treatments. Unidirectional scratches are made using diamond indenters as per the ASTM D7027 and G171 standards. The indenter depth, friction force and acoustic emission are measured and recorded during each scratch, and are then correlated with the applied load and sliding distance. This provides a detailed insight into the mechanical response of the surfaces to damage from a well-characterised probe. The in situ wear and friction measurements are normally complemented by post-test 3D optical imaging. The test system is fully computer controlled and is readily adapted to perform dry and lubricated sliding experiments to evaluate the friction and wear of material couples manufactured from coupons or sections of production parts.

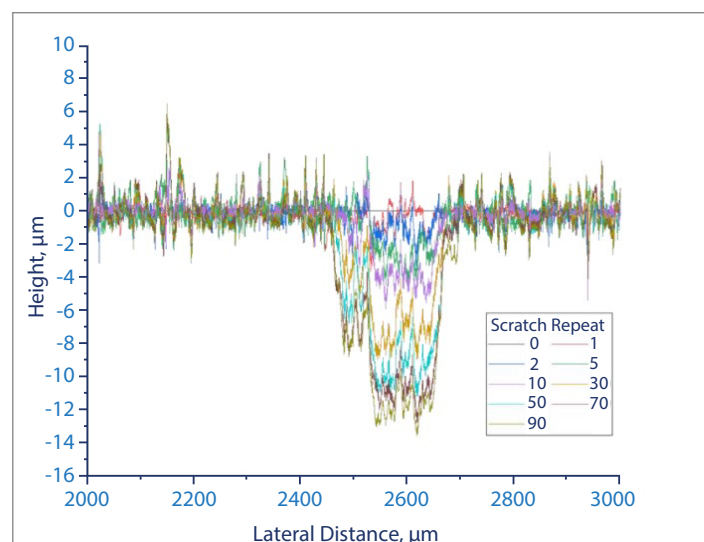


Figure 2: Surface profile measurements after incremental scratching. [1]

[1] M Gee, T Kamps, J Nunn and P Woolliams. Project IND1705 Multifunctional ultrafast microprobes for on-the-machine measurements, EMPIR, Good Practice Guide – In-situ wear damage measurement using fast microprobes with integrated feed-unit. National Physical Laboratory, 2021. [Good Practice Guide No 6. In-situ wear damage measurement using fast microprobes with integrated feed-unit.pdf](#)



Figure 3: Typical scratch on DLC-coated steel sample showing complete failure of coating at a critical load.