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Pin-on-disc

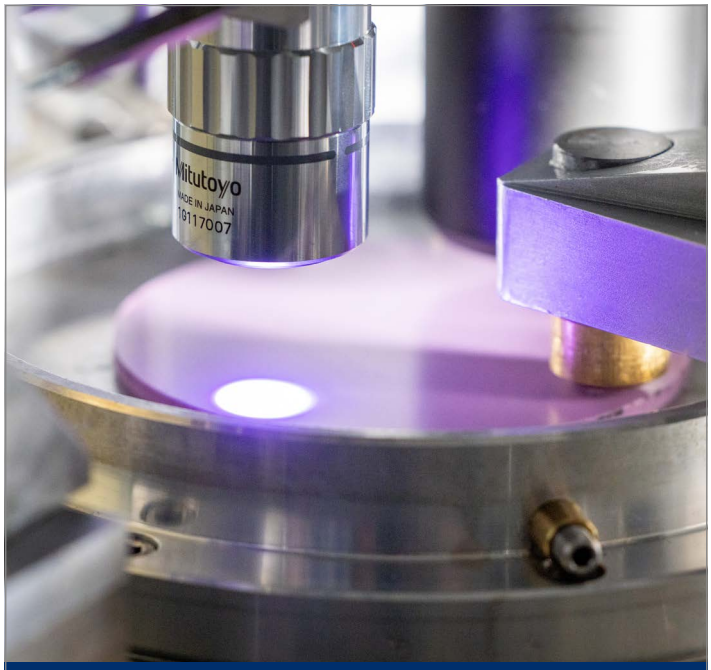

Figure 1: Pin-on-disc testing: NPL's integrated pin-on-disc tribometer equipped with 2D and 3D machine vision technology can identify wear mechanisms in near real-time.

Description

The pin-on-disc test system is used to investigate the way a material's surface responds to a unidirectional sliding tribological contact. This machine measures the friction and wear of contact between a stationary sample – such as a fixed ball – and the flat side of a rotating disc as per ASTM G99. Tests can be carried out under both dry and lubricated conditions. The system is fitted with several sensors to monitor the wear process as it is taking place, including a 2D linescan, a 3D multipoint probe and a linear variable differential transformer (LVDT). The 2D linescan continuously images the wear scar in situ, classifying the wear mechanism using a convolutional neural network in near real-time. The multipoint probe measures the topography of the wear track in real time, and the LVDT measures the total wear of the pin at the disc. The machine can be modified to become a test rig for thrust bearings.

Machine capability
Contact geometries: point contact, area contact and thrust bearing.
Optional modules: fluid property sensor, interferometer, charge detector and convolutional neural network.
Speed: 2 - 1,450 rpm (corresponding to 0.01 - 7.50 m/s for a 100 mm wear track diameter).
Load: 0 - 450 N.
Additional capability: thrust bearing rig.

Sample specification
Size: 75 - 130 mm diameter, typically 3 mm thick.
Sample nature: coated or bulk material.

Evaluation
Continuous acquisition of images and data, including friction, wear scar height and depth.
Real-time correlation of friction with surface topography evolution.
Near real-time wear mechanism classification using a convoluted neural network.

This measurement capability is explained in greater detail in this open access article (including videos):

M Gee, T Kamps, P Woolliams, A new paradigm in uniaxial wear testing for ceramics and ceramic coatings, International Journal of Refractory Metals and Hard Materials 130 (2025) 107127