

Surface Engineering – Facilities for Measurement

Wear and Friction

Sliding Wear:

- Reciprocating sliding wear and friction test system.
- High speed (50 Hz) reciprocating wear and friction test system (Plint TE77).
- Low speed ($>10^{-3}$ mS⁻¹) pin/ball-on-disc wear and friction test system.
- High speed (<5 mS⁻¹) pin/ball-on-disc wear and friction test system.
- High load (1 kN) pin/ball-on-disc wear and friction test system.
- Pin-on-disc test system for simulation of metalworking under hot workpiece/cold die conditions.
- High temperature ($<1500^{\circ}\text{C}$) reciprocating or scratch testing system (air atmospheres).
- High temperature ($<1500^{\circ}\text{C}$) environmentally controlled (vacuum, or any specified gas) tri-pin/ball on ring or thrust washer test system.
- Micro-tribology test system for in-situ use in SEM; loads from 1 mN to 100 mN

Abrasion Wear:

- ASTM G65 dry sand rubber wheel test system.
- ASTM B611 steel wheel test system.
- NPL versatile rotating wheel test system allowing tests with rubber or steel wheels, wet or dry, many different abrasives.
- Ball cratering or micro-abrasion test system.
- Versatile scratch testing system with friction measurement, acoustic emission detection; loads from 2 to 200 N
- Low load scratch test system with multi-pass facilities for simulation of abrasion.
- Slurry abrasion tests.

Erosion tests:

- Gas borne particulate erosion.
- Fluid jet erosion testing
- Multiple repeated indentation as model of erosion.

Properties of Coatings

- Nanoindenter (depth sensing indentation) for modulus and hardness measurement.
- Micro indenter with depth sensing for hardness measurement.
- Scratch testing for evaluation of coating failure. System has multipass facilities for examination of build-up of damage and acoustic emission for detection of failure events.
- Bend/tensile testing for adhesion measurement and work of fracture at ambient and elevated temperature.
- Residual stress measurement by X-ray diffraction at ambient and elevated temperature.
- Rockwell indentation test for adhesion measurement.
- Environmental testing of coatings.
- DC heated TMF (thermo mechanical fatigue) testing of coatings.
- Thermal cycling exposure testing.
- Laser Surface Acoustic Wave system for non-destructive measurement of elastic modulus, coating density and thickness.
- Measurement of residual stress by bending of coupons (Stoney technique).

Characterisation

- Optical microscopy & image analysis including 3D optical measurement of surface form
- Scanning electron microscopy (including high resolution field emission) with wavelength dispersive and energy dispersive X-ray analysis and EBSP.
- Non-contact optical profilometry.
- Atomic force microscopy (AFM) for topography and mechanical characterisation of surfaces.
- Nanoindenter stylus calibration by metrological AFM.
- X-ray diffraction at ambient and elevated temperatures.
- Residual stress by RAMAN microscopy.