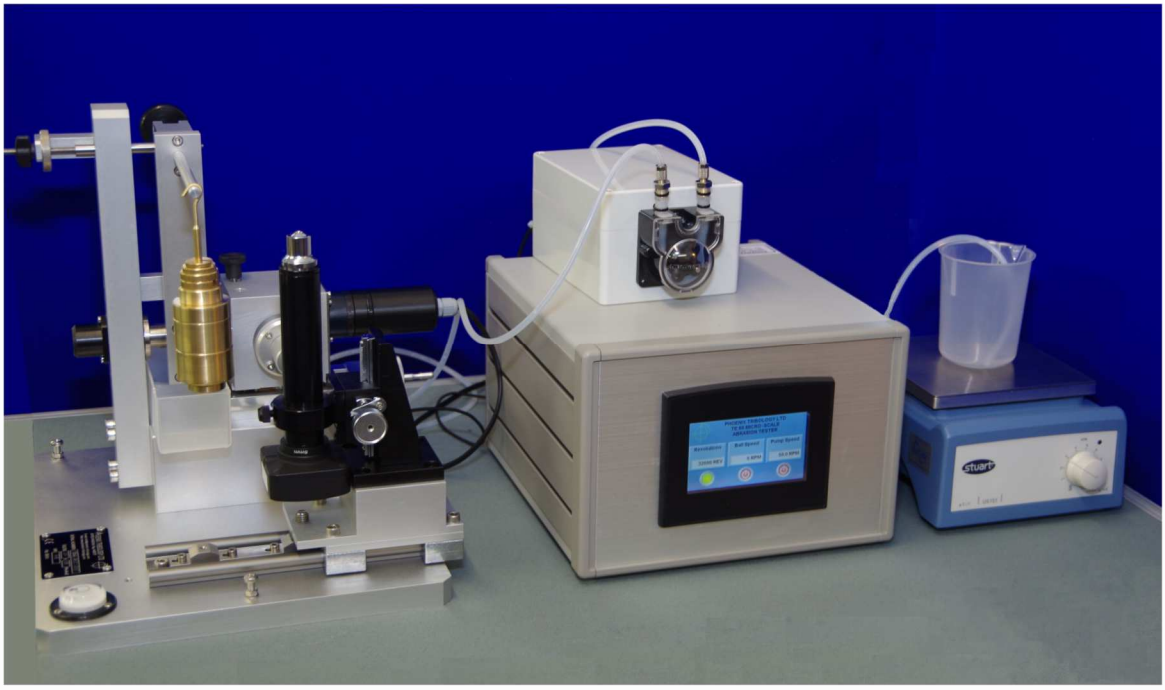
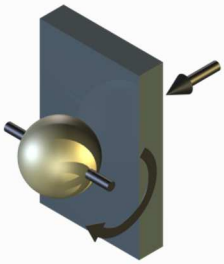
TE 66 MICRO-SCALE ABRASION TESTER





Background

The Micro-Scale Abrasion Tester is based on an experimental technique developed by I M Hutchings and K L Rutherford of Cambridge University Department of Materials Science and Metallurgy and is manufactured by Phoenix Tribology under licence.

The TE 66 may be used to determine the wear coefficient of hard and soft coatings and monolithic materials by abrasive wear in a ball on plate contact configuration. The machine may also be used as a crater-generating tool on coated surfaces for coating thickness determination.

The TE 66 may be used for tests in accordance with BS EN 1071-6: 2007: Advanced technical ceramics. Methods of test for ceramic coatings. Determination of the abrasion resistance of coatings by a micro-abrasion wear test.

Description

The rotation of a ball against a coated plate in the presence of an abrasive slurry results in the production of a circular depression. Eventually the coating is worn through and a “bulls-eye” depression is seen where the substrate shows through. Measurements of the inner and outer diameters of this bulls-eye are easily made and provide an accurate and low cost method of determining coating thickness. This is an established coating thickness measurement technique.

In order to use this configuration for wear coefficient determination it is necessary to measure precisely ball rotational speed, applied load and number of rotations completed (for sliding distance determination). The aim of such a test is to measure progressive wear over an extended number of cycles and thus determine wear rates and wear coefficients of the material (and coating).

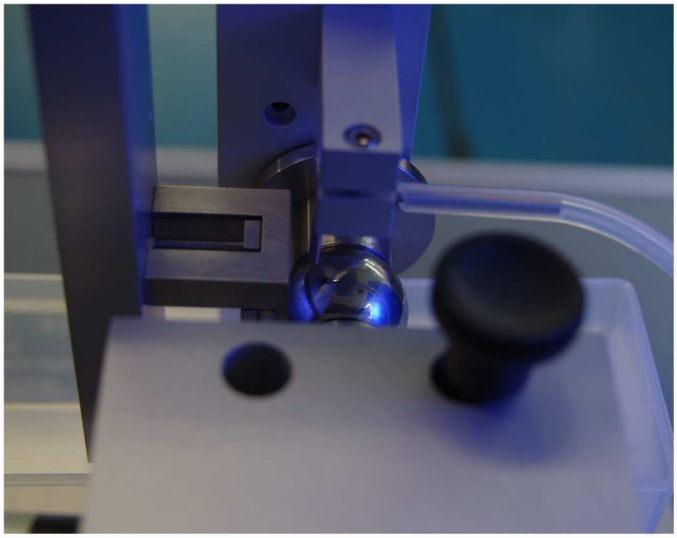
The progressive measurement of wear by interrupting the test for microscopic observation is cumbersome and results in errors in replacing the specimens.

Other ball-cratering devices use a free ball that rests on the coated surface and at two points on a rotating shaft. The static load on the surface is determined by the size of the ball and the tilt angle of the coated surface. The ball is driven by friction against the shaft and abrasive slurry is fed into the wearing contact. Since the ball is free and the friction conditions variable, the rotational speed, number of rotations and applied load are both uncertain.

In the TE 66 Micro-Scale Abrasion Tester the ball is fixed into the rotating shaft and the test surface is mounted on a counterbalanced beam that hangs vertically from a pivot. This configuration offers the following advantages over the free ball:

1. The load can be defined precisely without interaction with the friction force.
2. A wide range of loads can be applied precisely and repeatably, without the need for variable ball sizes.
3. The rotational speed of the ball and the number of cycles completed can be measured precisely.
4. Means can be provided for continuous measurement of the relative displacement of the specimens to indicate wear.

A 25 mm ball is clamped between two coaxial shafts each carried in support bearings. One shaft is driven by a variable speed dc geared motor. A batch counter is provided to measure and control the number of shaft revolutions.



The test sample is clamped onto a platform on a vertical beam. The beam is in balance when the samples are just in contact and the load is applied by adding dead weights to a cantilever arm.

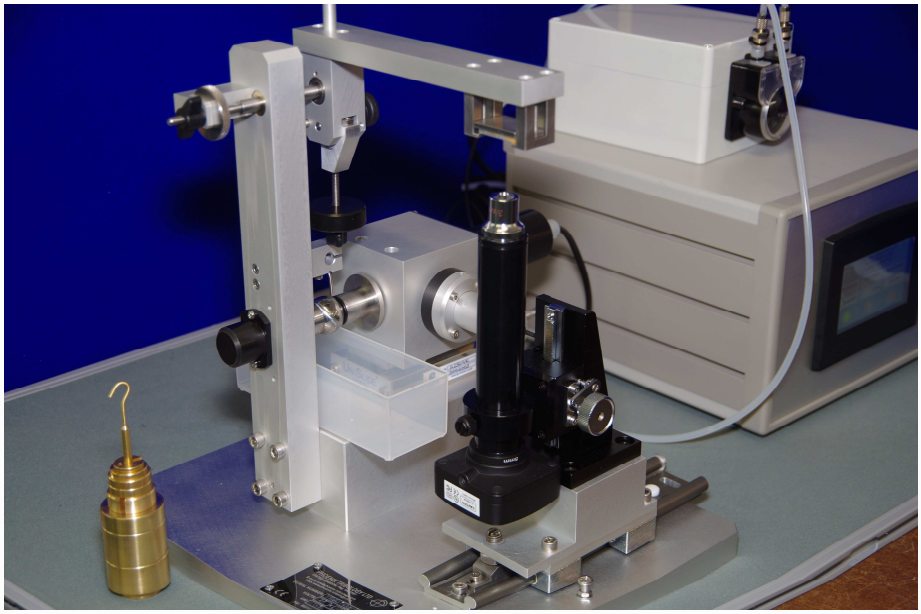
Slurry is stored in a container that can be agitated on a laboratory magnetic stirrer (available as option TE 66/S). A peristaltic pump is provided for pumping the slurry into the contact. It is fed to a position just above the contact point and collected in a waste tray underneath.

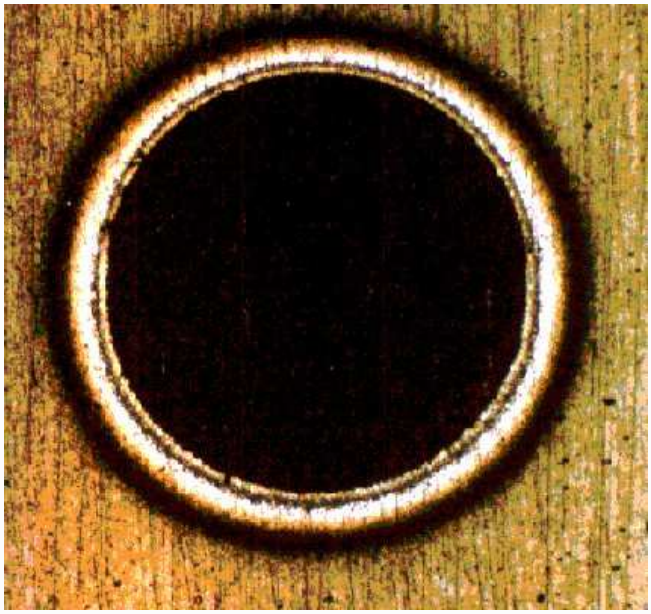
Control and Data Acquisition

Speed set-point control is manual, implemented via a PLC, with input via touch-screen. When the TE 66/W, TE 66/F and TE 66/E options are fitted, the output data is recorded at 1 Hz sampling rate, stored by the PLC and exported on USB stick, for post-processing.

TE 66/DM Wear Measuring Microscope

The optional digital microscope is used to view the contact crater in situ and make measurements of the wear scar width. The crater is viewed by rotating the load arm to bring the sample out of contact with the ball, thus avoiding disturbance to the contact by removal of the ball.





The use of the TE 66/DM is strongly recommended for all TE 66 installations. The reporting of wear scar measurements is considered an essential part of the use of the ball-cratering test. The TE 66 is provided with the necessary support for the TE 66/M to view the test plate mounted on the loading beam.

TE 66/S Laboratory Magnetic Stirrer

Slurry is stored in a container that is agitated on the laboratory magnetic stirrer. The slurry is pumped by the integral peristaltic pump on the TE 66. It is fed to a position just above the contact point and collected in a waste tray underneath. 3 metres of pump tubing is provided with the TE 66/S.

TE 66/W On-Line Wear Monitor

This non-contacting displacement transducer may be used to monitor the position of the beam relative the ball axis during a test. Wear depth and wear rates may be determined from this measurement. The use of the TE 66/W system is recommended only for tests where the coating or substrate will be wearing more than 10 µm.

TE 66/F Friction Measuring System for Adhesion Testing

This adapter is in the form of a modified specimen load beam incorporating a strain gauge force transducer for friction force measurement.

TE 66/E Electrical Insulation and Slip Ring

The adapter incorporates electrical isolation of the specimen mounting and the provision of an electrical slip ring on the ball drive shaft. This may be used either in conjunction with a simple electrical resistance circuit, for detection of break-through on non-conducting coatings, or in conjunction with a potentiostat for electro-chemical measurement in processes involving combined abrasion and corrosion.

TE 66/LC Line Contact Adapter

This item of tooling allows tests to be run with a line contact specimen in a non-conforming block on ring configuration. The tooling allows a disc specimen to be mounted in place of the standard ball specimen.

TE 66 Multi-station Option

In addition to the standard single station tester, multi-station units can be assembled, incorporating a single drive motor and control system and multiple test assemblies. This is an economical way of increasing testing capacity without increasing the number of testers required.

TE 66 MICRO-SCALE ABRASION TESTER

Technical Specifications

Ball Speed Range:	30 to 150 rpm
Load Range:	0.05 to 5 N
Ball Diameter:	25 mm
Pump Feed Rate:	up to 60 ml/hour
User Interface:	PLC with touch-screen
Data Acquisition Rate:	1 Hz
Data Export:	USB stick

TE 66/DM Wear Measuring Microscope

Digital Camera:	5MP CMOS USB Camera
Magnification:	x3 and x5

TE 66/W On-Line Wear Monitor

Displacement Range:	0 to 1 mm
Resolution:	0.2 µm
Accuracy:	within 3 %
Output Range:	1 V = 100 µm

TE 66/F Friction Force Measuring System

Friction Force Range:	0 - 10 N

TE 66/LC Line Contact Adapter

Disc Diameter:	25 mm
Disc Width:	Up to 10 mm

Services

Electricity:	220/240V, single phase, 50 Hz, 120 W 110/120 V, single phase, 60 Hz, 120 W

Installation

Bench-mounting machine:	720 mm x 440 mm x 570 mm high, 15 kg
Bench-mounting cabinet:	530 mm x 420 mm x 320 mm high, 10 kg
Packing specifications:	0.21 m^3, GW 50 kg, NW 25 kg