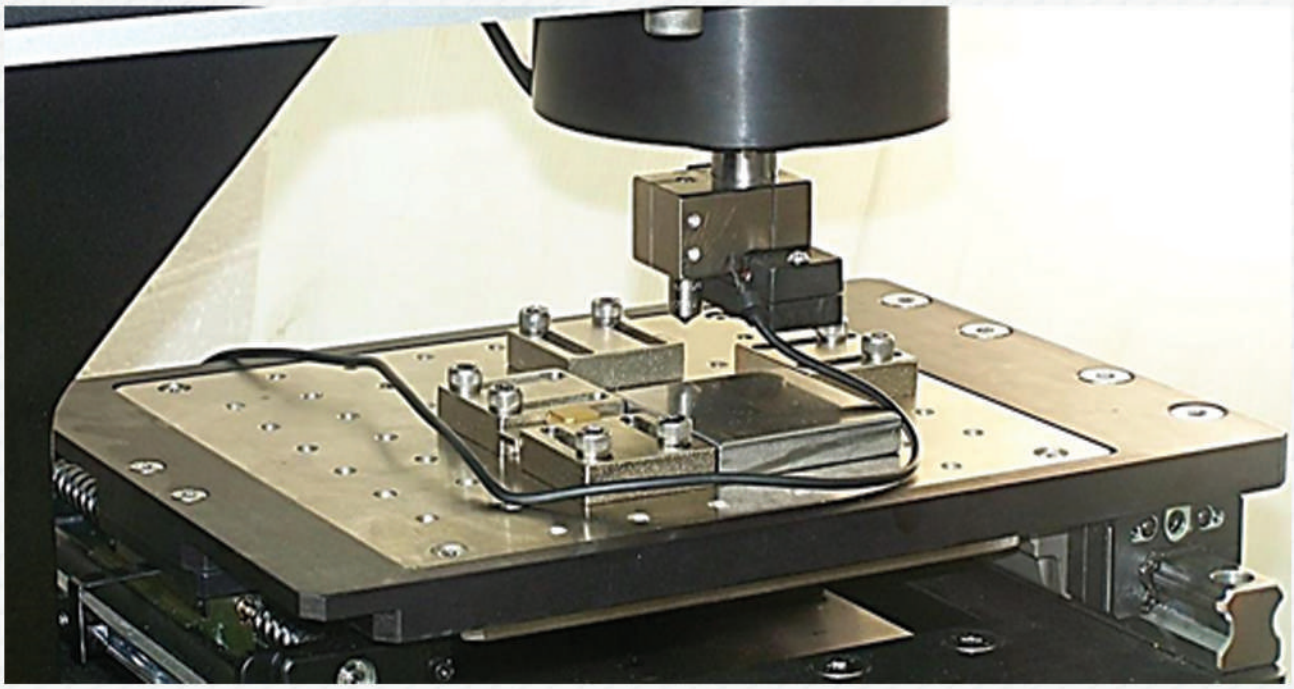
DUCOM
MATERIAL CHARACTERIZATION SYSTEMS

Product Information Sheet:
Scratch Tester



Reliable measurement of coating failure

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BASIC INSTRUMENT

Ducom scratch tester (see Figure 1) is used in tribological characterization of coatings by evaluating the scratch resistance or friction, critical load to failure, adhesion force and nature of damage under high contact stress. An indenter is pressed on the test specimen (see Figure 2A) with a controlled normal load, scratch speed and scratch length. Servo controlled normal load is in the range of 2 N to 200 N and it can be either fixed or varied at a maximum rate of 10 N/mm. Scratch speed can be set between 0.1 mm/s to 2 mm/s. Measured parameters are friction force up to 200 N at a least count of 100 mN, plastic deformation up to 2 mm, and acoustic emission in dB.

An imaging system in scratch tester can acquire scratches in-situ (see Figure 2B) for post-test characterization of coating failure. LabView based WinducomTM software is used to acquire and display the operating parameters and measured parameters.

Figure 1. Ducom scratch tester newly designed.

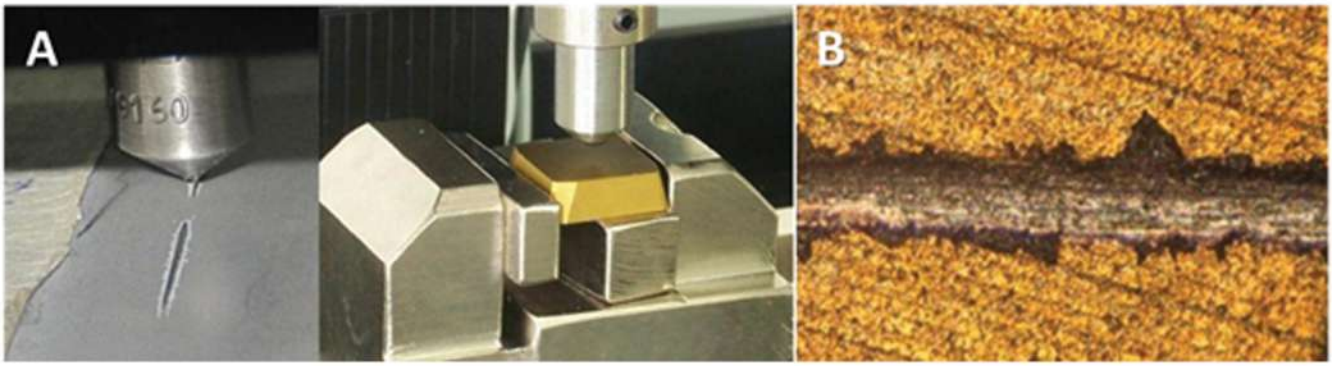


Figure 2. Scratch tester with an indenter pressed on the specimen (A), and wear scar (B).

APPLICATIONS

- Determination of critical load for hard and brittle coatings like titanium nitrides, boron nitrides, diamond like carbon, etc.
- Single particle scratch resistance behaviour of antireflective coatings and its comparison with erosion.
- Estimation of bond strength at substrate – coating interface.
- Product development and quality control of surface engineered product.
- Scratch resistant behaviour of dental materials in physiological and corrosive environment.

FUNCTIONAL FEATURES

- Automated Load Control: Software controlled load profiles – continuous, fixed and ramp for evaluation of critical failure load of coating thereby providing a simple, practical and quick quality control tool.

- Automated Scratch Test Profile: Software controlled movement of test specimen along X and Y axis for unidirectional scratch, bidirectional scratches and scratches at different location on the specimen.

- Integrated Image Acquisition System (IAS): In-situ measurement of scratch length and width for damage assessment (e.g., delamination and spallation) for quick analysis and interpretation of test results.

- Optical Measuring System (magnification of 10X and 50X): It is used for real-time visualization and video recording of the scratching process.

- Acoustic Emission Sensor: Acoustic emission is used to detect early damage to the coatings (e.g., sub-surface cracking) which can be correlated later with the critical load to failure for multilayered coatings.

- Environment Chamber: Lubricant corrosion cup with temperature control for testing biomaterials at physiological conditions.

OPTIONALS

- Automated Load Control Units – High Load (20 N to 200 N) and Low Load (2 N to 20 N)
- Acoustic emission sensor
- Image acquisition system (IAS)
- Scratch depth sensor
- Optical microscope with 10X and 50X
- Image stitching software for lengthwise visualization of complete scratch
- Lubricant corrosion cup with temperature control

Please contact us for the technical specification sheet.

USER CONVENIENCE

• Ease of use: It is easy to mount and replace samples for the test. Integrated camera in the loading assembly provides for quick imaging of scratch track post-test. Pre-programmed test parameters (as loading profile, scratch speed, number of scratches) help conduct repetitive set of experiments on different samples for quality control.

• Low maintenance cost: Ducom instruments with high value design features and quality of the components ensures low maintenance cost for the users. In addition, any online customer support is at free of cost.

• Ease of calibration: It is quicker and easier to calibrate the friction force and normal force using a known weight and loading pan. This traditional setup does not ask for specialized operating skills and it is a well- known technique.

• Modular system: The scratch tester can be upgraded with the optionals (as mentioned above) at any time after the purchase.

• Interface: User friendly software interface with CompariView module for comparative viewing of test results from multiple scratches or scratches from different materials and coatings

PRINCIPLE OF OPERATION

Ducom Scratch Tester consists of an indenter that is mounted on the Z-axis of the tester and the specimen to be tested is placed below on an X-Y stage and it is firmly held in a vice or chuck (see Figure 3). The motion along X and Y axis is controlled by a ball screw servo motor. An indenter is pressed against the test specimen with the desired force using a servo-controlled loading unit that ensure high level of precision despite the surface waviness. The friction force during the X – Y stage controlled scratch length is measured. A change in friction force which may represent delamination of coating (see Figure 4), along with optical images of scratch can give a clear description of coating failure.

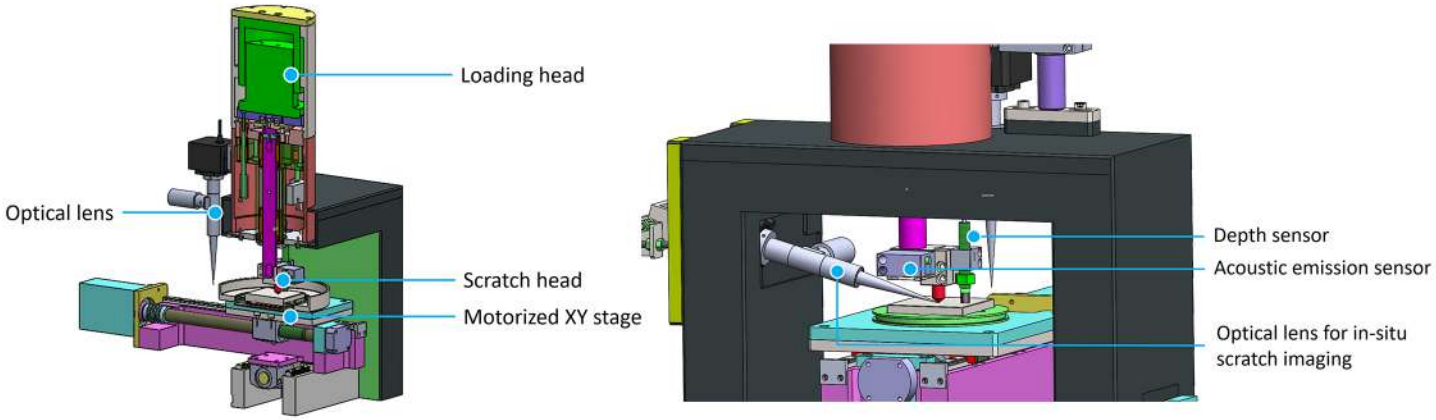


Figure 3. Description of Ducom scratch tester assembly

Acoustic emission sensor is mounted on the loading unit to detect the acoustic signals that are relevant to crack initiation and progression, during scratching. Optical microscope with different magnifications can be switched on to record the process of scratching.

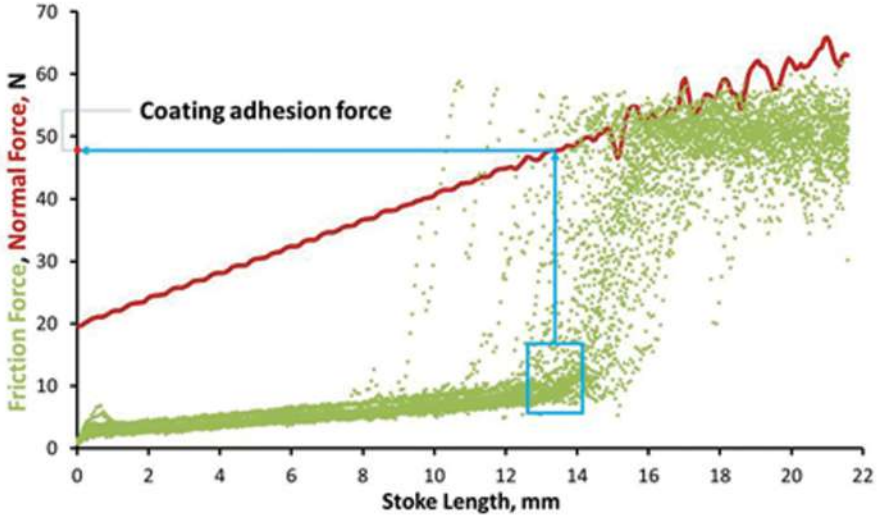


Figure 4. Evolution of friction force as a function of normal force and stroke length

INSTRUMENT CONTROL AND DATA ACQUISITION

The Ducom Scratch Tester is controlled by LabView based WinDucom software. The raw data are also measured and displayed online. Stitched image of scratch is scaled to match the scratch length and superimposed on the graph (see Figure 5). Normal load, Friction force, Acoustic emission, Friction coefficient and Scratch depth are tagged to the image. Acquired data can be presented in several ways. Graphs of individual test can be printed. Results of different tests can be superimposed for comparative viewing. Data can be exported to excel.

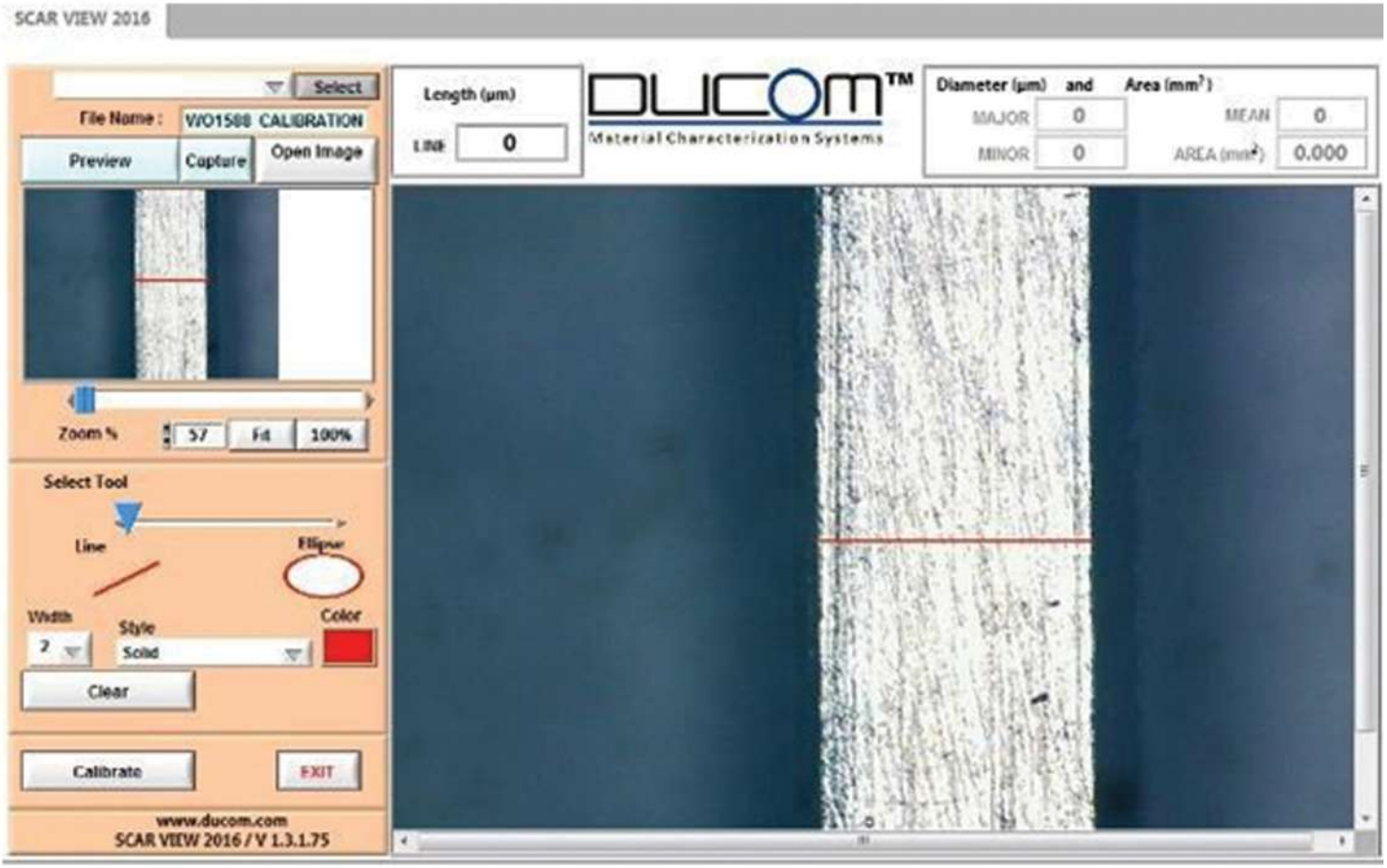
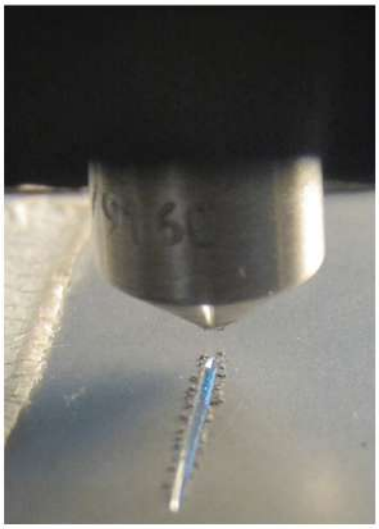
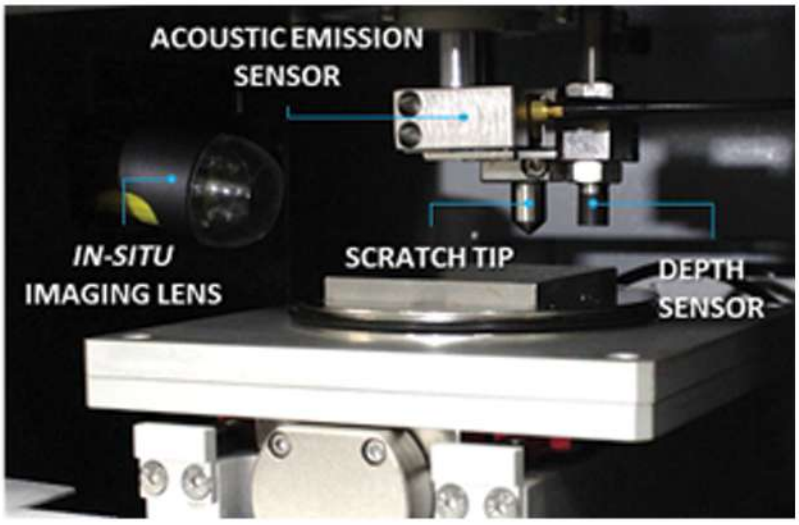


Figure 5. ScarView interface for image analysis

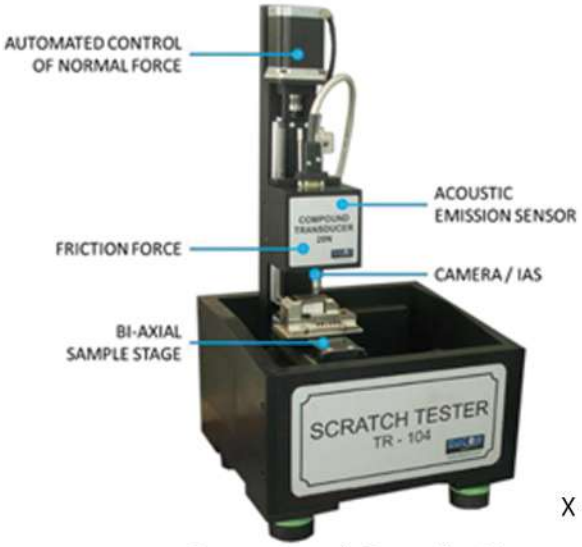
PICTURE GALLERY



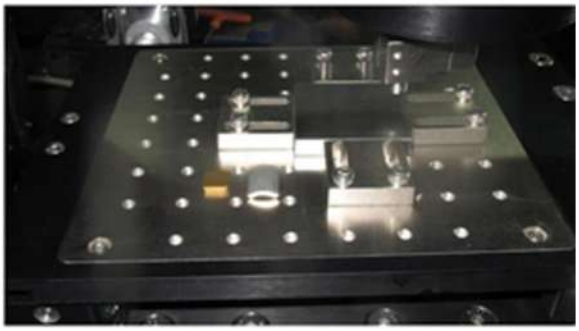
Stylus in Ducom scratch tester



Ducom scratch tester (advanced)



Ducom Scratch Tester (basic)



X – Y stage with sample holder for different size and geometry

Multiple scratches on the glass specimen

Optical image of the scratches on an antireflective coating

ABOUT DUCOM

Founded in 1978, Ducom Instruments has led the way in designing and manufacturing advanced materials testing instruments with a specialization in tribology. Applying cutting-edge technology and strong design principles to its products, Ducom focuses on providing customers with an excellent ownership experience starting with ease of use and maintenance.

Our locations in the United States, Netherlands and India each have an in-house Research and Development initiative coupled with development partnerships with world renowned institutions. As a result, Ducom holds several proprietary technologies, copyrights and patents with additional filings every year. Many of these technologies are applied to our instruments, and work in the background so users can enjoy better results.

Our instruments are operational all over the world: from research labs that require advanced and highly configurable test systems, to facilities with standardized quality control requirements, Ducom is a trusted solutions partner with decades of experience in a multitude of industries.

Certifications:

ISO 9001:2008 Certified Organization
AS9100:2009 Certified Manufacturing Organization