UST®

Indentation
Scratch
Deformation
Tribology
Surface Profile
Haptics
Basic Functions

Adequate measurements are of great importance for a reliable simulation and evaluation of micromechanical properties of materials and surface coatings, such as deformation or haptics. As material and coating behaviour can vary considerably, a series of proper, real-time, quantitative measurements have to be performed with high resolution in the right dimension.

UST®-Universal Surface Tester, is by far the only open multi-modular system that provides a complete mechanical testing solution for the evaluation of bulk materials and surface coatings. Its unique configuration allows for a wide range of tip choices with various materials and sizes ranging from nanometer to centimeter.

Highlights

• One machine for all measurements
• All measurements with same resolution
• All measurements in real time, continuous and in-situ
• Mechanical property with local surface profile resolution
• Wide selection of tips from nanometer to centimeter

UST®

• One machine for all tests
• Same resolution (60nm)
• No need for correlation
• Local resolution
• Continuous measurement
• Surface structure combined with properties

Other Systems

• One machine for one type measurement
• Different resolution
• Need for further correlation
• No record with local resolution
• Point by point measurement
• No surface structure vs. properties
Basic Unit

Option 1: UST®-100
Load range: 1 mN-100 mN

Option 2: UST®-1000
Load range: 10 mN-1,000 mN
for harder surfaces and coatings

UST® Basic Unit includes:
- 2D Deformation Measurement
- Tip check/Calibration
- 3 Standard Tips (2 Steel Cones, Ball)
- 1 Big Clamp/1 Small Clamp/Tools/Screws

Standard Measurement: 2D Deformation
(total, permanent and elastic deformation)
Test Principle

Step 1: Scan with no load. Surface structure is continuously determined.
Step 2: Scan on the same path with additional load to determine total deformation.
Step 3: Scan on the same path with no load to determine the elastic deformation.

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egin{align*}
V_{g} &= Z_{1}(X) - Z_{2}(X) \\
V_{e} &= Z_{3}(X) - Z_{2}(X) \\
V_{p} &= Z_{1}(X) - Z_{3}(X)
\end{align*}
\]

Total deformation = Step 1-Step 2;
Elastic deformation = Step 3- Step 2;
Permanent deformation = Step 1-Step 3

Standards and Specifications

DIN EN ISO 14577-1; DIN 4762, 4768, ISO 4287, 4288
**Modules**

A selection of 10 different modules is available for all types of measurements and applications. Each module includes all necessary hardware, software, suggested tip and necessary tools.

**Module 1: 3D Deformation**
Performs several single scans automatically on an area and registers the 3D deformation properties of a complete surface.

- 3D Deformation
- Tips:
  - Diamond Cone 60°/90°/120°
  - Steel Cone 60°

**Module 2: 3D Topography**
Performs several single scans automatically on an area and registers both the 3D topography and the material properties of a complete surface.

- 3D Topography
- 3D Roughness
- Particle Mode
- Tips:
  - Diamond Cone 60°/90°/120°
  - Steel Cone 60°
Module 3: Scratch

**Standard Scratch (Budget Version)**
- Standard scratch test with local surface profile
- Tip: Scratch Diamond 5° undercut

**Micro Scratch with Microfriction (Premium Version)**
- Hardware:
  - Friction table with high resolution piezo sensor
  - Controller card for PC
  - Sample fixing and clamping set
- Tip: Scratch Diamond 5° undercut

Continuous measurement along one line on a sample made out of three different materials: wood, flat polymer, polymer with grooves for the correlation of surface profile and microfriction.
Module 4: Microfriction (Standard)
Measures the friction force between a sample and the tip during a scan with an accuracy in nm.

- Hardware:
  - Friction table with sensor
  - Controller card for PC
  - Sample fixing and clamping
- Micro Friction + 2D Topography
- Micro Friction + 2D Deformation
- Tip: Customized tip on request (e.g. haptic tip)

Module 5: Abrasion and Wear
Measures the abrasion rate with certain load repeating several times.

- Total Abrasion
- Wear Rate
- Tip: Steel ball 20mm

Red line (1st meas.): surface profile
Blue line (4th meas.): last measurement
Green line (2nd meas.): with 1st load
Purple line (3rd meas.): 50th abrasion time

Module 6: Damping
Special measuring mode for examining the elastic behaviour of soft materials.

- Surface height profile is continuously recorded
- Damping Oscillation
- Tip: Papillary stylus or customized tip on request
Module 7: Viscoelasticity (Creeping & Recovery)

- 3-Step Measurement
- Material’s reaction under strain and the relief property
- Tip: Customized tip on request

Module 8: Universal Hardness

- According to DIN EN ISO 14577-1
- Two-Step Measurement
- Total Deformation
- Tip: Vickers Diamond
  Berkovich-Diamond, or customized tip on request

Module 9: 2D Roughness

- According to DIN 4762, 4768, ISO 4287, 4288
- Scan once with a certain load
- Ra, Rq, Rz
- Automatic filter selection
- Tip: Diamond Cone 60°/90°/120°
  Steel Cone 60°
**Module 10: TAX**

High quality measurement module for the evaluation of the abrasive wear resistance on the micro and macro scale.

It is available as a module on UST®, or provided as a micro-calotester: **TAPERADER®**

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**Hardware Options**

1. **Exchangable Measurement Head**: UST 100 mN and UST 1000 mN

2. **Microscope**: for documentation of the measurement process and results (photo function)

3. **Videocamera**: for documentation of the measurement process and results (video function)

4. **Optical 3D Topography Module**: non-tactile optical measurement of 3D topography

5. **Vacuum Plate Package**: for fixing samples. Vacuum pump is included.

6. **Mini-Clamping Tool Set**: fixing tool for harder samples

7. **Quick Plates**: for easy and quick fixture of samples

**Upgrade Options**

New X-Y automatic sample table and all software are available for upgrade. Please contact our technical engineers for detailed information.
Tip Options

**Steel Tip Groups**
- Steel ball: 0.8 mm
- 1.8 mm
- 5.0 mm
- Steel Cone: 60°

**Other Tip Groups**
- Cutting tool
- Aluminum ball 20mm
- Table tennis
- Juby
- Leather
- Papillar

**Diamond Tip Groups**
- Diamond pyramid: 60°
- Diamond: 60°
- 90°
- 120°