

μ -X360s

X-Ray Stress Analyser



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Pulstec X-Ray Stress Analyser μ-X360s

In modern production environments, knowledge of the residual stress state of components is becoming increasingly important as components are designed to be lighter and the load limits of materials are being pushed ever further. In addition to numerous other destructive and non-destructive methods, X-ray residual stress determination has proven to be particularly practical and reliable. However, the conventional measuring methods require an extremely precise setup of the measurement.

The innovative X-ray stress analyser μ-X360s from Pulstec is a revolution in the determination of residual stresses and retained austenite. The extremely compact and lightweight system has a fixed incidence angle to the component surface and determines the distance to the component surface from the measured Debye-Scherrer ring and is therefore uncomplicated and quick to set up.

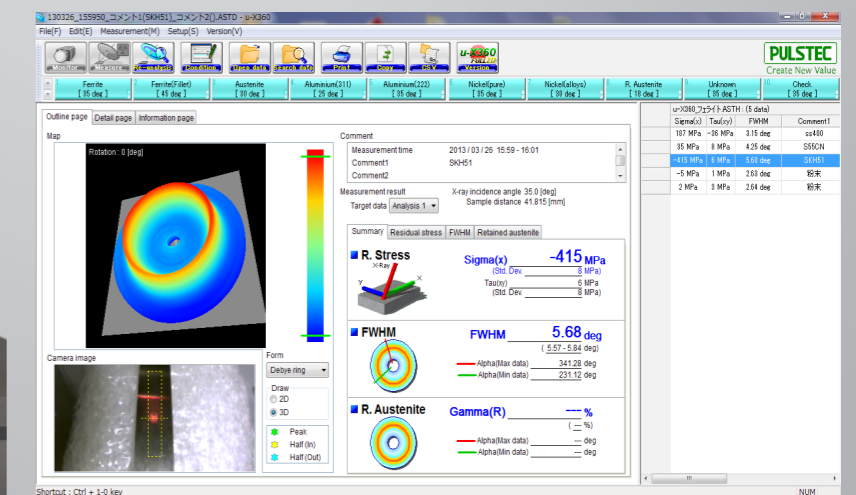
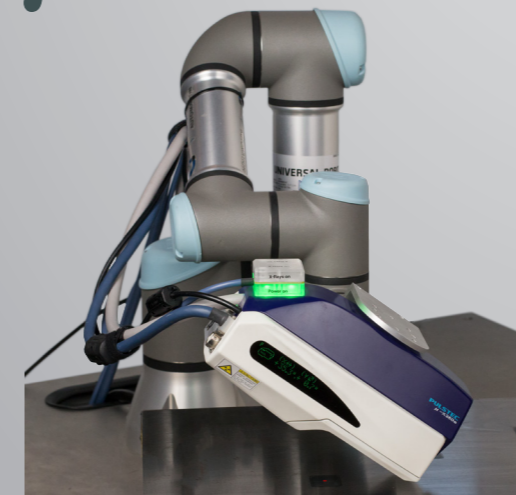
The innovative and precise μ-X360s has a number of special features:

- The low electrical tube power of 30 kV at 1.5 mA with air cooling results in low radiation emissions.
- The extremely compact and lightweight design allows flexible and mobile use in laboratories or in the field.
- The short measuring time of usually only 45 seconds on ferritic samples enables
 - serial measurements in production lines and production environments as well as
 - efficient mapping of residual stresses.
- The sensor technology and the system design without goniometer enable
 - easy, user-friendly measurement without positioning errors and
 - improved accessibility for measurements at narrow measuring points.

Pulstec μ-X360s - Residual Stress Determination According to the Cos-Alpha Method
Short measurement times and simple operation enable new applications of residual stress and retained austenite determination.



micro μ-X360s



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Pulstec μ-360s – Simplicity at its Best

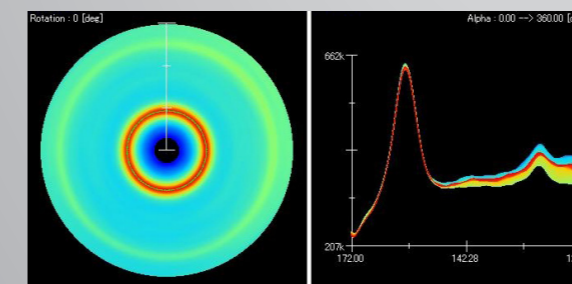
Since the samples do not have to be moved or tilted during the measurement, time and effort for sample preparation can be significantly reduced. The new μ-X360s X-ray stress analyser allows easy collimator and tube change by the user himself. The system is adjusted using a single powder sample suitable for the tube material, regardless of the sample material being examined.

The available X-ray tubes cover a wide range of materials. The following X-ray tubes are optionally available:

Sample material / Anode material of the X-ray tube	Cr	Cu	Co	Mn	V
Ferrite	X		X		X
Austenite	X			X	X
Aluminium	X		X		
Tungsten/Tungsten carbide					X
Silicon carbide					X
Nickel/Nickel-based alloys	X	X		X	
Cobalt-Chromium alloys	X			X	
Titanium					X
Chromium			X		
Copper				X	X
Copper alloys		X			
Neodymium	X				
Zirconium	X				
Magnesium alloys			X		

Pulstec μ-X360s - Mobile, Fast and User-Friendly
Automatic residual stress determination in the age of Industry 4.0 with uncomplicated integration into production environments.

Optional:
Retained austenite



R. Austenite **Gamma(R)** **18.2 %**
(15.8 - 22.3 %)
— Alpha(Max data) **335.52 deg**
— Alpha(Min data) **98.64 deg**

Optional:
X-ray tubes exchange



Available types:
Cr, Cu, Co, Mn, V

Additional Equipment

A wide range of accessories is available to enable the μ-X360s to perform a variety of measurement tasks efficiently and safely:

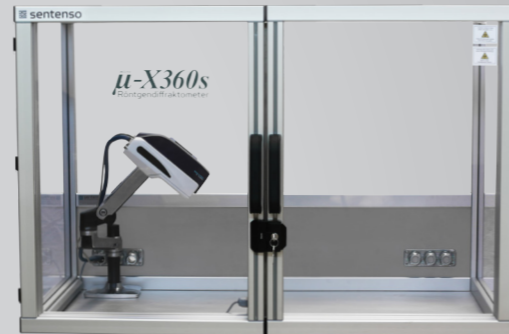
Tripod and flexible support arm

Mobile measurements require a secure and flexible stand. A flexible support arm can be mounted on the high-quality tripod to allow the greatest possible freedom of movement during mobile measurements.



Radiation protection cabinet

Measurements in laboratory environments and with robots require increased safety, which is achieved with the generous spaced radiation protection cabinet. The 5 mm thick PVC panes effectively shield the scattered radiation and at the same time allow a good view of the X-ray stress analyser during the measurement. The large access door is equipped with a safety switch. The cabinet is also optionally available with an underbuilt rolling rack that can accommodate a robot control in addition to the high-voltage source.



Electropolishing set

When determining residual stress, the X-rays penetrate only a few micrometres into the component surface. However, in order to evaluate the stress state of a component, for example with regard to its fatigue strength, the depth profile of the residual stress is crucial. The electropolishing set offers the necessary equipment to electrochemically remove near-surface layers on the component gently and without influencing the mechanical stress.

Service and maintenance

To ensure the long-term reliable function of the X-ray stress analyser, regular maintenance of the equipment is advisable. The optionally available maintenance contract with annual inspection of the X-ray stress analyser as well as all other components and accessories maintains the value of the measuring equipment and offers the following benefits:

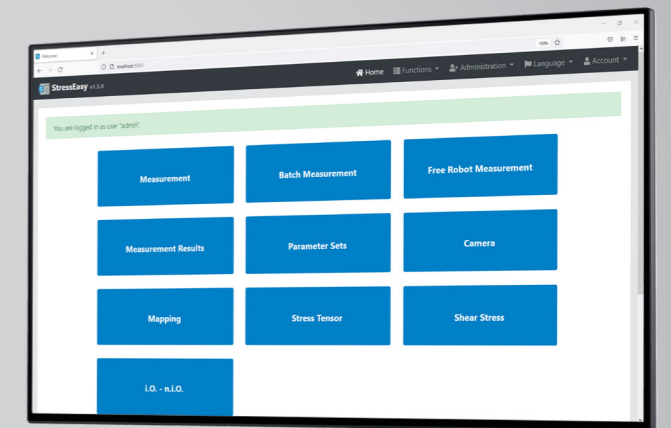
- Early detection of malfunctions and damage, minor repairs on site
- Calibration of residual stress determination with calibration samples
- Installation of software updates and checking of programme functions
- Hints for using the equipment and tips for measuring practice

StressEasy

The field-proven software extension StressEasy opens up far-reaching possibilities for measurement automation to the user. While the standard software supplied with the unit only controls individual measurements and manages their results, StressEasy, in addition to integrating a robot to move the sensor unit, enables the parameterisation and combination of individual measurements into an overall picture. It can be operated in any common web browser and can also be controlled remotely.

In particular, StressEasy enables the automation of the following measurement tasks:

- Complete stress tensor
- Non-planar stress conditions
- Residual stress mappings
- Batch measurements
- ok / not ok measurements
- Oscillation (linear, circular, psi angle)

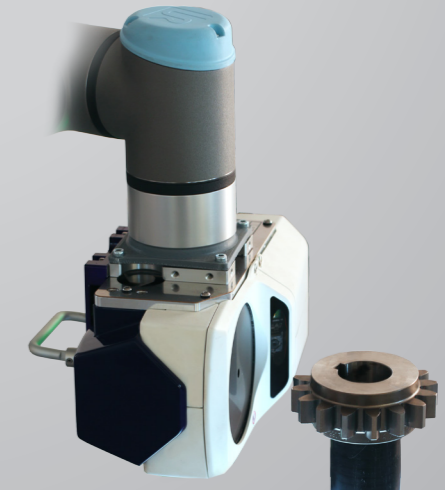


Six-axis robot

The use of a robot enables the movement of the sensor unit of the X-ray stress analyser for the automated execution of the measuring tasks mentioned above. Depending on the requirements, different robot models can be used. A collaborating robot, for example, allows simplified handling. For increased precision requirements, robots with increased positioning and repeat accuracy can be used.



Application with KUKA KR4 R600



Application with Universal Robots UR3e



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