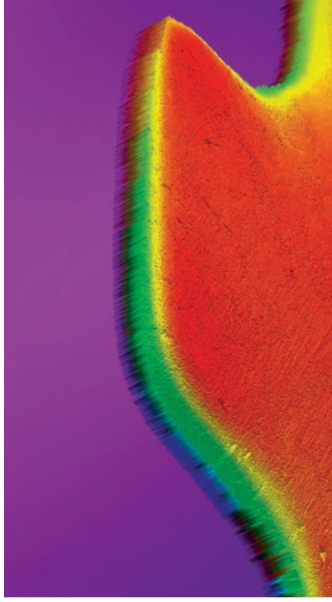
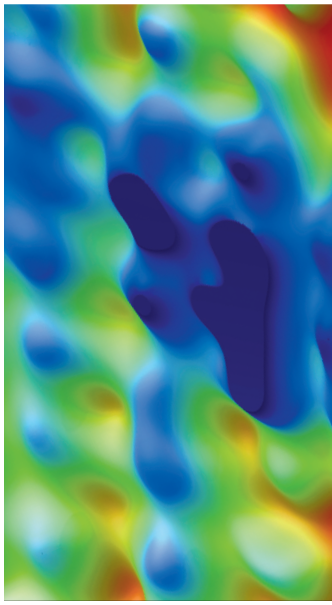




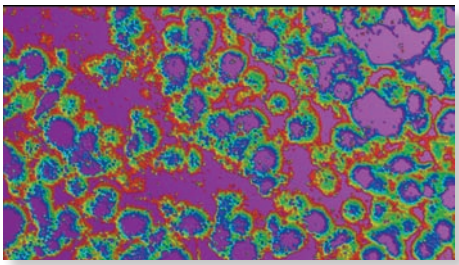
NP*FLEX* 3D Surface Metrology System

for Large-Sample, Non-Contact Measurement & Analysis

- Characterize Large Shapes and Critical Angles
  — *Measurement Flexibility*
- Collect High-Density, 3D Areal Information
  — *Definitive Results*
- Measure with Nanometer Resolution
  — *Revealed Detail*
- Perform Rapid Repeatable Data Acquisition
  — *High Throughput and Efficiency*

BRUKER

think forward



Pitted coating of aerospace turbine blade.

NP*FLEX*

Delivering New Perspective to Precision Manufacturing

Bruker's NP*FLEX*™ 3D Surface Metrology System brings unprecedented measurement capability and performance to precision manufacturing industries, enabling faster ramp-up times, improved product quality, and increased productivity. Based on white light interferometry, this non-contact system offers many benefits beyond such traditional contact measurement technologies as coordinate measuring machines (CMMs) and industrial stylus profilers. These benefits include three-dimensional (3D) images, rapid data-rich acquisition, and greater insight into part performance and functionality. The culmination of decades of expertise in interferometric technology and large-sample instrument design, the NP*FLEX* is the first optical metrology system to handle micro to macro features effortlessly on samples of widely varying sizes.

MEASUREMENT FLEXIBILITY TO CHARACTERIZE UNIQUE SHAPES AND ANGLES

- Innovative design accommodates samples of widely varied size and shape, up to 13-inches tall
- Open gantry, custom fixturing, and optional swivel head reveal previously inaccessible areas of interest

DEFINITIVE RESULTS FROM HIGH-DENSITY, 3D AREAL INFORMATION

- Each measurement contains complete surface information for multiple analyses
- More data leads to better decisions

REVEALED DETAIL AT NANOMETER RESOLUTION

- Interferometry provides sub-nanometer vertical resolution at every pixel
- Industry-proven technology ensures statistical certainty to achieve tighter tolerances

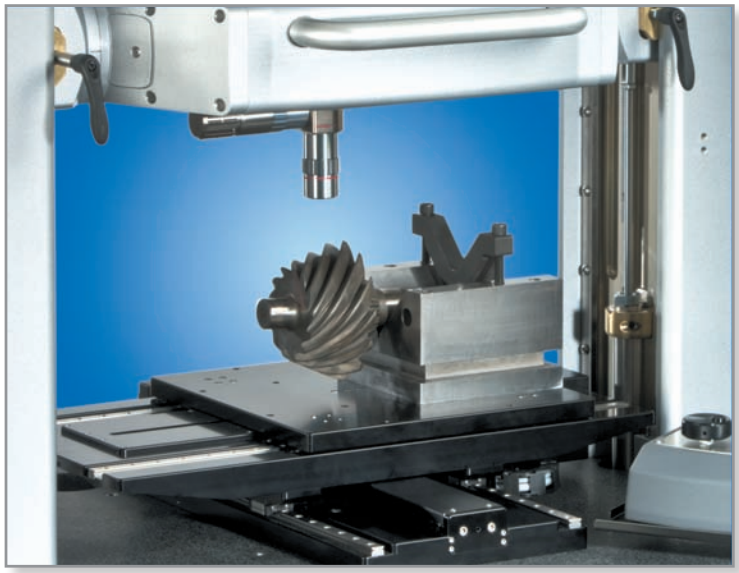
THROUGHPUT AND EFFICIENCY GAINS THROUGH RAPID DATA ACQUISITION

- Minimal sample preparation and measurement setup reduces time to result
- Large field of view characterizes more information about surfaces than contact measurement techniques

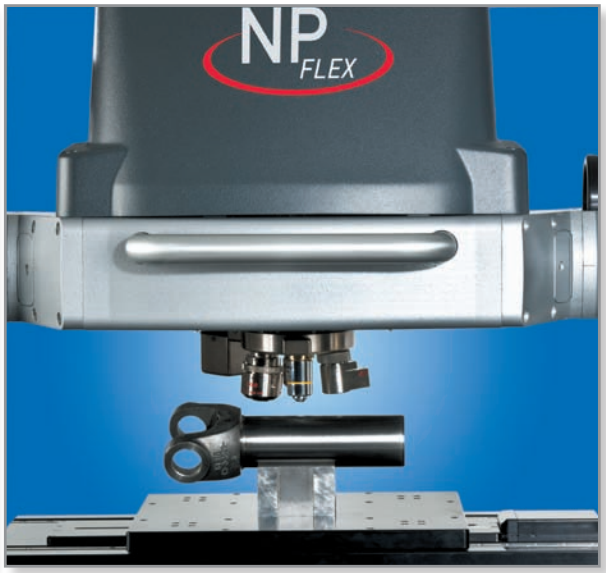
FLEXIBLE CHARACTERIZATION OF MANY SAMPLE TYPES

Often, manufacturers have had to settle for the time-intensive and wasteful process of destructively dissecting products to measure specific surfaces of interest. The NP*FLEX* has been designed to investigate widely varying sample sizes and shapes. With 13-inches of space below the super long working distance objectives, there is ample room for all types of fixtures and mounts. A low-profile stage offers the most active working space of any automated interferometer on the market, and if more room is needed for extremely tall samples, such as an entire engine block, the stage can be removed with ease.

The open-gantry bridge design of the NP*FLEX* also provides full access from both the front and back. The open architecture works hand-in-hand with Veeco's patented tip/tilt feature in the optical head, which maintains the ideal numerical aperture angle with longer working distances. This makes the NP*FLEX* adept at imaging in deep trenches, high-aspect ratio holes, or analyzing samples with high topographic relief.



NP*FLEX* with 34mm working distance objective imaging hypoid pinion gear.



NP*FLEX* with objective turret measuring wear on yoke.

ROBUST, PRODUCTION-FLOOR DEPENDABILITY

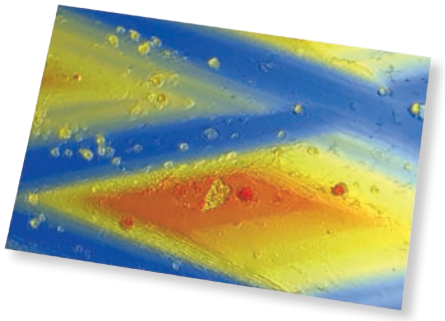
The NP*FLEX* is designed with the rigors of industry in mind. The granite base enables the system to handle up to 170 pounds. The bridge gantry design is resistant to interference levels commonly found on manufacturing floors, and the integrated air table offers repeatable results in a smaller footprint. An objective crash-mitigation system protects the objectives and sample from contact in any direction. The NP*FLEX* provides the ultimate flexibility of sample size, access, and environment usage, allowing precision manufacturers to concentrate on the implications of their data rather than how they acquire the information.

CUSTOMIZED SOLUTIONS

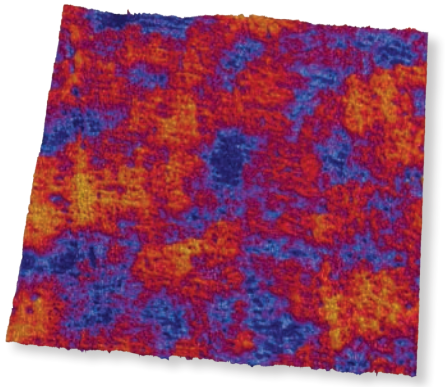
The NPFLEX is available with a number of options that can further customize its operation to specific application needs:

- *An optional swiveling head design permits repetitive investigation of sidewalls, beveled edges, and angled surfaces.*
- *The R&D Award-winning Through Transmissive Media (TTM) Module, combined with an environmental chamber, allows in-situ investigation, such as heating and cooling experiments, through dispersive materials up to 5 millimeters thick.*
- *Optional fold-mirror optics offer analysis down bores and along sidewalls of bowl-shapes.*

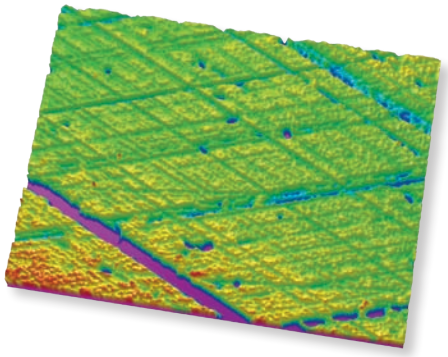
Metrology



Milled surface finish with burrs and native defects.



Mean summit curvature (Ssc) of clutch pressure plate, measured at 159.7/mm.



Cross-hatch honed engine bore with embedded residuals.

3D AREAL INFORMATION AT NANOMETER RESOLUTION

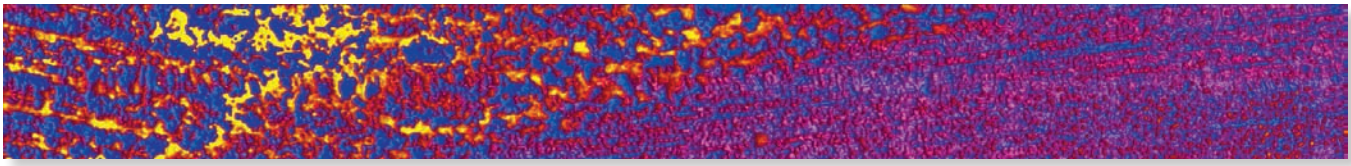
Once surfaces of interest are located, enough quantitative data needs to be acquired to make decisions with low uncertainty. Many large sample applications in the aerospace, automotive, and medical implant industries have been analyzed only with 2D contact metrology tools, which are limited to single lines of data. The two-dimensional scans reveal the sample profile, but do not deliver enough information to understand the complete details of the sample's surface texture.

The NP*FLEX* system utilizes white light interferometry to collect 3D areal information with sub-nanometer vertical resolution at every pixel. The data collected is not limited by the final size of a probe. The 3D rendering and large field-of-view datasets instantly tell a complete story with certainty. The datasets also permit many analyses, including click-button reporting on the full set of S-parameters, to provide information beyond mere surface roughness.

RAPID DATA ACQUISITION FOR BETTER THROUGHPUT AND EFFICIENCY

The NP*FLEX* 3D Metrology System delivers all this flexibility and high-density data without sacrificing throughput. The minimal sample preparation and measurement setup time required enables manufacturers to switch out parts quickly, or perform measurements on multiple surfaces without intimate knowledge of the part's shape. Single point-and-shoot analysis gives you meaningful data in less than 15 seconds.

Automated focus finder, intensity move-on, and other software features save precious seconds when activated, allowing an operator to tailor the analysis routines to specific needs without compromising data accuracy. The NP*FLEX* delivers flexibility, accuracy, and rapid time to results for high-precision manufacturing of large parts, providing a one-stop metrology solution to tighter tolerances and better end products.



Worn surface of hypoid pinion gear tooth. Stitched 22mm image along gear tooth shows worn area of contact patch (right of image). The lost volume of the worn area provides quantifiable characterization of the gear's treated surface.

ONE METROLOGY SOLUTION FROM CONCEPT THROUGH PRODUCTION

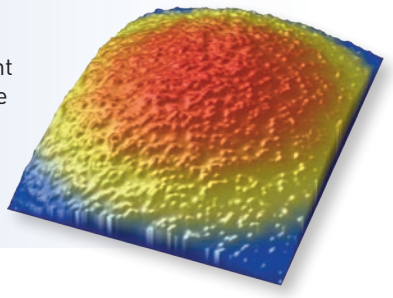
In the daily challenge of understanding and controlling manufacturing processes, more companies are gauging product quality by surface texture. The characteristics of the surface finish often determine a product's performance, lifetime, and likelihood of failure. The NP*FLEX* 3D Metrology System provides a single solution to surface measurement requirements over the entire lifecycle of a product, from initial design through post-production troubleshooting.

Research and Development

In R&D labs, great flexibility is required in both the ability to measure different aspects of a sample and the range of data analyses that can be performed. The white light interferometric technique of the NP*FLEX* provides a 3D, non-contact means of measuring virtually any surface feature, while providing accessibility to areas of an object that simply can't be reached with a touch probe or other profilometer.

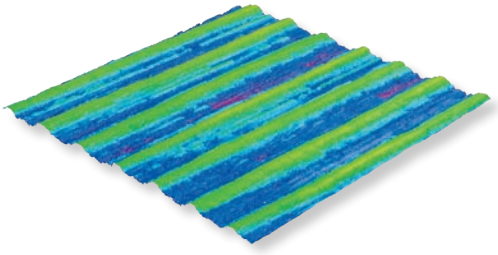
Implant R&D

Successful medical orthopedic implants must meet stringent requirements to ensure biological compatibility and corrosion/wear resistance. Through white light interferometric analyses of hip joints, manufacturers are able to identify a surface conditioning process that strikes a delicate balance between being rough enough to allow bonding to surrounding tissues (~2µm roughness), yet smooth enough to wear well (~200nm). The net savings and increased patient comfort from this analysis is incalculable.



Production Process Control and Manufacturing Quality

Precision manufacturing requires gauge R&R-capable metrology tools that provide rapid, quantitative data for reliable day-to-day statistical process control to ensure part quality and performance. The NP*FLEX* offers faster throughput, drastically reduced uncertainty, and tighter tolerance control than competing technologies.



Commercial Aerospace Quality Control

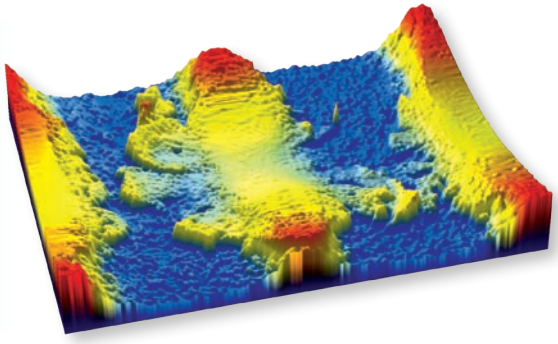
In the aerospace industry, it is necessary to inspect precision machined airplane skins for surface undulations, tears, laps, and burrs that can adversely affect aerodynamics. Open sample access, a large field of view, and the ability to analyze micro-texture surface parameters beyond just average roughness leads to crucial adjustments in the machining process that increase product yield and lower costs by a substantial factor.

Failure Analysis

The investigation of component failures is a crucial factor in improving part manufacturing. The combination of nanometer resolution with the ability to run multiple analyses from a single scan enables manufacturers to acquire a non-contact, 3D dataset of a faulty area. Seeing the entire picture, across a number of different parameters, quickly provides a full story of how the part failed.

Sensor Wear

White light interferometry plays an important role in evaluating prototype sensors for auto manufacturers' quality testing. Comparing wear data from laboratory prototypes with that of actual-use, high-mileage sensors can isolate and help predict causes of failure. Understanding the wear mechanisms often negates the need to redesign a part, leading to significant cost savings.



ULTIMATE MEASUREMENT FLEXIBILITY, PRECISION, AND SAMPLE ACCESS

The NP*FLEX* features non-contact techniques, open-access sample loading, and intuitive analysis software to characterize surface texture, finish, roughness, curvature, slope, and numerous other characteristics with angstrom-level accuracy. The system offers the most comprehensive metrology platform available for the surface characterization of large, precision machined samples.

SPECIFICATIONS

Measurement Capability	Non-contact, three-dimensional, surface roughness, critical dimension, film thickness, tribology
Objectives	Super long working distance objectives: 2X, 5X, 10X, with crash mitigation assembly; Standard working distance objectives: 1.5X, 2.5X, 5X, 10X, 20X, 50X, 100X; Optional through transmissive media objective kits; Optional four-position turret
Field of View Multipliers	0.55X, 0.75X, 1X, 1.5X, 2X; Auto-sensing motorized selector, discreet zoom
Measurement Array	Maximum array 640 × 480, high-speed, non-interlaced
Light Source	Long-lifetime green and white LEDs
Measurable Sample Dim.	H = 350mm (249mm with automated stage); D = 304mm; W = 304mm
Stage Weight Load Capacity	Up to 50kg (110lbs)
Air Table Weight Load Capacity	77kg (170lbs)
Optical Assembly	Integrated computer-controlled illuminator; Closed-loop precision vertical scanner
Computer System	Latest Dell® PC w/flat panel monitor, mounted on Ergotron® mobile workstation; Production mode, built-in databasing with pass/fail for any parameter; Optional HDVSI, MATLAB®/TCPIP, Film Analysis, Optical Analysis and SureVision
Vertical Resolution[1]	<0.15nm
RMS Repeatability[2]	0.03nm
Step Height	0.5% accuracy; <0.12% at 1σ repeatability
Lateral Spatial Sampling	0.1 to 13.2µm
Optical Resolution[3]	0.49µm min.
Field-of-View	7.68 × 5.76mm max, 0.06 × 0.05mm min.
Footprint	172cm H x 77cm D x 81cm W (67.6in. H x 30.4in. D x 32in. W)
Certification	CE, NRTL, T-Mark, ROHS compliant, ANSI B46.1 compliant

[1]As demonstrated by a PSI difference measurement on a SiC reference mirror with nulled fringes and 10 averages.
[2]As demonstrated by taking the one sigma Rq value of 30 PSI repeatability measurements on a SiC reference mirror.
[3]Based on Sparrow Criteria at 535nm.
Note: Specifications are subject to change without notice. Visit the Bruker website for most up-to-date specifications.

Top cover image: Stitched 3D image of clutch plate.
Bottom cover image: Stitched 3D image of camshaft chatter.

WORLDWIDE CUSTOMER SUPPORT FROM THE INDUSTRY LEADER

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