Polytec

Industrial Surface Measurement

Field of Application

- VIB
  Vibration Measurement by Laser Doppler Vibrometry
- LSV
  Speed and Length Measurement by Laser Surface Velocimetry
- **TOP**
  Surface Topography Measurements by White-Light Interferometry

Surface Measurement in Production Environments

Surface properties, such as roughness, are important parameters for quality assurance. Traditional contact measurement processes (i.e. surface profilometers) can make the surface measurements but take a long time, making them incompatible with the rapid feedback needed for high throughput production control. In addition, because of the contact, there is the risk of damage to the surface of the item being tested. Polytec's TopMap white-light interferometer is a state-of-the-art non-contact surface measurement system and an ideal tool to determine smoothness, height differences and parallelism of large surfaces and structures, including soft materials.

Measurement Principle

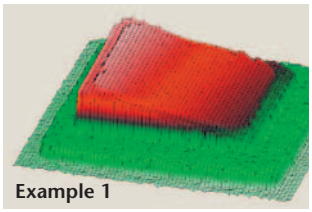
The TopMap sensor head is a Michelson interferometer in which the test piece is measured against a coplanar, flat reference mirror. Constructed with telecentric optics, the instrument can measure large surfaces quickly. In contrast, competing systems have smaller field-of-views and require that several images are stitched together to cover the same large surface, a process prone to errors. After setting the measurement parameters, the measurement process runs automatically, the topography of the sample is shown in 2-D or 3-D on the screen of the PC and can be analyzed manually or automatically. The results can be transferred in binary format or as ASCII code. This enables a direct data import and export to EXCEL, MATLAB® or in-house databases.

Advantages for Quality Assurance in Laboratory and Manufacturing

High throughput quality control is easily realized using TopMap white-light interferometers. The measurement itself is quick and fully automated, as are the analysis, savings and transfer of the results to the process control software. Further throughput advantages come with macro programming in Visual Basic® or by hiding areas of the image which are not relevant with the aid of masks. Significant contrast differences can make surfaces difficult to measure; however, Overlay Technology developed by Polytec can help compensate for these differences and produce excellent measurements.

Polytec GmbH
Optical Measurement Systems
Application Note
TOP-02

April 2006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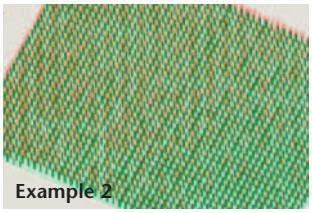
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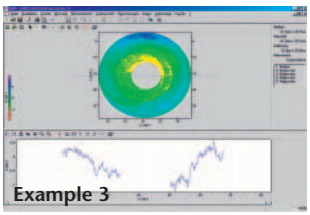
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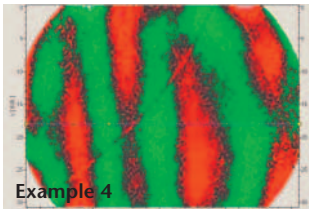
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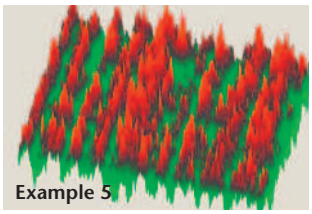
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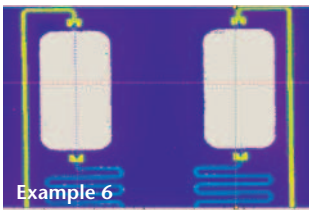
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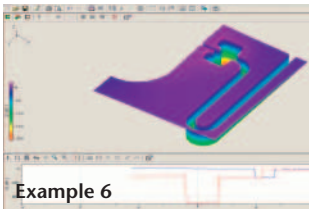
Example 6

Applications

Surface measurements are needed in many industries. Components and structures ranging from submillimeter to centimeter size can be found in the semiconductor and data storage industries (see Polytec Application Note TOP-01), in micro structures and sensors, and in engineering and automotive applications. A few examples follow.

Example 1: Laser Chip

Tilt and bending are important parameters for semiconductor laser chips. These topographical and geometric specifications must be precisely met.

Example 2: Solder Bumps

In the case of SMD printed circuit boards the height of the solder bumps is of great importance. These bumps must be measured quickly across a large surface area right after creation and before assembly, without any cooling off time.

Example 3: Piezo Actuator

Flatness deviations were measured on the annular surface of a piezo component. The results are displayed as color plot and cross section.

Example 4: Film for LCD Monitors

Faults (scratches) and ripples (±100 nm) are measured on this 2 mm thick transparent film for LCD monitors. The results are shown as a color plot.

Example 5: Steel Structures

A fine structure was generated through processing and can be measured with the white-light interferometer on a highly polished steel surface.

Example 6: Lab-on-a-Chip

Lab-on-a-chip systems perform sophisticated analysis in a few square centimeters that only a few years ago had to be performed by technicians in an analytic lab. Applications for these chips in molecular biology (bio-chips) are abundant with new applications in medicine, the food industry and environmental analysis on the horizon.

The diagnostic chips are made of a transparent plastic in which channels and chambers have been cut to a precision pattern. The channels draw the sample into the chip where the biochemical reactions take place. Producing many chips with sufficient quality is essential to reducing costs and rapid adoption of the technology. Whitelight interferometery can monitor the quality of the system topography as shown in the images.

For more information about surface metrology by Polytec please contact your local Polytec sales/application engineer or visit our web page **www.topmap.info**

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