HEADLINE

the art of metrology™

Current Information for our Customers and Partners / Spring 2010 Edition

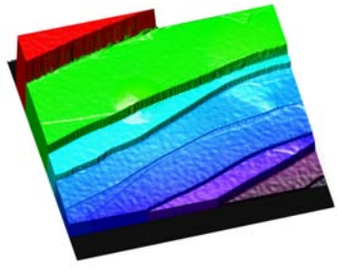
MicroSpy® Topo DT - New 3D-Microscope with Confocal and Interferometric Technology

The new FRT MicroSpy® Topo DT is an innovative dual technology 3D-microscope that offers measuring modes for different surfaces from very smooth to rough. Its versatility is due to the combination of confocal and interferometric technologies including whitelight- and phase-shift-interferometry. All measuring modes operate in a non-contact, areal, high-resolution way and deliver reliable results within seconds.

Phase-shift-interferometry for high-resolution measurements on smooth, large surface-areas

The strength of the interferometric phase-shift-mode lies in its ability to conduct measurements on large surface-areas with minimal surface structuring at sub-nanometer height resolution. The maximum vertical resolution is independent from the size of the field-of-view and the aperture of the objective in use.

This method is capable of capturing an area of up to 7.1 mm x 5.3 mm in less than 10 seconds by stepwise movement of the objective in an axial direction at the amount of a fraction of the wavelength of light. This generates multiple interference patterns that are mathematically transformed into a 3D-topography which can be used to perform highly precise analyses of geometry, roughness, volume, and other features.



HOPG-Structure (Highly Oriented Pyrolytic Graphite), 3D-topography measured with 100x objective and MicroSpy® Topo DT.

Whitelight-interferometry for roughly structured surfaces

In whitelight-interferometry, the objective is moved in the same way as it is done in the phase-shift mode. The measurement results however are calculated from the maximum interference contrast aquired at multiple focal planes. In comparison to phase-shift-interferometry, this method is better suited for roughly structured surfaces, while retaining all the advantages of interferometric measurements, such as the independence of the field-of-view from vertical resolution, non-contact measurements and fast measuring speed.

A wide selection of objectives has enabled more versatility in confocal microscopy

The versatility of the confocal mode is supported by the wide range of available high-class objectives that were orginally developed for light microscopy. This enables the user to choose the perfect objective according to the application. An example is the measurement of a specimen that requires large working distances. For this application, FRT offers specialized long-distance objectives which can be inserted into the 6-lens revolvable turret that allows instant objective-changes by simply turning the designated objective into position.

Contents

Dear Business Partners:

in the current edition of our customer magazine HEADLINE we move the new optical 3D-microscope MicroSpy® Topo DT into the spotlight. „DT“ means „Dual Technology“ and indicates the confocal and interferometric measuring modes of the system. We are confident that this new and powerful metrology tool will be a great addition especially for users who need more than confocal microscopy, which is usually the case when working with very smooth surfaces.

Beside the launch of our new product, we have also developed new metrology solutions. One solution that is featured in this edition of HEADLINE, is the ability to quickly measure micron-sized cavities with high-aspect-ratio. This is a common measuring task in the semiconductor and MEMS industry when it comes to the TSV (Trough Silicon Vias) process in 3D-Chip-Stacking. Read about all this and more in the current issue of the HEADLINE!

Many Regards,
Thomas Fries, CEO

Short interview about film thickness measurements with Dr. Michael Quinten, Technical Coordinator at FRT

Dr. Michael Quinten, Technical Coordinator and expert in film thickness measurements at FRT, describes the current state of development in this field.

Dr. Quinten, research and development in the field of thin films and coatings is an integral part in growth industries such as photovoltaics and microelectronics. Also, medical device, glas and illumination manufacturers have been making more use of them recently. Can you describe to us the relevance of films and coatings for FRT as a manufacturer of surface metrology equipment?

Dr. Quinten: Driven by customer requests, thin film measurements have become quite relevant for FRT. In the past few years, we extended our multisensor platform with film thickness sensors because we recognized that more and more users needed to inspect a greater set of metrology parameters with their tools. Beside parameters derived from surface structure such as roughness, step height, form and others, our users inquire about metrology solutions that allow the exact investigation of thin films and coatings in a non-contact way. Today, FRT offers multisensor metrology solutions as well as budget-friendly single-sensor tools like the MicroSpy FT for film thickness measurements.

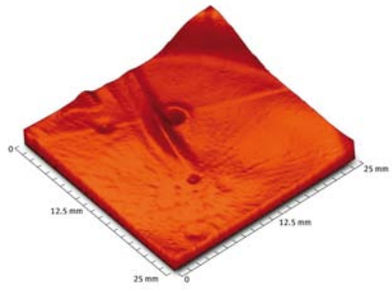
Could you tell us more about the different types of films and how they can be measured?

Dr. Quinten: We differentiate films and coatings into opaque and transparent ones. While the thickness of opaque films can be determined by step height measurements using an optical point sensor, transparent films are usually measured with a spectrometer. Film thickness ranges from a few millimeters to just a few nanometers. The latter ones are referred to as thin films, which are especially important in the photovoltaics industry right now. However, thin films can also be found in products that share a similar manufacturing process, such as TFT and OLED displays. Thicker films on the other hand are often applied in microelectronis and MEMS production, on wafers, as transparent substrates or adhesive coatings. They range from several 100 µm to a few mm in thickness.

Dr. Michael Quinten, Technical Coordinator and expert for film thickness measurements at FRT.

Can you name some typical measuring examples for film thickness investigation?

Dr. Quinten: A typical measuring task is the thickness determination of coatings like top coatings, conductive coatings or antireflective coatings. But we also measure the thickness of buried layers in so called film stacks quite often. Beside punctual thickness measurements, especially film thickness mappings of entire surface areas with 3D-visualization of the film are of interest. Our customers appreciate this way of visualization because it allows them to evaluate the uniform consistency and film distribution on their substrates.



3D film thickness mapping of SU8 resist

Where do you see the greatest challenges with regard to film thickness measurements in the near future?

A constant challenge is to identify new technological trends in all of our target markets. We put great effort into researching optical film and substrate properties and different kinds of film stacks. Another aspect comes from the technical side. Film stacks become more complex which demands new measuring approaches. With FRT's range of different film thickness sensors, that can be solved. The third challenge is in measurement and part handling automation for inline applications. Customers require fast measurement solutions on the one hand and options for seamless process integration on the other.

Short News +++ Short News +++ Short News +++ Short News +++ Short

FRT opens sales office in Taiwan

The new sales office Taipei, Taiwan is the second in Asia and serves the further expansion of FRT's sales and service network. Responsible is Sean Green, sales manager for the Asian region.

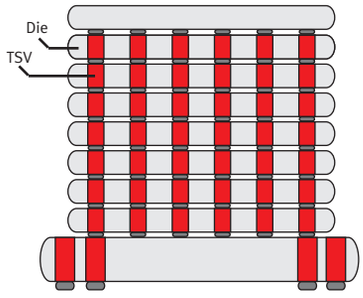
FRT participates in research projects

In 2010 FRT will continue its efforts in R&D. Together with industry and research institutions, FRT participates in five projects that aim at the development of innovative measuring solutions in the fields of sustainable energy production and microelectronics.

New Wafer Metrology Solution:
High-Aspect Ratio TSV-Measurement for 3D-Chip-Stack Production

3D-chip-stacking, a technology that allows further vertical circuit integration, is one of the hottest topics for manufacturers of microelectronic devices today. A common technique to connect or bond the different layers of a 3D-chip-stack are referred to as TSV (Through Silicon Via) interconnects. FRT now offers a unique metrology solution for measuring TSV in both stand-alone and multisensor metrology configurations for the lab as well as live production.

3D-chip-stacking can currently be implemented through various integration schemes such as “package on package“ approaches or stacked and wire-bonded die-packages. The most sophisticated technique however is TSV, where the individual die in a stack is interconnected through vias.

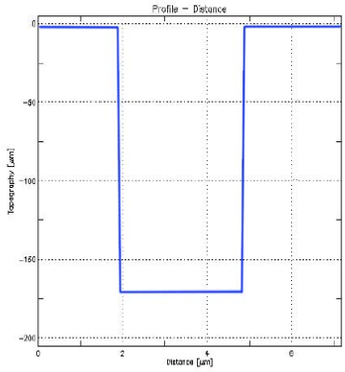


3D-Chip-Stack consisting of multiple die that are bonded through TSV technology.

TSV offers several advantages over other bonding technologies including smaller ic-form-factors and higher circuit densities. Also, due to shorter interconnections, the signals move faster and energy consumtion of the final chip is reduced. Another aspect that is especially interesting for MEMS manufacturers is the ability to create heterogenous chip structures made up of mechanical and electronic components that are necessary for the production of miniaturized MEMS-sensors.

The TSV Process

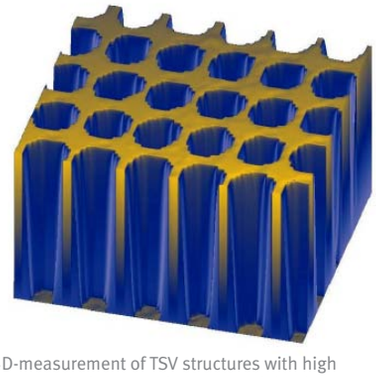
At the beginning of TSV creation, the wafers were run through a process of lithography and etching to create cavity-like structures. The diameter and depth of these structures are in the range of a few microns. During the next steps, called wafer-thinning, the cavities are transformed to the vias by backgrinding excess silicon of the wafer.



2D-measurement of a single TSV with a width of 3 µm and a depth of 170 µm.

The next step is called bonding. Here, multiple die are stacked and their vias are filled with a conductive material such as copper. To assure error-free TSV filling (and thus error-free bonding), continous control of uniformity during via creation is essential. A past challenge was to reliably measure via-structures because they reached deep into the silicon while having relatively small diameters (high-aspect-ratio).

FRT now offers a TSV wafer metrology solution that allows the automated and fast measurement of such TSV structures with high aspect-ratios of 1:30 or even better.



3D-measurement of TSV structures with high aspect-ratio between diameter and depth.

The measurement is conducted with a new non-contact, areal, interferometric, optical sensor that not only offers superior performance with regard to resolution and angular acceptance but also to measurement speed.

The measurement results can be used to determine and monitor etching parameters during TSV creation at the wafer level. Deviations from the standard process can be quickly identified, analyzed and corrected with the new solution.

Unique is the ability to integrate the new solution into FRT‘s multisensor metrology systems that combine multiple sensor technologies like optical profile and film-thickness sensors, confocal and atomic force microscopes and white light interferometers in one universal tool.

FRT‘s multisensor wafer metrology tools measure and evaluate surface parameters according to industry standards and customer specifictions based on roughness, contour, film thickness, planarity, volume, bow, SEMI-compliant TTV (total thickness variation of wafers) and much more.

The systems are available with different automation levels from manually operated tools to fully automated systems like the MicroProf® MFE series.

The MicroProf® MFE (Metrology for Frontend) tools can be equipped with class 1 cleanroom housing, automated wafer handling and alignment as well as software interconnectivity to fab production control systems over the SECS/GEM standard.

Additional Information

Internet
www.frt-gmbh.com
www.wafer-metrology.com

Spring News 2010

From the practice for the practice: FoRT-Bildung, the Metrology Seminar

As every year in the spring, we invite our customers, partners and interested parties to join us for the FoRT-Bildung. It is a seminar to introduce you to the topography and roughness terms and the main measurement methods with explanations of manufacturer neutral applications. By using concrete examples, the definitions and significance of the most relevant surface parameters are explained.

Addressed to surface metrology users, developers and quality engineers, this year's event will take place **May 19th 2010** at the company headquarters in Bergisch Gladbach.

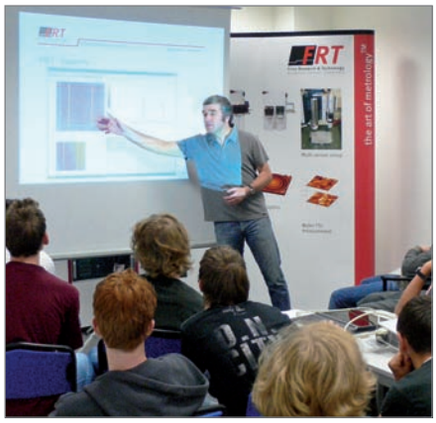
From the contents:

Significance of the characterisation of surfaces / roughness in technology

Practical examples will demonstrate the importance of surfaces and their characterisation for the respective product.

Measurement techniques for determining topography (part 1)

Various methods for measuring the topography of technical surfaces are presented: (light microscopy, scanning electron microscopy, contacting profiler, confocal measurement methods, interferometry etc.). After an outline of the underlying measuring principles, the possibilities and limitations of different techniques in different areas of application will be presented. In an exercise period the participants will have the opportunity to discuss the pros and cons of the described techniques by using examples from concrete measuring tasks.



Evaluation of surfaces (part 1 and 2)

This course handles the relevant aspects for evaluating the topography of surfaces by selection of measurement area, difference in information content, profile / 3D-measurement and filtering of data. The main parameters (roughness, waviness, etc.) are explained and illustrated with examples.

Based on height histograms and bearing curves, parameters such as core roughness or percentage contact area of material will be discussed. In the final exercise part, participants can get together to deepen the learned contents through practical examples and discuss their new knowledge. The seminar fee includes the lectures, extensive training materials, hot and cold beverages and lunch.

Cost: 750 Euro per person.
For further questions or for your registration, please contact Mrs. Ulrike Pisarski, telephone:
+49 (0) 2204 - 84 2430

Events 2010

- **Innovations in Microsystems 2010**
  03.16.2010 – 03. 17.2010, DE
- **SEMICON China**
  03.16.2010 – 03.18.2010, CN
- **MEDTEC Europe**
  03.23.2010 – 03.25.2010, DE
- **HMI, Hannover Messe**
  04.19.2010 – 04.23.2010, DE
- **CONTROL 2010**
  05.04.2010 – 05.07.2010, DE
- **FoRT-Bildung**
  05.19.2010, DE
- **INTERSOLAR 2010**
  06.09.2010 – 06.11.2010, DE
- **SEMICON West**
  07.13.2010 – 07.15.2010, US
- **SEMICON Europa**
  10.19.2010 – 10.21.2010, DE
- **FoRT-Bildung**
  11.03.2010, DE

Contact Information

FRT GmbH (Headquarters)
Friedrich-Ebert-Straße
D-51429 Bergisch Gladbach,Germany
Tel. +49 (0)2204 - 84 24 30
Fax +49 (0)2204 - 84 24 31

info@frt-gmbh.com
www.frt-gmbh.com

FRT of America (Westcoast Office)
1101 South Winchester Blvd.,Suite L-240
San Jose, CA 95128, USA
Tel. +1 408 - 261 2632
Fax +1 408 - 261 1173
Toll-Free: +1 866-FRT-PROF

info@frtofamerica.com
http://www.frtofamerica.com

Responsible for the content:
Dr. Thomas Fries