Application Note

Fries Research & Technology
Rauheit Kontur Topographie

Measurements of structure, height and warpage on BGAs and solder bumps

Measuring task

A process-related surface measurement defines itself through precise measuring results that can be rapidly and automatically generated. This may be particularly difficult when it comes to obtain a full automatic acquisition of data from several measuring points of a sample, whose exact position is not known.

This is the case for ball grid arrays (BGA) and solder bumps, for structured wafers and finished semiconductor chips.

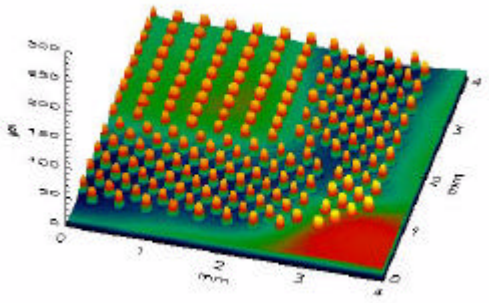


Fig 1: Semiconductor device with ball grid array (BGA)

Challenge:

In the back end part of the semiconductor manufacturing process there are no clean-room conditions, but the degree of automation is as high as in front end. Moreover, there are much more measuring tasks to be resolved. And the various materials with very different reflection behaviour make matters worse.

A rapid and easy-to-operate automation is absolutely essential for such applications. Heights, profiles, volumes, roughness as well as flatness or warpage have to be measured in any order whatever.

Solution:

FRT resolves these measuring tasks with the help of an optical distance sensor with an extremely high z-resolution and a high-precision xy-scan. The system can acquire the complete surface in order to measure waviness and flatness. For the evaluation, the structures (solder bumps) are suppressed allowing the acquisition of the devices distortion, which is of particular importance for the soldering process.

The same measuring system can also acquire topography measurements with high local resolution or profiles with high resolution across the complete surface. The automation works intuitively with the help of graphical symbols

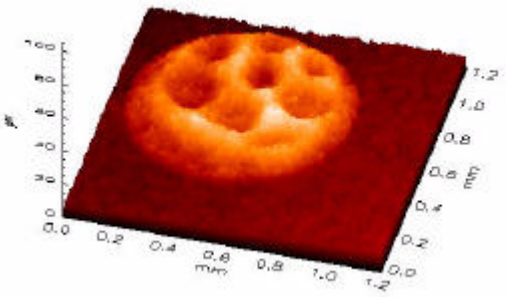


Fig 2: High resolution measurement of a solder bump

The optical sensor allows for fast and precise topography measurements. Surface areas from 200 µm x 200 µm up to 600 mm x 600 mm may be acquired. Thanks to different measuring heads, z-measuring ranges from 300 µm up to 3 mm can be acquired with high measuring rates without having to move the sensor or the sample in the z-direction. The maximum z-resolution is 3 nm. The maximum lateral resolution is 1 to 2 µm.

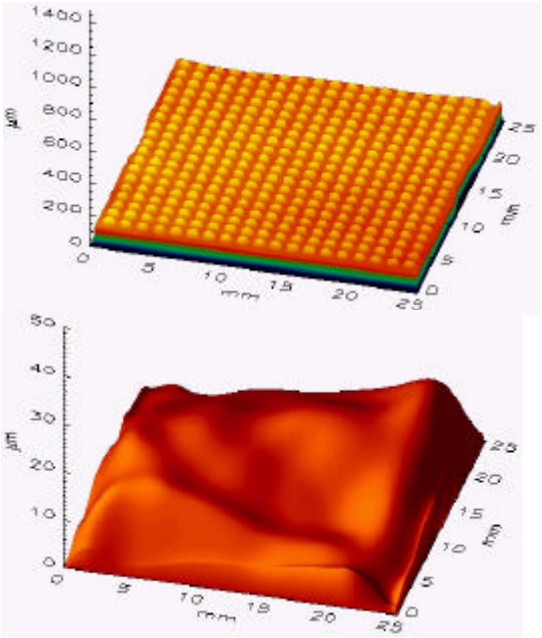


Fig 3: Complete device with solder bumps (above) and warpage of a part (below)

The system is equipped with a camera, which allows an easy positioning and selection of the measuring field.

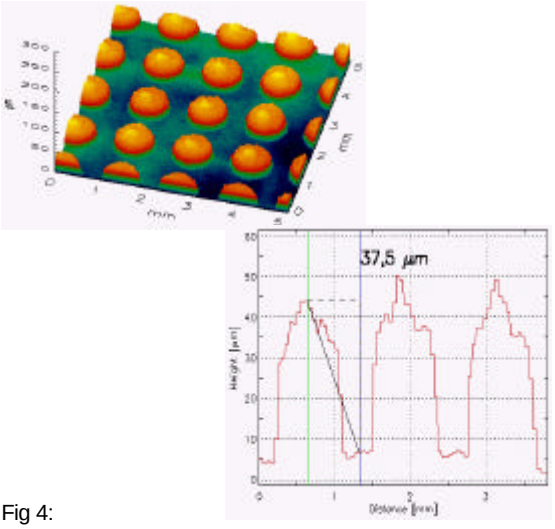


Fig 4:

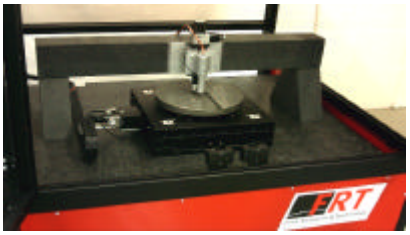
Detail measurement on solder bumps and profile for a precise z-measurement

The following systems can be used for this application:

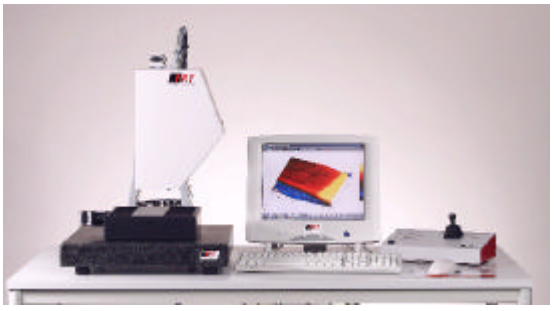
All versions of the MicroSpy®.

All versions of the MicroProf®.

All versions of the MicroGlider®.



Thanks to its high-precision camera with pattern recognition, the MicroProf® Vision allows the automatic detection and alignment of the sample.



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