VISCOM vision technology

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Newsletter

Editorial

Volker Pape

Dr. Martin Heuser

Dear Readers,

3D Inspection, Quality Uplink and FastFlow – these technological developments had a great impact on Viscom in 2013. Three strategic approaches have become clear: 3D technology is taking hold, as predicted. While previously there were mostly hastily designed attempts with limited use, technologically mature solutions for optimal use are now available. Increased output and throughput are – as always – a must. We have taken a huge step here, accomplishing an increase by a factor of 2 to 4, thanks to XM and FastFlow technology in AOI. Process automation and optimization, the third strategic approach, has a name at Viscom: Quality Uplink. This tool markedly increases process quality, stability, and flexibility.

Best regards,

Volker Pape
Executive Board
Viscom AG

Dr. Martin Heuser
Executive Board
Viscom AG

Viscom Technology Forum and User Meeting

Live Presentation of the New S3088 *ultra* 3D AOI

The invitations went out and, on March 19 and 20, the attendees flooded in – it was finally time for the big event, Viscom's Technology Forum and User Meeting. A highlight in the extensive program was a live presentation by Peter Krippner, Head of Assembly Inspection, and Detlef Beer, who is in charge of product development at Viscom. The brand-new 3D AOI system S3088 *ultra* with 3D XM module was introduced. New with the XM module is a high-speed camera technology that makes it possible to achieve shared and completely overlapping fields of view of all cameras. As a result, the number of positions to be moved to is reduced by up to 50 %. Additionally, the upper clearance has also been raised to 50 mm. The enormous boost in the camera's frame rate is also a decisive advantage of the high-performance camera technology. The multiple pictures needed for the 3D evaluation are taken very quickly, which reduces the time for image acquisition. Detlef Beer gave an impressive live demonstration of the 3D measurement with variable fringe projection, which Viscom performs using a projector and four cameras. "The advantage this offers over conventional

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systems with four projectors", says Detlef Beer, "is parallel acquisition of various scenes and, as a result, a data rate (number of images/scenes per unit of time) that is four times as fast. Also unique is the height measurement range of at least 25 mm, with a general inspection free space of 50 mm, with which even high plugs, or tantalum can be reliably measured." "With the new 3D AOI system S3088 *ultra*," he continues, "we've been able to at least double the throughput compared to the S3088 *flex*." Through the high speed with XM, additional illuminations, or further slanted views (inspection depth) as well as color recording remain in complete resolution almost without any effect on throughput. The multicolored illumination enables superior defect contrast and excellent flexibility in the scope of inspection. And that all this is accommodated in the compact housing of the S3088 family won over the audience.

In comparing it to the S3088 *flex*, Peter Krippner again pointed out the central features of the 8M camera technology, with resolution switchable from about 11 to about 23 µm/pixels, which lets it reliably and quickly identify typical types of defects, such as chip tombstoning, QFP with lifted leads, solder bridges, or polarity. Even 01005 BT, or QFPs with 0.4 mm pitch can be reliably inspected. The two AOI systems share the same hardware platform, high-performance linear drive, high-precision grayscale value calibration function and TCM system self-monitoring. What is new – for the S3088 *flex* and the S3088 *ultra* alike – is the FastFlow handling concept. With this feature, Viscom has found a solution for replacing printed circuit boards synchronously and almost without loss of time, and so generating a considerable throughput advantage.

But the event also boasted a number of other fascinating talks and useful workshops for users. This time round, it was physicist Dr. Ulf Merbold who was invited to give the keynote speech. As a NASA astronaut aboard the space shuttle Columbia in 1983, he rose to popularity to become one of Germany's best-known scientists. In his speech entitled "Science in Space", he gave listeners an insight into the wealth of experiences he gained during his time spent on space missions, including some vivid, enthralling accounts of the excitement he got out of starting his work in Houston and everyday life on a space shuttle.

Interesting lecture

The excitement didn't end there, however: There were also talks on the subject of SMT production that proved fascinating – if on a somewhat more down-to-earth subject, quite literally! One of these was a talk by Andreas Lebrecht, Head of Production at Vierling Production GmbH, on the launch of the 01005 component type: This demonstrated that the majority of processes (soldering paste printing, reflow soldering, AOI, verification/repair) have adapted to 01005 production reasonably well. For example, in the case of the S3088-III AOI system it has been possible to achieve this with relative ease by using the HR (High Resolution) function, minor adjustments to inspection algorithms, and integrated verification. It was only the placement process that required more work in switching it over to the new type: Vierling required a new placement machine as well as 160 new feeders for this purpose.

The talk given by Professor Armin Rahn, an expert in connection technology, sought to answer the question "What do we need to consider in the reflow process?". From him, participants learned

about the basics involved in performing the Pin-in-Paste process successfully. This addressed a variety of questions, including: Why P-i-P? What should the design look like? How much solder do I need? What paste printing options are available?

The free workshop for participants at the User Meeting looked at topics such as options for increasing throughput, the next generation of static process control (SPC), and tips for improved inspection with the aid of advanced analysis. Wirebond inspection and X-ray inspection operation were two further areas covered in a workshop.

Get-Together with Men in Blech

Having taken on board so much information on the first day, all the attendees were looking forward to the get-together afterwards, which was held in production building 3. This year, Viscom also enlisted the help of a small local brewery to stock the bar. The buffet and live music that came later provided plenty of opportunities for the attendees and Viscom experts to share their thoughts with one another. As the evening progressed into the late hours, this year's special guests – the Hamburg brass and dance band Men in Blech – set exactly the right mood: An intoxicating mix of rock, jazz, and soul classics as well as waltzes and slick dance interludes set the stage alight and left the audience thrilled. Not only that, but a free shuttle bus service also made sure that all the attendees got back to their hotels safely at the end of the night.

The second day kicked off with a case study by Professor Gerhard Weber from the University of Vienna. The anthropologist accompanied the audience on a virtual tour, to archeological excavations he had participated in and his later scientific findings in the laboratory. This included an account of excavations in the Somalia desert and the search for a 4 million-year-old elephant's tusk – at 40 degrees in the shade. His impressively prepared presentation was aided by computed tomography (CT) visualizations and fantastic animations, whose innovative insights were achieved using CT. For its CT investigations, the University of Vienna uses a custom-made X-ray unit based on the X8060 from Viscom. Its generous sample chamber and special spiral mode featuring outstanding resolution are ideal features for performing non-destructive testing on large and/or long test objects, and have been welcomed enthusiastically by the University of Vienna.

The next talk returned to the subject of SMT production. Titled "Optimizing solder joints – The battle between quality, reliability, and cost", it saw Dr. Heinz Wohlrabe from Dresden University of Technology report on the latest results of tests he had conducted. The process of analyzing and evaluating the reliability of solder joints included measuring results from angled solder joint inspections performed by Viscom AOI systems. On the basis of extensive tests and simulations, Dr. Wohlrabe was able to demonstrate that the alloy, volume, and distribution of solder, the temperature rise and gradients, as well as the geometry, size, and design of components and the pad layout all play significant roles in determining the reliability of solder joints.

Viscom's Dr. Taras Vynnyk focused on the range of 3D measuring technology processes available – a subject that is currently high on the agenda. Using detailed explanations and extensive functional diagrams, he outlined the approaches that today's 3D measuring technology is taking in the context of printed circuit board inspection. He then concluded by comparing all the benefits and drawbacks of the measuring methods so that the audience could gain a sound overview of the shape of the technology today.

It was Hans-Jürgen Funke from NXP Semiconductors – a discrete component manufacturer – who delivered the final talk in the program. As well as presenting detailed information about the company's product portfolio, Funke also reported on some intriguing research he had conducted in conjunction with Viscom. This concentrated on specially developed DFN (Discrete Flat No-Lead) housings, whose solder connections can be inspected using AOI systems. To enable this, they have been extended to include outwardly visible, tin-plated side pads which are wettable. The work also involved in-depth research into and illustrations of the effects that process variables such as a lack or excess of solder paste have. The conclusion was that AOI inspection of DFN components with solderable side pads is a viable option if the correct component types have been used with the right pad layouts, and the AOI system is equipped with angled cameras.

The afternoon saw all of Viscom's system solutions put on display – from its wide range of AOI systems and solutions for X-ray inspection operation, to wire bonding AOI equipment, and all the way through to conformal coating inspection in a demonstration area. Many of the participants took the opportunity to learn more about the performance features of the individual systems from the Viscom experts or discuss specific projects. ■

AOI for soldered printed circuit boards

2D and 3D Technology: A Comparison

3D is the subject on everybody's lips. But is this technology just marketing hype – or is it the real answer to the heightened demands being placed on soldered printed circuit board inspection? The fact is that smaller components and increasing component densities are creating an even bigger challenge for AOI systems to face. And the development process has stood up to this: Throughput has increased, image quality has improved, and cameras featuring an additional angled view and software algorithms for fully automated image evaluation have made defect detection a much more reliable process. What's more, 3D technology brings new insights, making actual height information available for evaluation for the very first time. So how important is this information, and how reliably is it recorded? Will 3D inspection supersede its 2D counterpart – or will it just work as a partner to it?

Inspection technologies side by side

AOI and X-ray inspection are used to ensure that typical defects in SMT production are detected, and to optimize the process. This involves cameras with vertical top views, angled views, and printed circuit board height measurement.
The systems available on the market use a range of different technologies:

- Cameras with orthogonal (vertical) top views (AOI, 2D technology)
- Cameras with an additional angled view (AOI, 2D technology)
- Height measurement of printed ciruit boards with components (AOI, 3D technology)
- X-ray inspection (AXI, 2D, 2.5D, or 3D technology)

A few years ago, automatic optical inspection was confined almost exclusively to the realm of 2D technology. 2D processes have continually seen improvements and systems featuring angled cameras demonstrate a particularly high level of process quality, thanks to their combination of a high inspection speed with outstanding, reliable defect detection but a low pseudo-defect rate.

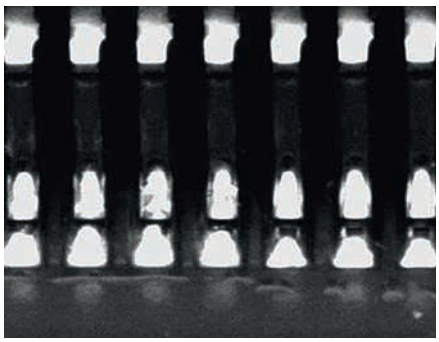
Genuine 3D processes, featuring actual height measurement and volumetric measuring, used to be excessively inaccurate, expensive, and slow. However, the development of sensor technology and evaluation hardware has allowed various genuine 3D technologies to make inroads, enabling (depending on the technology concerned) height measurement for components, IC pins, and solder joints.

Strengths and limitations of 2D technology in AOI contexts

2D inspection represents the current state of the art. Highly sophisticated, it is a reliable method for carrying out post-reflow inspections. The technical features offered by the systems available on the market differ in many respects, however: the camera resolution (in µm/pixels), the size of the camera sensor (number of pixels), the field of view resulting from the resolution and camera size, the frame rate (number of images per second), the presence of angled cameras, the acquisition of full-resolution color images (three color separations with a full number of pixels), the algorithm-based image processing or image comparison, and the multicolored illumination from as many directions in space as possible.

The better the individual features, the better the overall AOI performance, which is determined by the throughput, defect detection (as few undetected defects as possible are desirable), and pseudo-defect rate. As well as the image quality, which is intended to display the defects so that they are clearly recognizable, the software (algorithm-based image processing) has a key role to play. The better the algorithms used for fully automated defect evaluation, the easier it is for the user to make the correct defect detection settings. For 2D technology, angled-view cameras are a particularly important means of obtaining good inspection results and significantly more information about defect features. This includes achieving full sharpness and depth of field across the entire field of view – something that is possible if intelligent solutions are used.

2D systems that can boast good camera technology and software are able to offer a wide range of features: inspection



Defects in the angled view with Scheimpflug

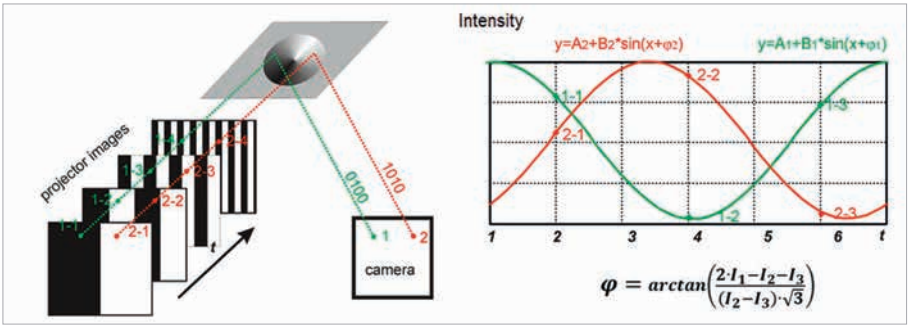
of all visible solder joints including gull-wing ICs, optical character recognition, data matrix code reading, straightforward recognition of certain polarity marks, high throughput, reasonable costs, and relatively few problems resulting from shadowing. There are many solutions for

additional tasks such as measurement or color analysis. 2D technology has its limitations too, however: It cannot inspect hidden solder joints or measure connectors (straightness for automatic bonding later on). As well as this, the defect rates associated with certain defect features can only be optimized using comparatively expensive means, and direct evaluation of 3D data is not possible – plus, there is a higher pseudo-defect rate for some defect features.

3D technology in AOI contexts

3D technology has been well known for its paste print inspection capabilities for some time now. The 3D processes used in post-reflow inspection had for many years been too imprecise, expensive, and slow – and insufficiently stable. Since then, however, they have grown into a success, including in this application. For the first time, they have enabled actual height information to be obtained and additional defect features to be detected. This accommodates components that are not all on the same level, for example, and bent leads. Additional features relating to height can be inspected too. Basic features such as the presence of components can finally be checked more easily and pseudo defects reduced. In this context, the moiré multi-frequency process using multi-phase shift (known as the structured light projection method) has particularly won through.

Despite this, 3D technology also has some drawbacks and limitations: As more work is involved in the process of defect detection, this drives up the associated costs. On the technology side, many basic defect features such as a number of polarity marks and characters cannot be detected, data matrix codes are not read, there is no color information, and the edges under



The structured light projection principle

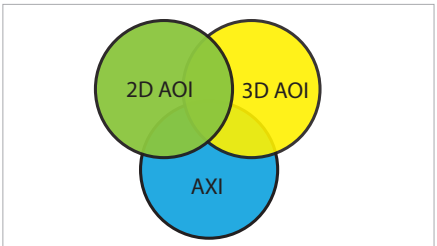
the components are not analyzed (in the case of PLCCs and MELFs, for example). Not only that, but the technology is also subject to more shadowing problems and reduced throughput; additionally, it cannot evaluate hidden solder joints in a way that classifies each individual connection (e. g., in the case of QFN or BGA components), and high components can only be inspected to a limited degree.

Summary: 2D and 3D technology

3D technology is coming to the fore. It demonstrates some disadvantages relating to its methods, although it does provide more reliability as it is able to obtain more information. 3D technology cannot and will not replace 2D technology, however: While it is opening up new technology horizons, it cannot do everything better than 2D technology – and indeed, in some cases it falls far short. Notably, it is often impossible to ensure alignment with IPC-A-610 criteria due to the presence of combined conditions or the requirements for only "visibly good wetting". Consequently, it makes sense to use 3D technology in AOI contexts as an addition to 2D technology, in much the same way as AXI X-ray inspection operation can enhance AOI. After all, what matters is not the technology used, but whether the right inspection result is obtained.

Where AOI is concerned, using a combination of 2D and 3D technology is the way to ensure better detection of all visible defect features. Assuming that 3D technology is implemented correctly, many defect features can be recorded directly and detected with reliability. This is particularly true for tilted components and bent leads. This requires a software platform that not only provides all the necessary evaluation algorithms with a high level of quality, but is also able to flexibly combine the options offered by 2D and 3D technology in a way that exploits their strengths.

The ideal solution is to use various elements from the 2D AOI, 3D AOI, and AXI toolkit to build tailored solutions that meet customer-specific requirements – and for a single manufacturer to do this. Combining the various options available in this way can considerably improve both inspection quality and user processes.



Ideal coverage using the most basic inspection technology

Viscom-Download

The text is truncated. Here you will find an detailed article about the subject:
www.technical-articles.viscom.com

New entry Lars Bartels

Reinforcing Viscom's Customer Support

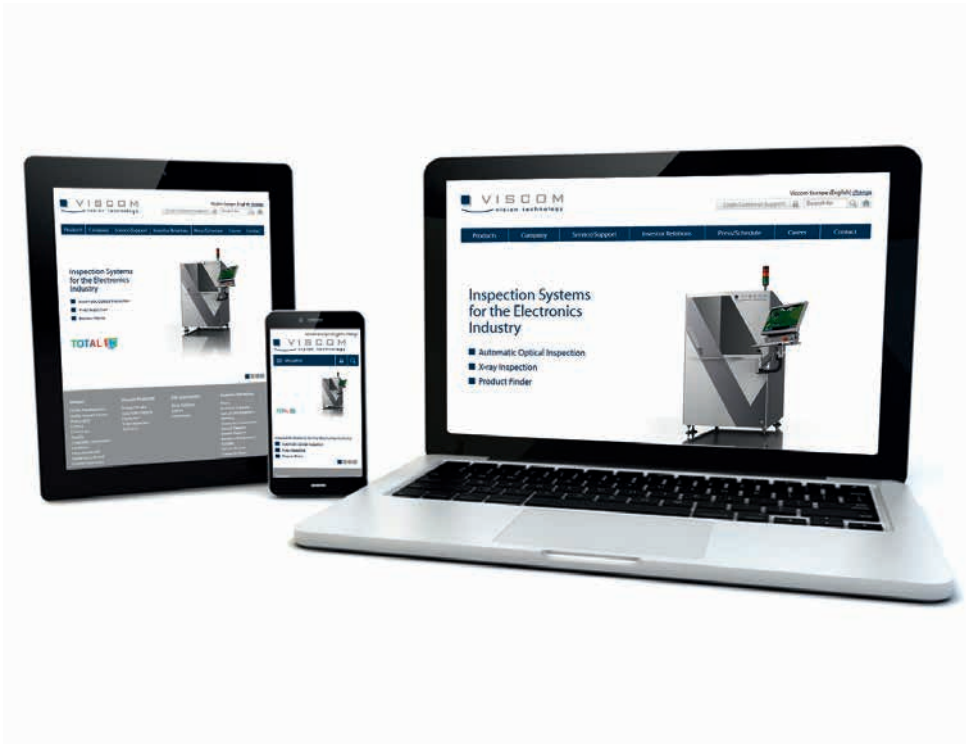
Since January 2014, Lars Bartels has reinforced Viscom's sales customer support in Europe. With Bartels, Viscom has added an expert in AOI and X-ray inspection to its sales team. From 2004 to 2013, he carried out product and project management tasks and worked in sales for two international manufacturers of inspection systems. For three years before that, he worked for a leading X-ray inspection system manufacturer.

"Lars Bartels knows users' expectations of AOI and X-ray inspection operations" says Torsten Pelzer, sales manager at Viscom. "We are happy to have him on board. With his many years of practical experience, he can competently advise our customers on all matters related to assembly inspection – from selecting a suitable AOI system to answering detailed technical questions. Additionally, with his comprehensive background and experience in SMT production, he has the necessary understanding of upstream and downstream processes." ■

Lars Bartels

User-friendly and easy to navigate

Viscom Website Relaunch



Viscom has completely redesigned its website. The fresh layout offers intuitive navigation with a high degree of user-friendliness. Added to this is a clearly arranged product finder, oriented on the demands of customers, as well as a comprehensive customer support area.

Through flexible sliders and teasers, Viscom systematically directs visitors to important information, new products or special offers. The product pages offer, at a glance, a detailed introduction to the respective inspection solution. Moreover, the pages are optimized for all common terminals. Regardless of whether the user calls up the pages by PC, smartphone or tablet, the website always appears in the optimal format. ■

Vikis Children's Group

Viscom Receives Business Award for its Company Childcare

F. l. t. r.: Marlen Giesa und Julia Mischke (Managerial staffs of Vikis Children's Group), Sandra Liedtke (Investor Relations Manager) und Dirk Schwingel (Executive Board)

As part of the WiKiZ project (standing for Wirtschaft • Kinder • Zukunft in German – Business • Children • Future) run by Hanover's Young Businesspersons' Association (Wirtschaftsjunioren) under the auspices of the Hannover Chamber of Commerce, Viscom AG has received an award for its Vikis Children's Group. The project gave accolades to companies and institutes in the Hannover region who have found exemplary in-house childcare solutions that benefit their business and their employees. Alongside awards for Hannover Medical School and service94 GmbH, Hannover Young Businesspersons' Association honored the outstanding solution that Viscom AG has found for providing childcare while its employees are at work. This entrepreneurial venture has allowed employees to strike a healthy balance between work and family life.

The Vikis Children's Group was founded in 2009 as an answer to many Viscom employees' wish for a simple way to come back to a working environment and be safe in the knowledge that their children were being well looked after close to their place of work. The Vikis Children's Group can accommodate fifteen children between one and three years old. Three trained specialists are on hand to give expert care to these additions to the Viscom family. ■

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