Intelligent Visual Inspection Guidance

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This article was published for the first time in the „epp“, issue 01/02.

Software – guided manual visual inspection

ERSA presents an approach how to gather special knowledge around processes and, based on that, how to use this knowledge to draw decisions for overcoming actual process problems. This software is called ERSA ImageDoc. It is a software platform designed for process optimization and cataloguing process knowledge. Within databases mainly visual beside further information is gathered. But in contrast to standard database applications, it presents that information step by step in an order and way which comes along with the way an operator would pass to evaluate his inspection result and improve his process. It starts with capturing the inspected image, called visualization.

A large number of manual visual inspection systems can be found within production sites. They are used for sample inspection, to support the production setup or for special investigations in regard of failure analysis. Sometimes they present astonishing detail views. However – the evaluation of those images is always a matter of experience, available specs and at least knowledge of individuals. This article shows how software can be used to support operators with adequate knowledge to allow quick and objective decisions. Decisons to stabilize processes and, at least, save money.

The importance of process knowledge

Board production is a complex theme with numerous parameters influencing the production result. Production steps within a line are on one hand independent blocks – finally they interfere like in any organism. The way they interfere is defined by the typical set-up of the whole production line, by the technology produced, by environmental influences, product design, etc..

The quality of the production could be expressed mainly by the following 3 parameters:

- The total number of produced products per time (output) related to a production quota,
- the number of rejected products (boards for rework, scrap)
- The quality state of the delivered product (reliability, lifetime, latent defects)

These figures participate in the company´s success. While all influence the profit, the last one additionally effects your reputation on the market.

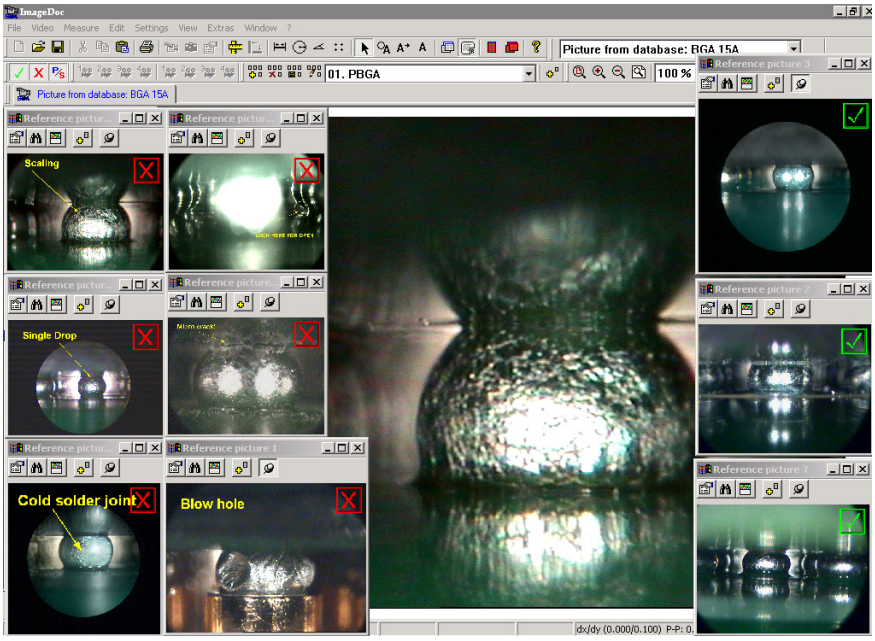
Production lines are run by skilled engineers and operators. They have gathered experience within discussions with seniors or by probably trial and error within time. Such people carry significant knowledge with them: Knowledge, which is only to a certain percentage common knowledge. Knowledge, which is related to a certain process set-up. Knowledge, which is individual. Knowledge, which could save money if different people within an organization could participate.

Visualization

As the first step the ERSA ImageDoc software is fitted with an interface to any visual inspection equipment offering a standard video signal. A typical example of such equipment is the ERSASCOPE inspection system for BGA inspection. Here, images from hidden solder joints are visualized to the inspecting person.

Reference Picture Groups

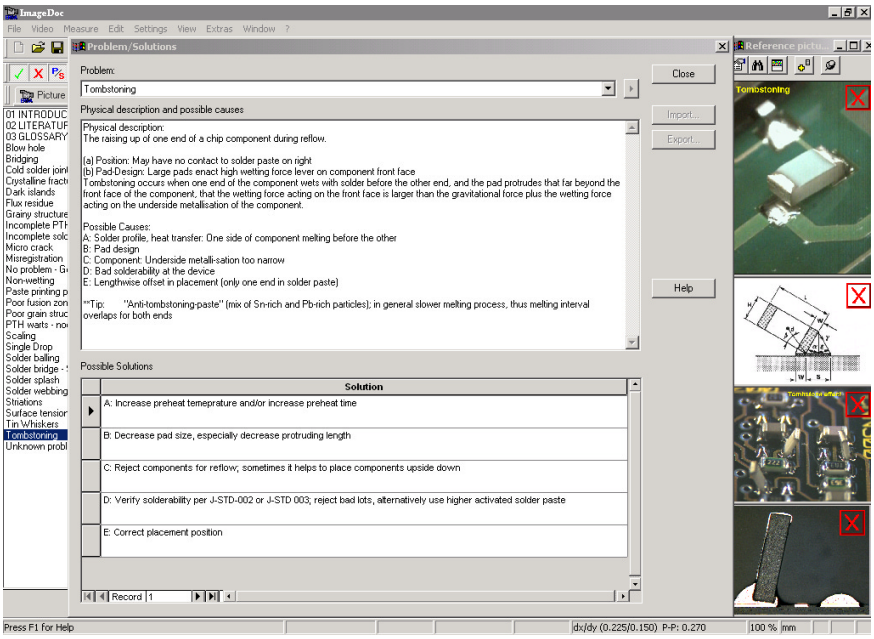
The evaluation of such images is, as described above, a matter of experience. In case



Reference Picture Group „PBGA“ with live image in the middle and good and poor examples around.

of hidden solder joints it could mostly be expected that there cannot be any experience from the inspector´s side at all, because such images are often seen for the first time. But the information presented by the image can be enormous and valuable. The operator needs a supporting tool to evaluate the image. This tool is called Reference Picture Groups. Supporting a specific theme or often a component, it presents different images of different levels of errors.
The operator decides whether he can match his image with one of the presented images within the Refrence Picture Group. If not, he has to investigate whether the image he received displays an acceptable property or not, and he has to input the result into the software. It has to be stated that in the decision phase a manual image processing takes place. The basis build the images within the Reference Picture Groups, the processing is done within the operator´s brain. In comparison to industrial image processing there is a significant advantage: the step of defining a set of parameters for the decision, which is maybe the programming of an AOI, is dropped. The human brain is able to create an adequate parameter set when watching the images and thus can be adopted to any kind of problem immediately. Thus such a tool like the Reference Picture Groups is applicable to a wide variety of different types of problems. And one can experience that the brain is able to behave somehow like a fuzzy-controller, meaning it evaluates the grade of problem and allows a more decided evaluation than simply good or poor.

Problem/Solution Database
After a problem has been identified the next step is to match or link the image to a to a problem within the Problem / Solution Database. This presents explanations to causes of the problem occurred and how to overcome this problem. Here, specific production line configurations can be saved beside common process knowledge for future use. This could be e.g. published articles around the problem, specifications, company guidelines or machine specific settings within the production line. With that information the operator should be able to change the process parameters adequately and improve the process quality.



Problem / Solution Database, example tombstoning. Knowledge presented to the user to inform and as a guidance for process improvement

Naturally the whole proceeding is always a mixture between more or less determined software supported action and on the other hand investigation into new failure patterns occurred. But as a strength of the software concept, the investigation results should be added to the software whenever they appear to let the software database grow to an even more powerful specific knowledge database for the key processes. The software in the end lives from the input of the user to grow and the user vice versa benefits from the input from the software to decide and react.

Quality improvement by Intelligent visual inspection guidance

Obviously in the end a loop is closed. The loop starts at a process with questionable output and leads via inspection and evaluation to an improved process. Such a loop was mentioned first by Deming in 1950 as a basic procedure in quality management.

Investments for the users, ROI

The benefits for a company are clear: Reduced investigation time for production problems increases the production ratio and lowers the standoff time. Enhanced problem evaluation increases the overall quality level. And a common knowledge database distributes knowledge to all participating people and thus incorporates a training effect to the complete staff. Information distribution and thus an essential requirement for knowledge management is guaranteed. Finally process improvement increases yields, provides more shippable products per month, increased quality and ultimately leads to increased profits.

Summary

Intelligent visual inspection guidance is a concept which can be implemented by companies themselves by just adding the software platform to even existing visual inspection systems. It turns a simple viewing system to a quality assurance tool. The efficiency such a tool may offer to a company does not only return the investment quickly, it offers long-term advantages in quality and reputation.

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