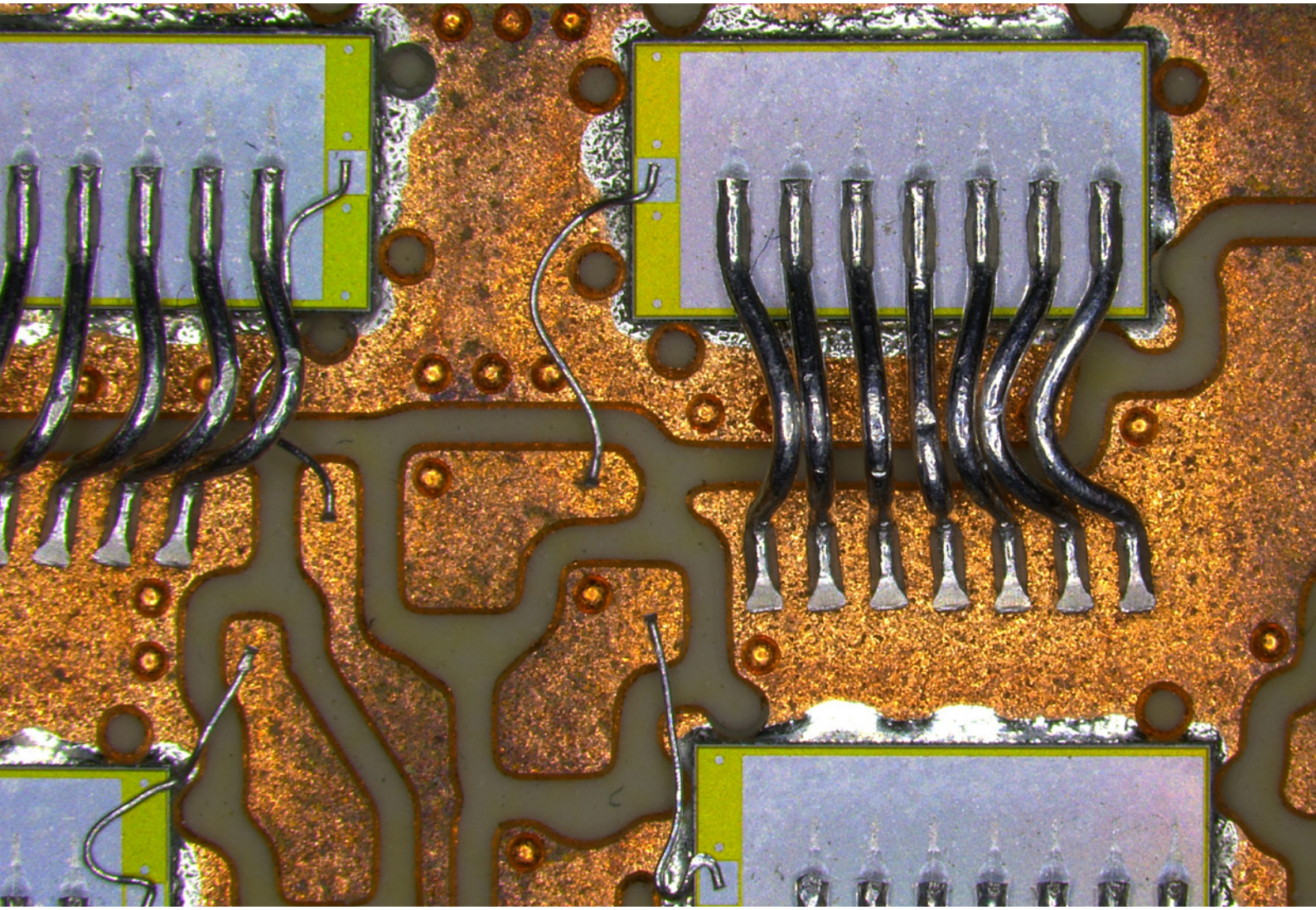
From Eye to Insight

Leica MICROSYSTEMS

TOP CHALLENGES FOR VISUAL INSPECTION

Routine visual inspection performed with a microscope



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This article discusses the challenges encountered when performing visual inspection and rework using a microscope. Using the right type of microscope and optical setup is paramount in order to optimize the workflow and increase throughput. Challenges which can occur when performing visual inspection and rework with a microscope include determining the appropriate magnification and illumination and having a large enough working distance. However, other critical ones relate to workflow optimization, efficient reporting of results and training of users, and user comfort during inspection. Leica digital and stereo microscopes can help you overcome these challenges with a number of solutions which enable more efficient inspection and rework.

Introduction

Suppliers and manufacturers need to inspect parts and components in an efficient and cost-effective way. The goal is to ensure and optimize product performance and lifetime. Typical challenges that users may face for inspection and rework with a microscope are described in this article. Leica digital and stereo microscopes which can help users overcome these challenges, enabling the inspection workflow efficiency to be optimized, are also mentioned.

Challenges for Visual Inspection

Visual inspection of parts and components is most often performed with a digital or stereo microscope. When inspection only is required, then a digital microscope or microscope with camera is the most appropriate solution. If inspection with rework is needed, then a stereo microscope with eyepieces is normally used.

Inspection only and inspection with rework (digital microscope or microscope with camera)

A number of challenges encountered when doing visual inspection can lead to inefficiency in the workflow. Below are several common challenges that users may face.

> Insufficient optical performance and illumination

Using the wrong set of optical lenses and light illumination [1-3] may prevent the user from quickly shifting the view from sample overview (low magnification with large field of view and depth of field; refer to figure 1A) to seeing the fine details (higher magnification) without losing focus. When this is the case, additional adjustments are required in order to get a sharp image each time the magnification is changed. The illumination plays an important role as it can enhance different sample details during imaging (refer to figure 1B and C).

> Too small working distance

The working distance of a microscope (refer to figure 1D) is the distance between the bottom of the objective lens and top of the sample [1]. Using a microscope objective with a short working distance can make it difficult for doing rework requiring access to the sample with tools or handling of the sample, especially when inspecting samples with features having large differences in height. The sample could touch the objective more easily, possibly resulting in damage, when inspecting with a short working distance.

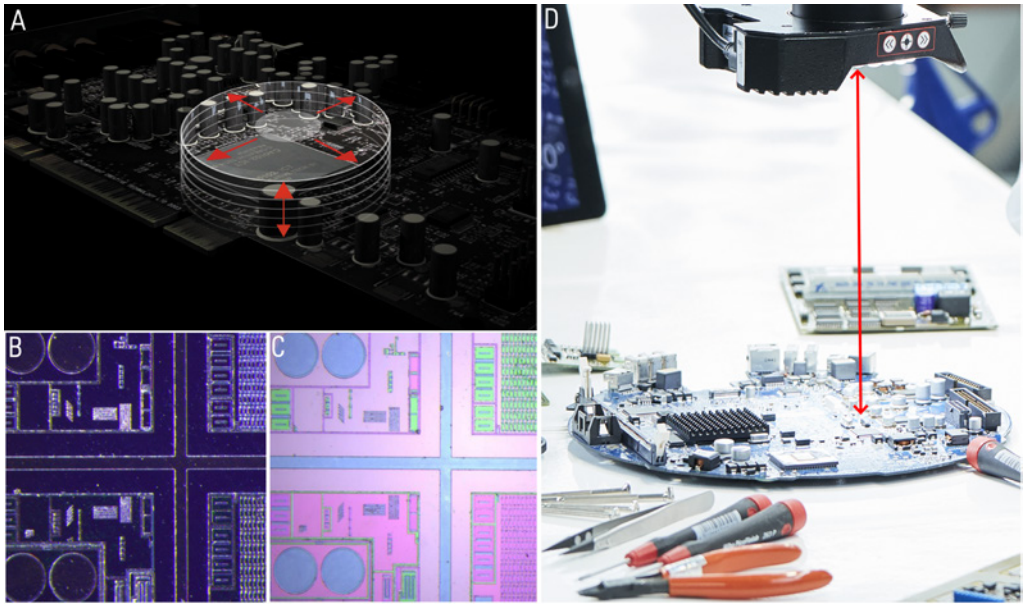

Fig. 1: A) Red arrows indicate field of view (horizontal) and depth of field (vertical) of a microscope image. A microelectronics sample imaged with B) ring light and C) coaxial illumination. D) The microscope working distance is indicated with the red arrow.

> Delay with the use of dedicated workstations

When performing sample measurements, analysis and/or comparison to standard references, it is sometimes necessary to transport samples and notes across workstations to perform dedicated inspection tasks. This workflow can lead to possible waiting/idle time if the workstations are occupied. If there is manual image data transfer between inspection workstations, e.g. using mobile media like USB and SD cards, the media can be misplaced or even lost in the process, thereby leading to delays and reduced inspection efficiency.

> Difficulty to operate the microscope

Complex microscope operations may require special training for users to become proficient. Making sure each user possesses the proper skill level to perform the operation is important and often requires additional training time, especially when there is a large variation in the initial user-skills level. Non-intuitive microscope and software packages can slow down user training and decrease productivity.

> Inability to quickly adapt to new inspection needs

Inspecting different samples, such as printed circuit boards, electronic assemblies, automotive parts and components, or medical devices, often requires a different microscope setting (objectives, illumination, etc.). A complex and inflexible microscope solution can limit the user's ability to quickly adapt it their needs and the type of sample they want to inspect.

> Cumbersome reporting of results

When reporting and sharing of results (i.e., image analysis, data, and reports), they must be easily accessible to others in order to maintain an efficient workflow. However, when using dedicated workstations for this task, sharing of information between users may become difficult and slow, due to waiting when trying to access a workstation or the manual transfer of data, which results in decreased productivity.

> Risk of strain and injury to users during inspection

Sample inspection with a microscope is often times a slow process which can take hours due to repetitive tasks. Reproducing the same motions over long periods of time can cause discomfort and strain on the user, especially when using a microscope which is not ergonomically designed or does not provide ergonomic accessories.

Inspection with rework (stereo microscope)

For visual inspection with rework, then a 3D perspective with immediate depth perception is necessary, so a stereo microscope with eyepieces should be used. An example would be doing inspection and rework of electronic parts or printed circuit boards (PCB).

Cannot quickly scan samples during inspection and rework

An additional challenge encountered for inspection with rework which can cause inefficiency is the inability to quickly change the microscope settings allowing users to go from a sample overview to fine details. This challenge arises when using a stereo microscope which does not provide enough depth of field, field of view, and resolution, thus requiring a lot of adjustments.

Refer to table 1 for an overview of the challenges for visual inspection.

Challenge Faced	Inspection Only and/or Inspection & Rework
Insufficient optics & illumination	both
Small working distance	both
Delay with dedicated workstations	both
Difficult to train users	both
Inability to adapt to needs	both
Cumbersome reporting	both
Risk of strain and injury	both
Slow scanning of samples for rework	Inspection & Rework

Table 1: Overview of challenges encountered when doing inspection and rework which can lead to inefficiency.

Leica microscopes: Overcoming challenges

Digital and stereo microscopes from Leica Microsystems are solutions for visual inspection only or inspection with rework which can overcome the challenges mentioned above [4].

Inspection only solution

With the Emspira 3 digital microscope used in stand-alone mode, it offers integrated functionalities enabling measurement, comparison, and data sharing without the need of a computer.

Inspection and rework solution

With Ivesta 3 stereo microscopes, users can optimize their workflow and save time during inspection. They use the FusionOptics [5] technology which can increase inspection efficiency, enabling the microscope to provide both a large depth of field and high resolution.

With M series stereo microscopes, users can handle easily routine inspection or documentation tasks.

Ivesta 3 and M series stereo microscopes with a Flexacam c5 camera can also be used for inspection in stand-alone mode with integrated measurement, comparison, and data sharing functionalities.

References

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