



Why now is the time to switch to AI-Enabled Automated Defect Classification

Semiconductor manufacturing is challenging, with integrated circuit production one of the most complex processes of all. Prodrive Technologies has a deep understanding of the intricacies of these methods, harnessing powerful and proven solutions from Robovision and NVIDIA in its embedded computing systems.

Here, Bas van Bree, Program Manager for Prodrive Technologies discusses the challenges, solutions, and potential benefits of switching to defect inspection and classification utilizing the power of AI, such as faster production times and removing the possibility of human error.



COMPLEXITY, QUALITY, PRODUCTIVITY

Chips are becoming more complex for many reasons. Circuits require more complex features, all while feature sizes on chips are shrinking. Furthermore, customers are constantly pushing for faster processes.

At the same time, quality control is non-negotiable for businesses producing semiconductors in order to generate acceptable yield and sufficient output. While semiconductor production requires inspecting features of an extremely small size, the image processing and defect classification are comparable to those used in other fields, such as the production of electronics, flat panel displays, automotive vehicles, and digital printing.

Regardless of the industry, quality and productivity are key to these applications. In the semiconductor manufacturing sector, this means effective and accurate inspection and defect review, whether manual or automated, are of the utmost importance. But achieving this elevated level of accuracy and efficiency is not without its challenges.



FIVE CHALLENGES AFFECTING SEMICONDUCTOR QUALITY INSPECTION



Enhancing operational productivity and efficiency while systems also need to be able to deal with ever changing and more complex designs.



Both accuracy of the inspection and the throughput need to be improved.



Ways to improve the yield of the production line with improved defect classification, in order to stay competitive.



Trailing nodes also provide profitable output to serve demand for low-end chips. Production must be kept operational with legacy hardware.



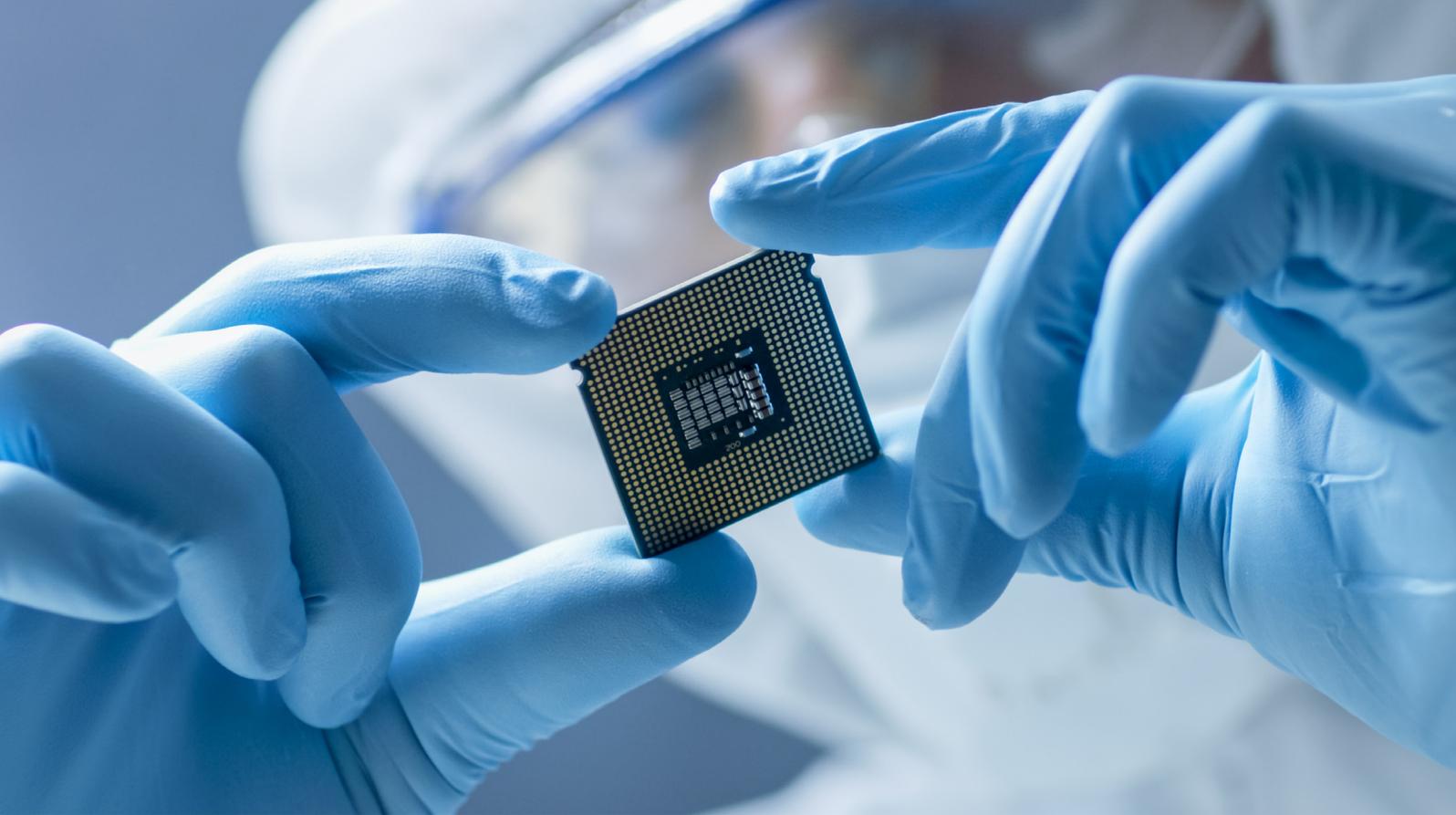
It is difficult to find the right people within the organization to maintain complex inspection systems.

THE RISE OF AI

For semiconductor manufacturers, new AI tools and techniques can help manage increasing inspection tool throughput and device complexity challenges. This may potentially add functionality, while also bringing value for these manufacturers. However, it is a new frontier for many organizations.

For this reason, businesses looking to take this step and benefit from AI-technology need a partner that collaborates closely with customers to define the most efficient systems and solutions for their specific application.

Prodrive Technologies already collaborates with manufacturers to understand their needs and based on this, define what is possible. When Prodrive's embedded computing systems are built for customers' machines, devices, and software, it is not just important to consider an integration that works now, but also how these systems can be scaled up in future in order to help develop the application further.

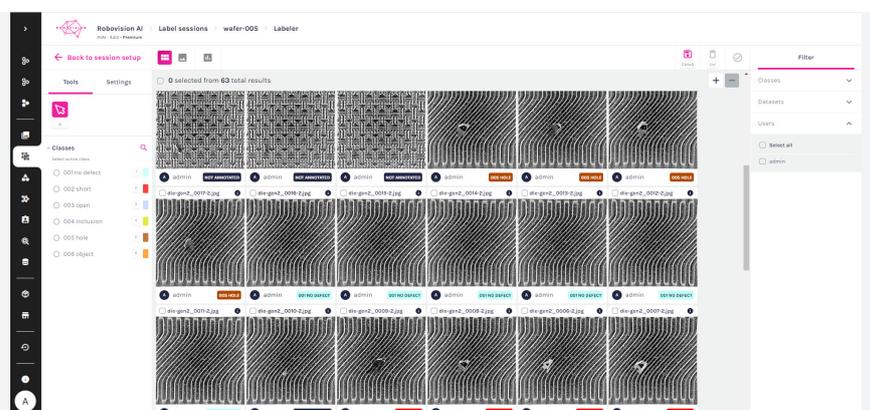


TRANSFORMING WAFER INSPECTION

The good news for manufacturers is that AI and machine learning is enhancing the potential to do automated defect review. With Prodrive Technologies, it is now possible to leverage deep learning within the fab thanks to the Robovision AI-enabled platform (the RVAI platform), which has been tailored for AI-enabled Automated Defect Classification (ADC) applications, all with a solution that can evolve as businesses, and products, change.

Those using Prodrive's AI-enabled semiconductor defect review and classification solutions can input data sets to train an AI model – an algorithm trained with relevant customer data. By adding more data over time, eg examples of specific defects, the accuracies will continue to improve. For example, consider an application where a microscope is used to examine the quality of a layer of a wafer, producing an image for inspection. Rather than this being a manual process, now the AI technology can review the image to not only define the presence of a defect, but also classify defects automatically.

These smart AI systems feature highly refined defect classification technology that 'learns' based on examples of real-life defect examples encountered during processing. This delivers automatic, accurate results, helping to speed up lead times and reduce the possibility of human error.



Of course, human error is an issue throughout complex semiconductor manufacturing. Operators on the production line may be required to do tedious and repetitive tasks, which can cause complacency to set in. Equally production operatives may be poorly trained or inexperienced. Let's not forget that manual labelling can be a challenging task. Mistakes do happen in production, but the use of AI inspection systems helps reduce this.

WHY NOW?

When considering that advanced integrated circuit semiconductors consist of hundreds of layers, and that each layer of a wafer requires a new model based on a unique dataset, there is a clear benefit to utilising AI. However, to gain the biggest benefits, it is crucial that operators are empowered and have the understanding to efficiently create the new AI models as needed. Prodrive works with Robovision's easy-to-use AI platform (RVAI) which enables an operator to create a model fast, as well as with high accuracy. The approach combines tested hardware from Prodrive with proven AI-enabled software from Robovision.

Once these systems are in place, this gives manufacturers the ability to notice far more quickly what is going wrong in production. The sooner a defect is detected and classified, the sooner flaws in the production process can be eliminated and production yield can be improved. Of course, automated defect classification is not new technology. However, as throughput and complexity in semiconductor manufacturing increase, it can take a lot of time to manually develop and train these systems. The DL capability of AI systems speed up this process, while also making it more accurate.

The options available now, are also as scalable as they are powerful. Prodrive Technologies has a range of systems that are qualified to use NVIDIA hardware for processing and packaged as an easy-to-develop solution, fit-for-use in a wafer fab specifically including the Zeus Scalable server series and the Poseidon Industrial PC.

Prodrive Technologies integrates this futureproof technology that facilitates quality checking to be done via AI on a wide range of different customer systems in varied manufacturing applications. NVIDIA-Certified systems are systems that incorporate NVIDIA GPU and networking solutions and are tested specifically for contemporary AI workloads.

Importantly, manufacturers can not only integrate these advanced technologies on new tools and developments but can also apply these solutions as an add-on to existing equipment in the field. This in turn enhances productivity of these machines, helping to extend their usage longer.

STEPPING INTO THE FUTURE OF AI-ENABLED DEFECT CLASSIFICATION

The reality is that an increasing number of manufacturers are moving to AI-based defect classification. Those that do not change and update their defect classification methods risk being left behind their competitors.

Prodrive's proven AI-enabled systems are already being used in real application settings. These businesses were able to see clearly how the Prodrive Technologies system outperforms manual labelling. The result? Drastic yield improvement as well as high accuracy within the application. The time to switch is now.



ARRANGE A DEMO

Learn how Prodrive Technologies can help you gain a competitive advantage with AI-enabled inspection and classification systems. Contact us to arrange a demo now.



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ABOUT PRODRIVE TECHNOLOGIES

Founded in 1993, Netherlands-based Prodrive Technologies designs and manufactures electronics, software, and mechatronic solutions using the very latest process techniques, many of which it has developed. In close cooperation with customers, Prodrive Technologies develops and delivers a wide range of high-tech products, systems and solutions, doing everything in-house to cater to many different markets. Prodrive Technologies owns flexible and fully automated manufacturing plants/factories in the Netherlands, U.S., and China where it effectively optimizes product designs for each customer.



www.prodrive-technologies.com

ABOUT ROBOVISION

Robovision is a team of over 100 people from multiple disciplines who are dedicated to the mission of building artificial intelligence (AI) to enable collaborative intelligence.



www.robovision.ai

ABOUT NVIDIA

NVIDIA's invention of the GPU in 1999 sparked the growth of the PC gaming market, redefined modern computer graphics, and revolutionized parallel computing. More recently, GPU deep learning ignited modern AI — the next era of computing — with the GPU acting as the brain of computers, robots, and self-driving cars that can perceive and understand the world.



www.nvidia.com/