

MACRO INTELLIGENCE

*Insights for Increasing Yield
and Reliability through Smarter
Macro Defect Inspection #6*

A Technical Bulletin from Microtronic – the Industry Specialists in Macro Defect Inspection

Operator shortage? Intelligent machine vision can give more and better wafer inspection.

Right now, wafer manufacturers are having serious problems in finding and retaining operators. And they're desperately looking for ways to keep their fabs running effectively.

Fortunately, machine vision can offer a smart solution. To see how it works, let's first look at the basic fab workflow and check out some opportunities for improvement...

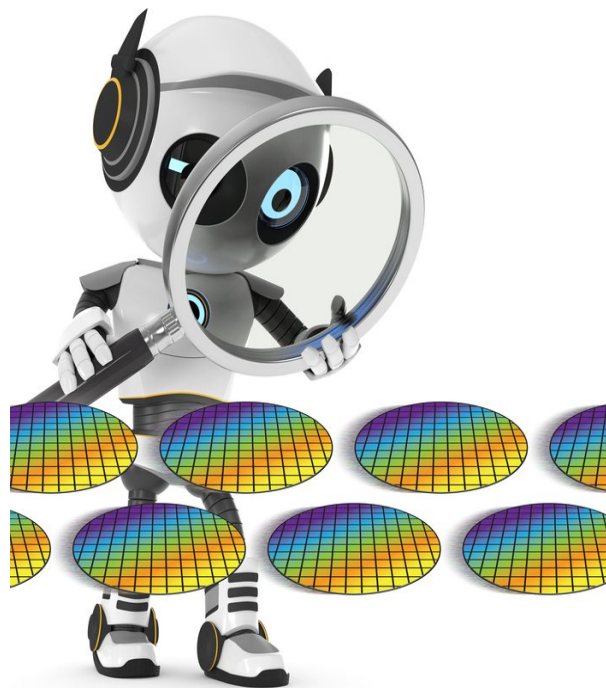
How to improve ADI

In a typical fab, after wafers are patterned in Photo they go to microscope inspection. This "After Develop Inspection" (ADI) is important because if there was a patterning problem in Photo, the fab needs to catch it quickly so the wafers can be reworked.

If ADI misses a problem, the wafers will proceed to Etch, Deposition, or Implant, and those wafers can't be reworked – instead, they become potential scrap or reliability concerns.

But even though ADI is critical, most fabs only inspect five wafers from each lot – and only five sites on those five wafers. This is because of time and cost constraints. To increase their sample size, some fabs may inspect all the wafers in the lot; but they still just look at five sites per wafer. Either way, the total sample sizes are still small, allowing many problems to escape detection.

And there's an additional problem with microscope ADI: Operator fatigue results in a steady decline in the quality and consistency of operator inspection from the start to the end of each work shift. And that can seriously impact wafer yield.





So, bottom line, to increase its performance a fab needs to increase the overall amount and quality of its wafer inspection while reducing the inconsistency problems associated with human inspection.

And right now there is an extremely fast, automated macro inspection tool that can help on both counts. It's the EagleView, shown here, from Microtronic.

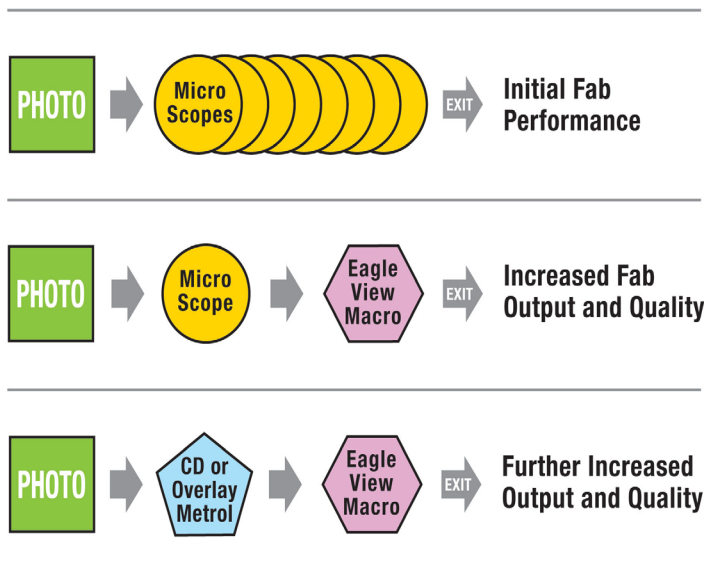
Finally, 100% wafer inspection

When an EagleView macro inspection system is added to the workflow, a fab can reduce human inspection to a single wafer in the lot. After that, because of its speed and intelligence EagleView can inspect 100% of the surface of every wafer in every lot. There's no more need for sampling. And no more operator fatigue. This automated tool remains accurate and consistent from the start to the end of every shift – every day.

EagleView dramatically increases both the total amount and the quality of wafer inspection. This enables more process excursions to be caught more quickly – and corrected more quickly. This improves yields by reducing excursions and scrap.

And if additional machine inspection is added – in the form of CD or Overlay Metrology tools – human microscope inspection can actually be eliminated altogether, to bring even greater increases in fab performance. See the progression in the graphic below.

Decreasing Human Inspection and Increasing Fab Performance



Basically, to maximize fab performance while reducing the amount of human inspection, two rules need to be applied:

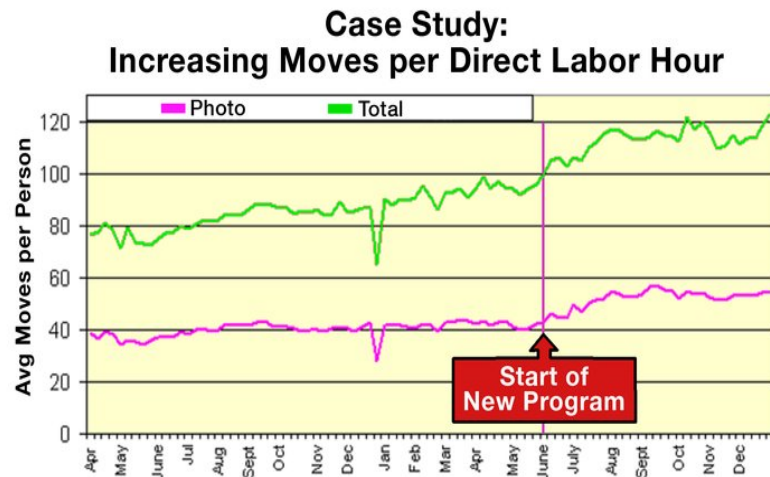
1. Each lot must receive both a micro and a macro wafer inspection. The micro inspection sample can be as small as one wafer, while macro inspection is done on *all* the wafers.
2. The micro inspection can be done by microscope, overlay or CD metrology tools – to ensure that at least one wafer in the lot was patterned correctly (reticle check, CD size, registration).

The high-speed EagleView can then inspect all the wafers for macro defects automatically, with no need to create or maintain recipes.

Increasing performance with reduced staff

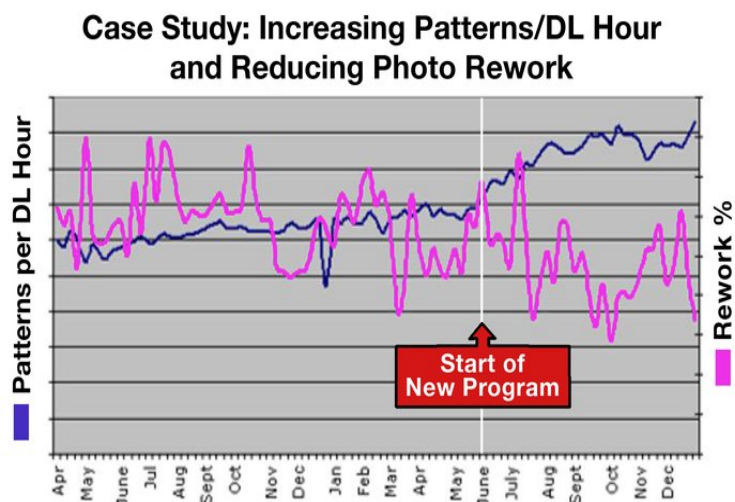
In the past, a typical line might have had eight microscope inspectors per shift. With EagleView they can reduce that to one or two per shift! Even adding one or two EagleView operators per shift, the net savings could be 16-20 staff! And those operator positions could either be reallocated to other bottleneck areas, or could be eliminated.

As illustrated in the two graphs shown here, actual fab case studies confirm that as human microscope inspection is reduced and the amount of machine wafer inspection is increased, fab performance and yields increase – with improved productivity, faster cycle times, and reduced staffing.



We see that from the time the manual inspection reduction program was initiated, indicated by the red arrows, performance began to move in a positive direction on multiple fronts.

There were increases in average moves and in patterns per direct labor hour. The percentage of rework needed also dropped dramatically.



The major benefits

Overall, we can see a number of significant benefits in this new wafer inspection program. First, it allows the fab to reduce or make better use of its staffing. Second, it eliminates sampling and enables the fab to macro-inspect every wafer in every lot. And this, in turn, allows many more process problems to be spotted and corrected, and the wafers reworked, much more quickly.

Bottom line, high-performance, high-volume macro wafer inspection made possible by the Microtronic EagleView can dramatically improve fab efficiency – increasing throughputs and yields while at the same time reducing staff.

Specializing in semiconductor macro defect inspection

For more than two decades Microtronic has been working to optimize semiconductor wafer macro defect inspection to enhance yields and reliability. If you have questions in any of these areas, please just call us at (508) 627-8951 or email info@microtronic.com.

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