

Whole Wafer Macro CD Metrology

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For over ten years automated macro defect inspection systems have been utilized by lithography cells to monitor random litho track defectivity. These systems focus on throughput over sensitivity to ensure a large population of samples can be cost-effectively inspected quick enough to react to highlight track defect excursions.

In addition to litho track-induced defects, macro defect inspection systems can also detect scanner-induced defocus defects. Defocus defects are characterized by a large variation in the width of exposed pattern lines. Although useful for monitoring defect excursions, the application provides little use for predicting a trend towards a future excursion or predicting the range of the pattern variation across the field. These applications require an expensive, high resolution CD-SEM or OCD system which typically measure five points and extrapolate results for whole wafer variation.

For highly repetitive structures under the proper illumination conditions, there can be a direct correlation between Grayscale Value (GSV) and variation in linewidth critical dimension. Figure 1 displays an array of simple test structures with CD varied from +5nm to -5nm of nominal.

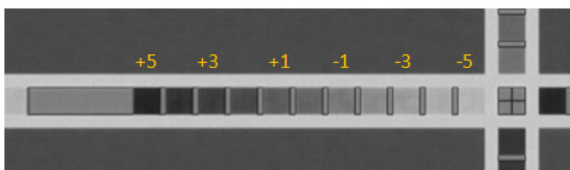


Figure 1

For this example, there is a clear linear correlation between CD variation and GSV response from the camera as displayed in Figure 2.

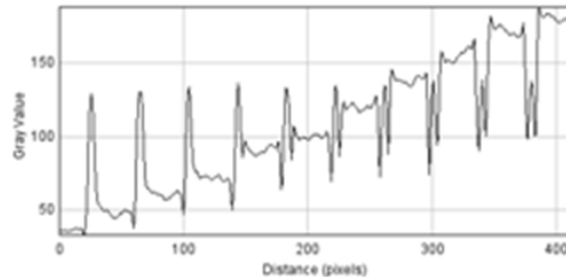


Figure 2

This direct correlation can then be utilized by a high speed macro defect inspection system to provide a single solution for both defect and metrology results. A whole wafer image can be mapped to the corresponding GSV range for each distinct CD range. Figure 3 shows a zoomed in area of CD variation along the transition of a FEM.

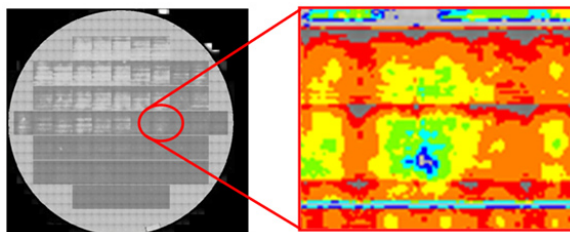


Figure 3-CD variation detail at the transition

The technique was generated through cooperation between Rudolph Technologies and Samsung SEC utilizing the latest generation AXi 940 macro inspection module.