Advanced Darkfield Inspection

At 65nm design rules and below, the semiconductor industry faces multiple challenges associated with new materials and tighter geometries. The competitive environment, shorter product life cycles and single wafer processing techniques drive the need for cost effective manufacturing, including cost effective defect inspectors that provide the required sensitivity at production throughputs. To date, laser-based darkfield inspection tools have filled a key role by providing high-throughput defect monitoring capability. However, conventional darkfield inspection tools based on acousto-optic deflectors/photo-multiplier tubes (AOD/PMT) can no longer meet manufacturers’ inspection needs, having reached their limit in terms of sensitivity at throughput.

A new darkfield imaging inspector has been designed which incorporates the imaging technology from broadband brightfield inspectors. A focused laser beam illuminates the wafer surface and scattered light is imaged onto a unique, multi-pixel sensor, instead of a ‘single-pixel’ PMT. This darkfield imaging tool provides the high resolution needed for today’s design rules without sacrificing the superior throughputs typically associated with darkfield tools. Figure 1 illustrates and compares brightfield imaging, the new darkfield imaging technology, and traditional darkfield scattering. These inspection technology illustrations depict only a subset (normal incidence brightfield and oblique incidence darkfield) of possible tool configurations.

The patented optical subsystem used in the new inspector focuses a collimated UV laser beam onto a line on the wafer surface. This line is then imaged onto a linear, CCD-based sensor capable of high data rates (>1Gpps) that enable parallel collection. The optical elements of this darkfield imaging tool are unique to the industry and are critical enabling technologies for high resolution inspection at throughputs typically associated with traditional darkfield tools.

Figure 2 shows two examples of the resolution obtained with this darkfield imaging technology compared to conventional darkfield inspectors. The SEM images show the areas of a logic wafer and a DRAM wafer used in this comparison. Raw scattering images were gathered using a traditional AOD/PMT darkfield system and the new darkfield imaging system. The images taken with the new inspector qualitatively demonstrate the higher resolution of the logic structures and better definition of the array/periphery interface on the DRAM device. This higher resolution translates into increased defect sensitivity and improved inspection capability on smaller design rules.

The new inspector also incorporates low-angle oblique illumination for surface selectivity and noise suppression; selectable incident and collection polarizations for maximizing sensitivity to DOI while minimizing noise due to nuisance and film thickness variations; and true programmable Fourier filters to provide superior pattern suppression and sensitivity on memory devices.

Applications for this innovative technology include front-end memory defect monitoring, back-end logic defect monitoring and low cost daily photo-cell monitoring, complementing higher sensitivity broadband brightfield inspections at critical photo steps. With its high sensitivity, high throughput and noise suppression capability, the new inspector meets the cost and performance requirements for defect monitoring on a broad range of semiconductor applications at 65nm and beyond.

To read an expanded version of this article, which outlines how you can use advanced darkfield inspection in production applications today, go to: www.kla-tencor.com/yieldOctober2

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AGENCY: Right Hand Communications
CLIENT: KLA-Tencor
JOB #: 9181
JOB NAME: Advertorial - English version
 SPECS: Full Page AD (2/C)
Bleed: 8.125" x 10.75" Trim: 7.875" x 10.5" Live: 7.125" x 9.75"