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Integrated Metrology for Poly CMP Process Control

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Abstract
In poly CMP, a process window is defined by two process extremes: over-dishing that is the result of over-polish especially on coarse patterns, the other being poly residue due to under-polish. Advanced devices which employ timely shrinkage of design and experience decreased depth of focus (DOF) require a tighter process control due to reduced process window and increased variance in wafer to wafer, within wafer and within die.

A tight control over the Poly-CMP process provides an overall performance to isolation structures in CMOS Flash Memory devices. Within wafer planarity has to be strictly controlled to ensure electrical performance of the devices.

In order to ensure no poly residues remained over or between electrical structures in field oxide area, and also to maintain a proper final poly thickness in active area, a set of measurements should be implemented. Therefore, metrology tools employed in the poly-CMP must be capable of providing measurements on a wide range of poly thickness from a thin layer of poly residues to a thick poly layer often encountered in the processes. In order to set proper CMP parameters for an advance process control (APC) which became an essential part in the CMP, precise measurements of the thick poly as well as the underneath oxide layer is needed prior to polishing, and an accurate measurement of post CMP thicknesses are crucial.

As the poly thickness increases, it blocks light penetration and becomes oblique from the shorter wavelength end of the spectrum. For a typical poly thickness encountered in the poly-CMP process the measurement of both the top poly and the underneath oxide becomes not feasible by the VIS to UV spectrum.

NovaScan Integrated Metrology tools provide a broadband capability necessary for the measurement of the thick poly layer hence enabling the use of APC for this process step. This paper will elaborate the needs of Integrated Metrology in the Poly CMP process step and will suggest a solution as well as field proven implementation path as a successful APC scheme.

Topics : Poly CMP process control, broadband capable integrated metrology, measurement of top poly and sublayers.
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