APPLICATION NOTE NO. 20101833

ALUMINUM OXIDE FILM THICKNESS MEASUREMENT

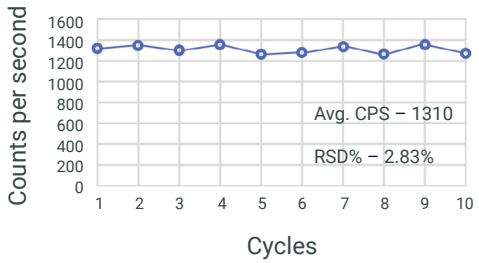
BOND PAD APPLICATION / DEVICE WAFER

INTRODUCTION

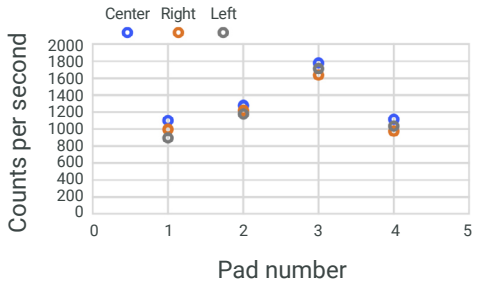
Elemental analysis and detection of light (low-Z) elements is performed with a state-of-the-art, light-element detector and with helium purging of the air between the X-ray beam and wafer. These light elements represent the evolving trend of elements affecting the semiconductor industry in applications such as glass substrate, photoresist, isolators and more.

These elements are undetectable and/or overlapped with other elements in the sample when analyzed with other tools. Onyx EDXRF solutions open a wide range of capabilities, both in-line and off-line, for many semiconductor applications, enabling analysis of light (low-energy) elements such as magnesium, fluorine, oxygen, nitrogen and carbon.

REPEATABILITY



ACROSS WAFER VARIATION

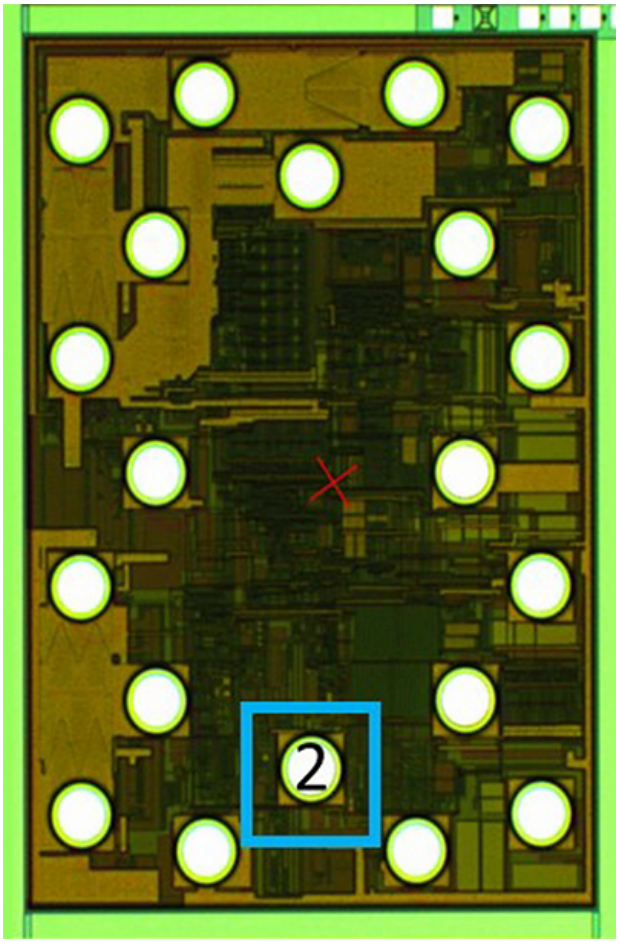


REPEATABILITY TEST

- Pad number two was measured 10 times for repeatability test
- Center die was selected
- Optimization of precision and throughput can be done once customer defines requirements

SAMPLE DESCRIPTION

- Each die contains 20 pads
- Ground pads and signal pads
- Customer indicated that the oxide thickness was different between the two types of pads



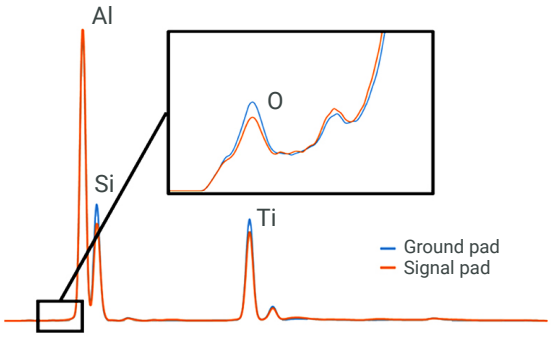
Magnification: X2

MEASUREMENT OBJECTIVE

One wafer was received for XRF analysis.

Performed analysis:

- XRF comparison of oxide thickness on aluminum bond pads across the wafer
- Oxygen level monitoring from the Al_2O_3 layer
- Repeatability for oxygen



XRF spectra comparison of the two pad types.

SUMMARY

- Notice that the counts captured from each pad within a die were slightly different but very consistent on the same pad number on several die across the wafer. The material differences between pads within a die are due to underlying film artifacts. A simple calibration will eliminate artifacts and present the true oxide thickness.
- Onyx XRF capability is very sensitive to thickness variation. Any element can be analyzed both qualitatively and quantitatively.
- Light elements can be detected and analyzed.
- To accurately calculate layer thickness from the XRF intensity, known standards are required.
- RSD percent for oxygen detection in Al_2O_3 thin layer: 2.83 percent (at 50 seconds).
- Acquisition time and precision can be optimized per customer requirements.

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