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WAFERMAP for Windows

APPLICATION NOTE 1: Metrology Self Test

Many metrology tools such as ellipsometers require daily monitoring to check for any drift or problems. Typically daily measurements will be done using a known test wafer or a calibrated standard wafer. Therefore it is necessary to compare actual measurements with earlier ones regarding mean, standard deviation, maximum, minimum etc.

In the following example an additional self test method will be shown. It allows to check for the condition of metrology tools without comparing tests with earlier results. The self test requires only one randomly selected wafer, it is not necessary to use a calibrated standard wafer.

Two measurements have to be perfomed, one as standard and one with the wafer turned by 180°. Afterwards the map of the turned wafer will be rotated back by 180° using WAFERMAP. Now the two maps can be compared by either subtracting from each other or calculating the ratio between both. If the metrology tool is in good condition the difference should always be 0 and the ratio should be 1. If any difference occurs, the reason might be a repeatablity problem (especially when differences are very small) or a general problem of the metrology tool.

This test can be done in addition to already established test procedures, especially for new equipment, where no experience with the tool exists.

Example:

A 200mm oxidized wafer was choosen and a standard oxide thickness map was generated using an ellipsometer. Edge exclusion was 5mm, 121 points were measured in a circular arrangement.The same wafer was measured two times, first in standard mode (map „A“) and a second time 180° turned on the vacuum chuck of the ellipsometer (map „B“). Now map B was rotated by 180° (in WAFERMAP for Windows select „Edit“ → „Operation“ → „Rotate Grid” → enter the angle 180° → click on „Perform Operation” → click on „OK”). The resulting map B’ is shown below.

Then the difference between map B’ and map A was calculated (in WAFERMAP for Windows select „Multi-File-Operations“ → „Compare“ → select the files A and B in the 2 windows on the left → choose „X-Y“ in the center → click on „OK”). The resulting map C is shown below. Also the ratio between map B’ and A was calculated (in WAFERMAP for Windows select „Multi-File-Operations“→ „Compare“ → select the files A and B in the 2 windows on the left → choose „X/Y“ in the center → click on „OK”). The resulting map D is also shown below.

It is obvious, that there is a large difference between both maps A and B’. The reason might be an misalignment of the vacuum chuck itself, or larger particles between chuck and wafer and therefore a misaligned wafer.

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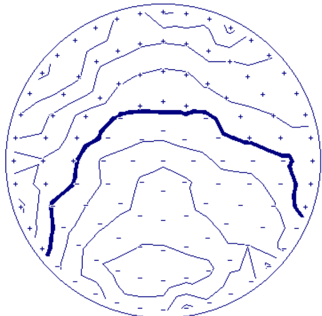
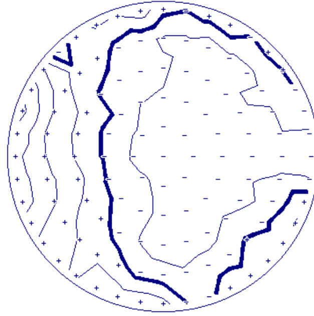
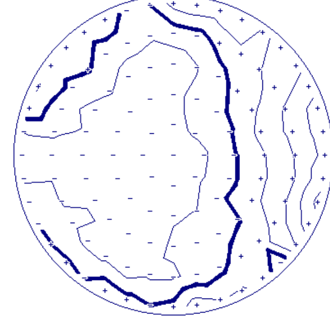
Figures:

Standard measurement	180° turned wafer	180° rotated map
A	**B**	**B'**

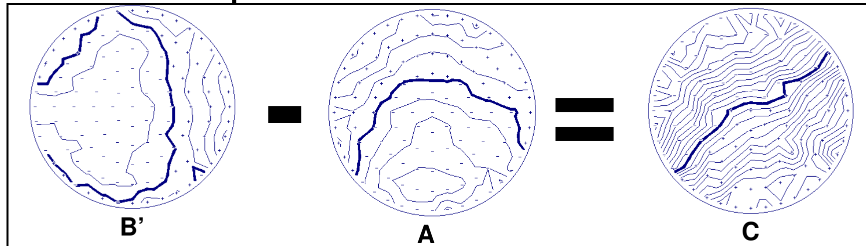


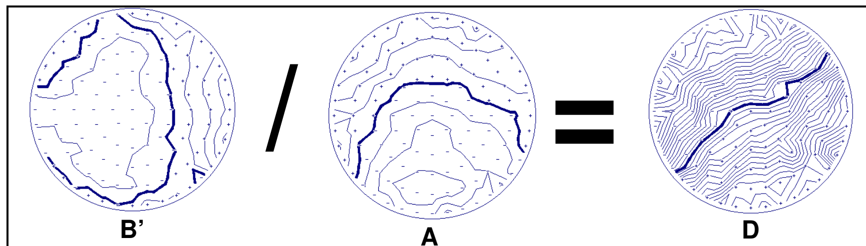




Mean: 6.8nm	Mean: 6.8nm	Mean: 6.8nm
Max: 7.09nm	Max: 7.09nm	Max: 7.09nm
Min: 6.54nm	Min: 6.67nm	Min: 6.67nm
Std.Dev: 2.05%	Std.Dev: 1.37%	Std.Dev: 1.37%
Range: 0.56nm	Range: 0.42nm	Range: 0.42nm
Interval: 1.0%	Interval: 1.0%	Interval: 1.0%

Mathematical Operations:





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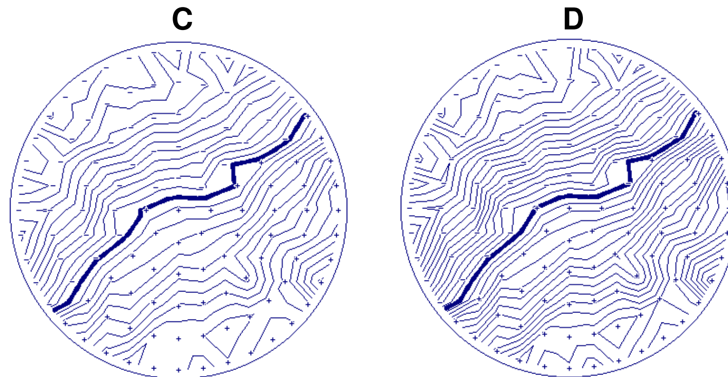

Mean: 0.0nm
Max: 0.28nm
Min: -0.24nm
Range: 0.53nm
Interval: 2000.0%

Mean: 1.0
Max: 1.04
Min: 0.97
Range: 0.08
Interval: 0.2%

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