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Wafer-Chuck Influence on Features

A study of Feature-Profile variations using Weir PW

1.1 Concept

Post-Exposure Bake plates support wafers kinematically on 3 pins as shown in figure 1. Each pin is 2 mm in diameter and is located approximately 30 mm from the center of the wafer. The remainder of the wafer is then suspended approximately 75 um above the heating plate.

Data from a Nanometrics OCD Scatter tool is next analyzed using the Weir PW software suite to investigate if these pins can influence feature structures.

1.2 Observations

Data included whole-wafer metrology of 25x28 mm dice variables:

- Bottom Critical Dimensions (BCD)
- Top Critical Diemensions (TCD)
- Side-wall-angle (SWA)
- Photoresist Thickness (T3) and
- Anti-Reflective coating (BARC) thickness.

In the analyses, Weir PW applied a 6th order whole-wafer model to the data to remove wafer tilt and flatness. The average field was also removed to allow these small perturbations to be viewed.

The BARC uniformity is plotted in figure 2. Notice the single hotspot located at 3 o'clock; 30 mm radius on the wafer. The point can be seen a little clearer when plotting points in the enclosed box. The effect covers about 4 mm, twice the diameter of the pin.

Figures 3 and 4 show the distribution of Photoresist and BCD contours. The structures bias BCD values by about 2.5 nm. Plots show three areas of influence; seen at the 30 mm radius on 60 degrees intervals. Each area is approximately 4 mm in diameter.

TCD and SWA variables did not replicate these effects.

1.3 Conclusion:

Bake-plate support pins do influence feature uniformity.

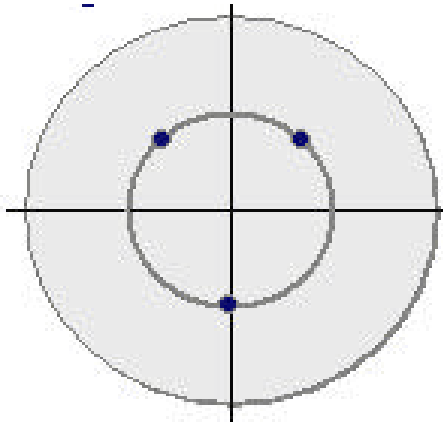

Fig. 1: Bake-plate support pin structure. Pins are 2mm diameter and located on the 30 mm radius, at 60 degree intervals.

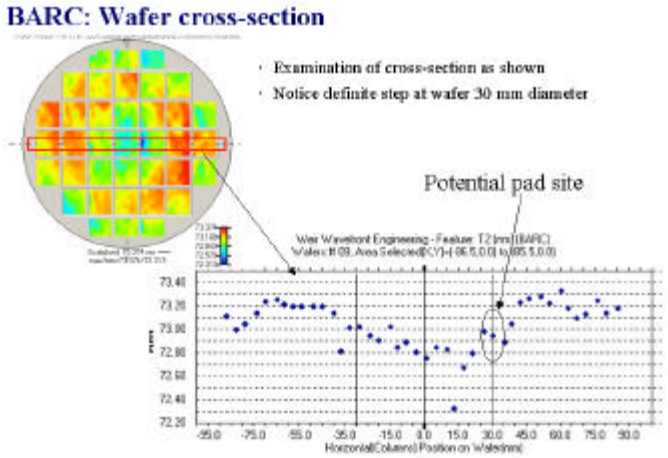

Fig 2: BARC uniformity with pin "hotspot"

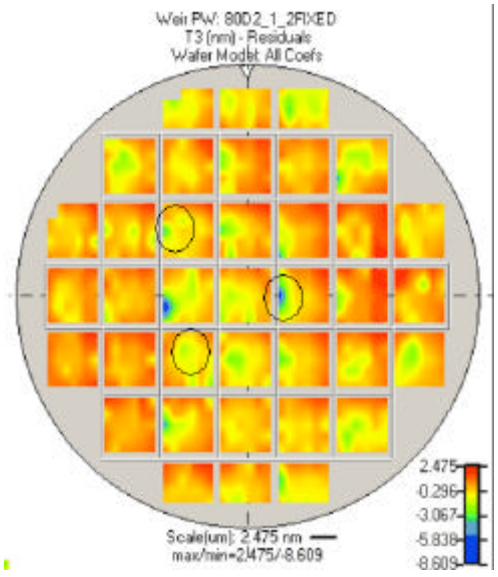

Fig. 3: Photoresist contour showing location of support pins; influenced areas however are now slightly shifted to the left.

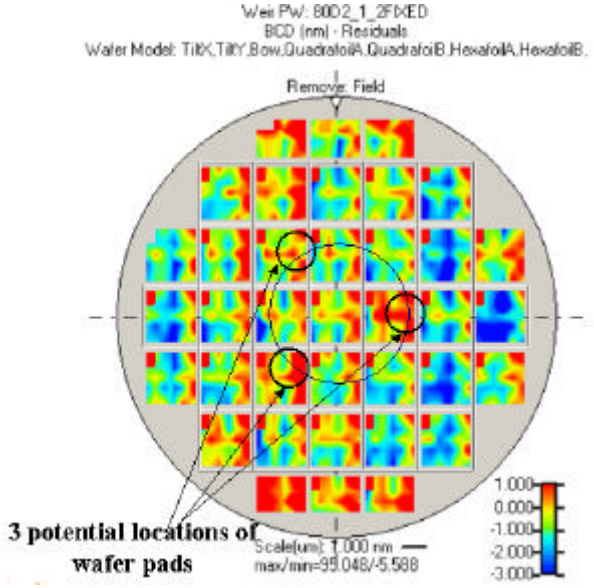

Fig. 4: Bottom CD high points resulting from influence of wafer-chuck support pins.