HSQ Post Apply Bake Experiment
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HSQ Post Apply Bake Experiment

• Purpose
  – To identify, and confirm the effect of different post apply bake conditions for HSQ
Process Condition

- XR-1541 (HSQ) 6% on a 1” square silicon substrate piece
- Spin conditions = 5000 rpm, 2500 rpm/s, 60 sec
- post apply bake (various conditions)
- average resulting thickness (pre-develop) ~ 116nm
- Develop: MF-319 for 70 seconds, DI water rinse for 60 seconds, nitrogen blow dry
Experiment 1

• 3 post apply bake conditions
  • 80 C 4 min
  • 150 C 2 min
  • 250 C 2 min
Residues around the square starts to appear at dose of 600uC/cm^2.

Squares of negative resist (HSQ) with different doses. Starting from the bottom left square to the bottom right square, doses are: 200, 250, 300, 350, 400, 450, 500, 550, 600, 650 (uC/cm^2). Starting from the top left square to the top right square, doses are: 700, 750, 800, 850, 900, 950, 1000, 1150, 1300, 1500 (uC/cm^2)
Residues around the square start to appear at dose of 600 uC/cm².

Squares of negative resist (HSQ) with different doses. Starting from the bottom left square to the bottom right square, doses are: 200, 250, 300, 350, 400, 450, 500, 550, 600, 650 (uC/cm²). Starting from the top left square to the top right square, doses are: 700, 750, 800, 850, 900, 950, 1000, 1150, 1300, 1500 (uC/cm²).
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Residues around the square starts to appear at dose of 350uC/cm².
Summary of different bake conditions

- small difference in thickness vs. dose for the various bake conditions at lower doses (left graph)
- difference in residue around 50 x 50 um feature with different bake conditions (see right table)
- lower bake temperature can achieve a higher post develop resist thickness without residue by using higher dose (see right table)
Experiment 2

• Purpose
  • see if experiment 1 is repeatable
  • evaluate no bake
Residues around the square starts to appear at dose of 600uC/cm^2.

Squares of negative resist (HSQ) with different doses. Starting from the bottom left square to the bottom right square, doses are: 200, 250, 300, 350, 400, 450, 500, 550, 600, 650 (uC/cm^2). Starting from the top left square to the top right square, doses are: 700, 750, 800, 850, 900, 950, 1000, 1150, 1300, 1500 (uC/cm^2)
Thickness vs. Dose (80C bake for 4min)

Normalized Thickness

Residues around the square starts to appear at dose of 550uC/cm^2.

Squares of negative resist (HSQ) with different doses. Starting from the bottom left square to the bottom right square, doses are: 200,250,300,350,400,450,500,550,600,650 (uC/cm^2). Starting from the top left square to the top right square, doses are: 700,750,800,850,900,950,1000,1150,1300,1500 (uC/cm^2)
Residues around the square starts to appear at dose of 500uC/cm^2.

Squares of negative resist (HSQ) with different doses. Starting from the bottom left square to the bottom right square, doses are: 200, 250, 300, 350, 400, 450, 500, 550, 600, 650 (uC/cm^2). Starting from the top left square to the top right square, doses are: 700, 750, 800, 850, 900, 950, 1000, 1150, 1300, 1500 (uC/cm^2)
Thickness vs. Dose (250C bake for 2min)

Residues around the square starts to appear at dose of 400uC/cm^2.

Squares of negative resist (HSQ) with different doses. Starting from the bottom left square to the bottom right square, doses are: 200,250,300,350,400,450,500,550,600,650 (uC/cm^2). Starting from the top left square to the top right square, doses are: 700,750,800,850,900,950,1000,1150,1300,1500 (uC/cm^2)
Summary of different bake conditions

- Some differences to experiment 1 but general trend is repeatable
- There is no significant difference in thickness vs. dose for the various bake conditions (left graph)
- BUT, there is a difference in residue around 50 x 50 um feature with different bake conditions (see right table)
- Lower bake temperature can achieve a higher post develop resist thickness without residue by using higher dose (see right table)