Electron beam lithography with alignment of two layers using FOX16

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A few important points in data conversion and mask processing of multilayered Ebeam lithography is discussed. The conversion is done using Layout Beamer software at EPFL CMi cleanroom.

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Here are the dose and beams that were used:

- 1200 uC/cm2
- 100na_300um (spot size: 55nm – grid size: 30nm)

Wafer is cleaned with 5min O_2 at high power.
Ebeam coating: Dispensing 2 ml of FOX16 and spinning at the speed of 1700 rpm. Loading on the holder and doing manual alignment using dicing markers

Manual alignment on Ebeam holder:
•Fixing the holder on the stage (do not forget the locking screw)
•Using minimum magnification (0.63) check on dicing marker at one side of the wafer and move horizontally to the next one on the other side of the wafer
•Use the rotation screw to fix for half the vertical misalignment and fix the rest with stage movement
•Repeat this procedure several times to land on the same spot on both sides of the wafer (usually 2-3 repetition is enough)

Holder 5 was used. Markers are located at (x,y)mm ~ (46,19)mm with respect to the Faraday cup (0,0) this is the bottom left marker. The one I use for the first layer. It seems like that it can be used for writing.
The electronic stability of the beam was about 15nm drift in both x and y axis over 1min. The chips are aligned using the chip alignment technique that I have been using throughout the entire process.
Beam loading code line: **pg arch rest beam 100na_300um**
The 100na beam failed first time to find the alignment markers (it was able to find the pre-marker grid). After failing once, I used the same beam again and it was able to find. Possible reason is high initial mismatch of the coordinates. And by doing it once, it roughly aligned and was able to find the markers for the second time.
Ebeam development:

- 2min in TMAH 25% with stirring and agitation of the beaker
- Rinsing
- 1min N_2 gun drying

Overlap of the patterns are checked using optical microscope and SEM after etching and before: When saving your final mask, have everything in one GDS and load that into your beamer conversion software. If not, the software will assume some random limit

optimization of your GDS boarders and your patterns can come up misaligned.

Solution 1: Always keep the design boarder fixed on all your converted GDS files and set them manually.

Solution 2: Another way is to include a dummy wafer boarder layer in all your GDS files that fixes the automatic boarder selection to the upper bounds. For example that layer can be a circle with your wafer size diameter (100 mm for a 4 inch wafer).