Special Topics on Basic EECS I Design Technology Co-Optimization

Lecture 8

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L8

Selectively etch the mandrels.

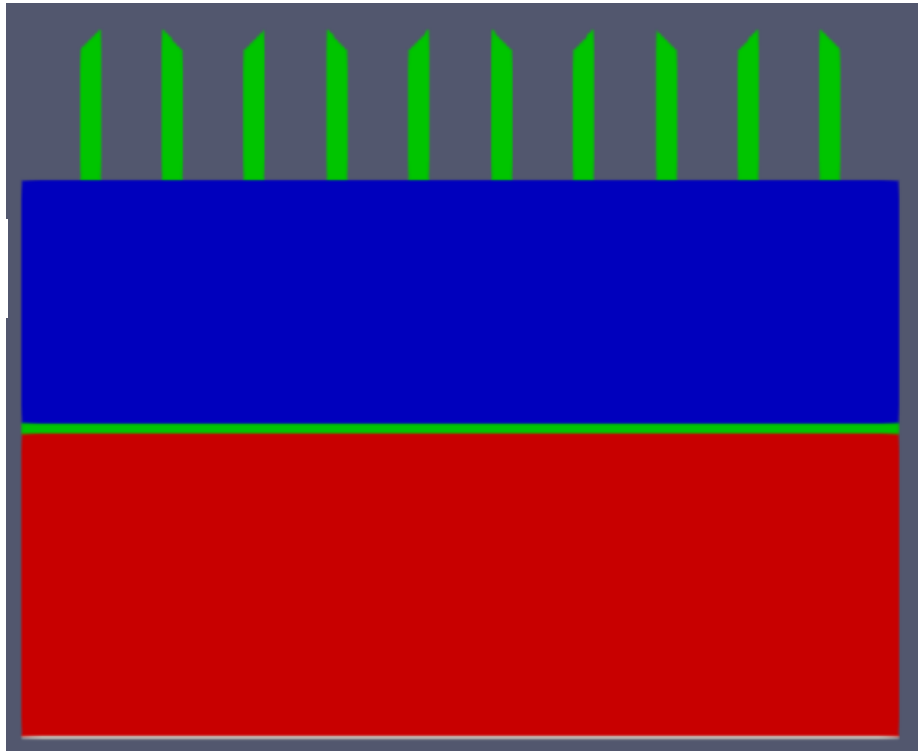
- Without selectivity, we fail to get the wanted shape.
  - For selectivity, (just like a mask) define a model.

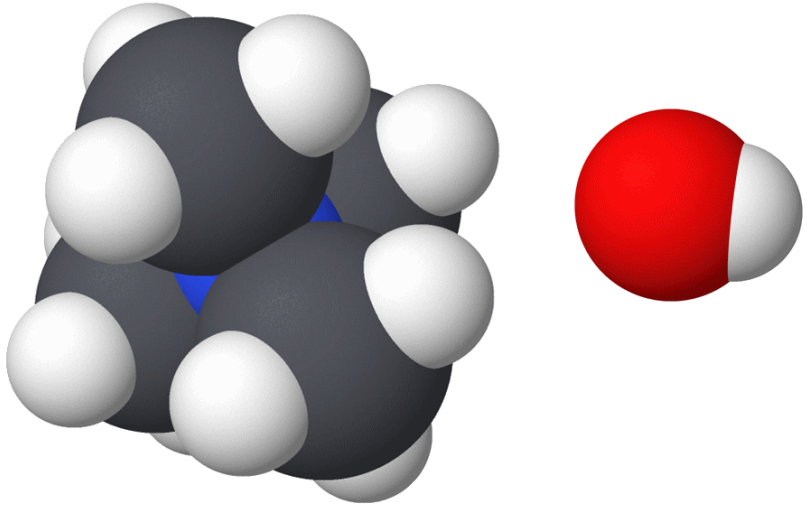
```
model (name="model_fin") {
   select (region="AmorphousSilicon")
}
```

  - Selected regions are etched.
  - At present, selection is binary.

Removal of the mandrels

- Try `etch (model="model_fin",thickness=50)`
  - Now, only mandrels are removed.
  - TMAH
    (Tetramethyl ammonium hydroxide)
    Molecular formula: $N(CH_3)^{4+}\ OH^-$
    Si (100): 500 nm min^{-1}
    Si_3N_4: ~0
    SiO_2: 0.2 nm min^{-1}





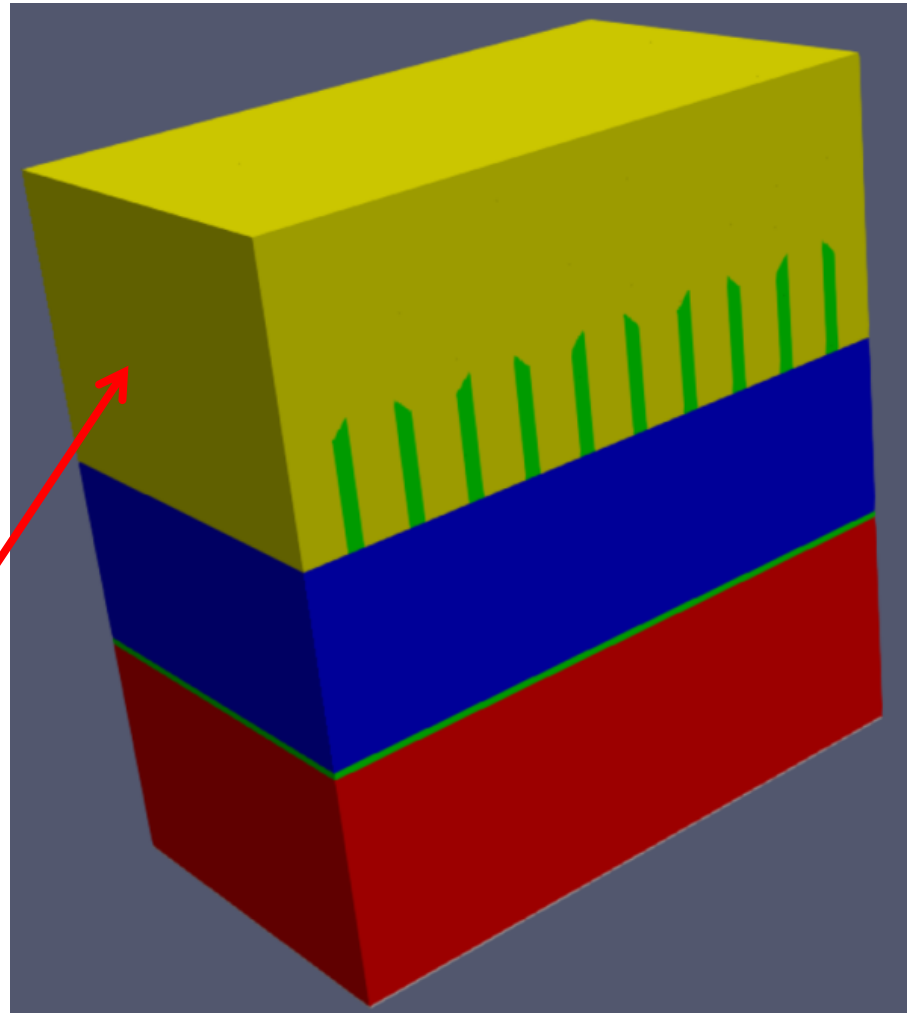
3D spacefill model
of TMAH (Wikipedia)

Spin-coat a layer of photoresist.

- We have no special comment for the spin coating.
  - Try the following:

```
depo (region="Photoresist",thickness=120)

cmp (position=303)
```

(It's not deposition.)
(It's not cmp.)



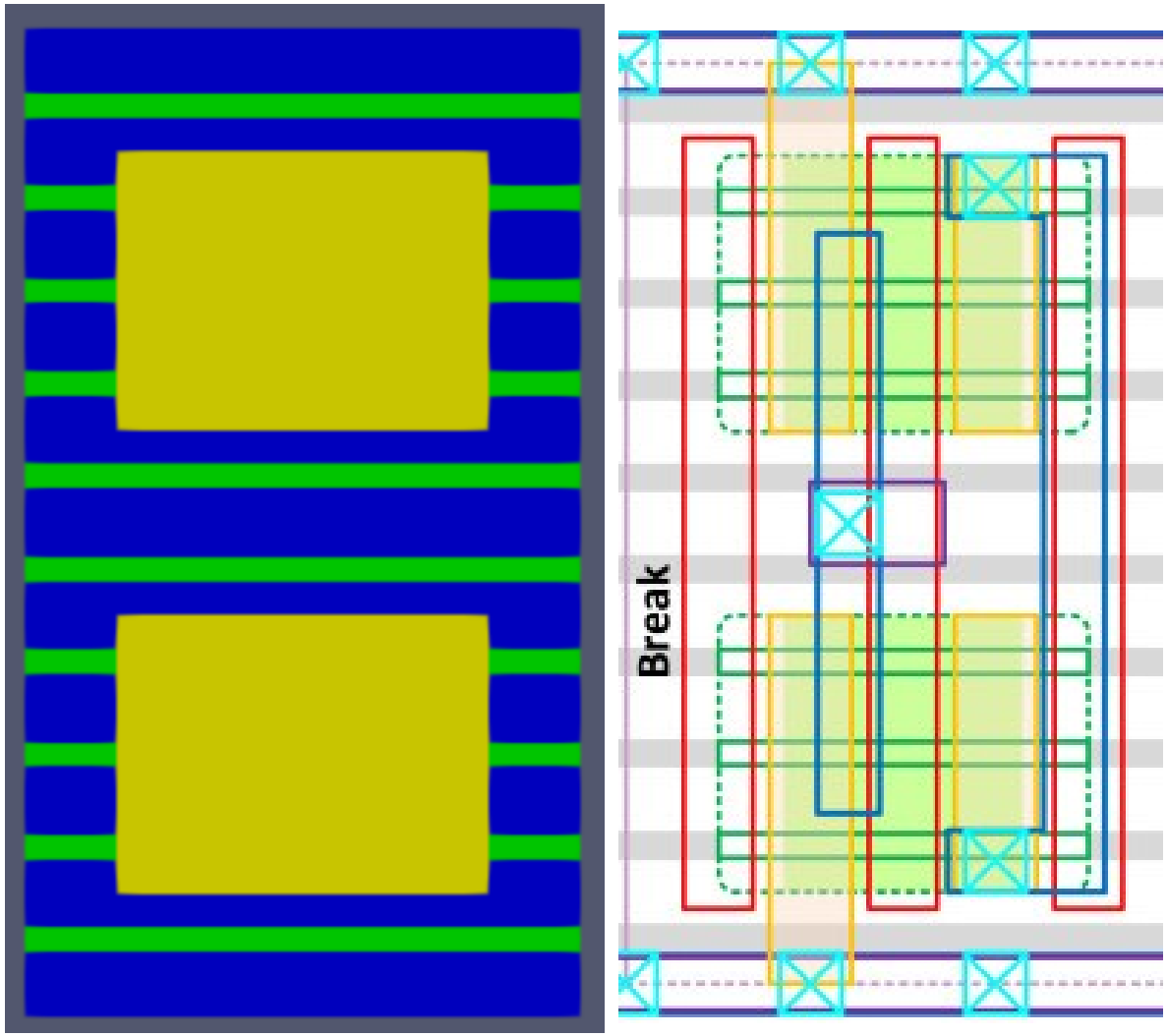
Photoresist
(Not mandrel)

Active region

- PR patterned
  - Try the following:

```
mask (name="mask_active") {
   rectangle (x0=27,y0= 36,x1=135,y1=117)
   rectangle (x0=27,y0=171,x1=135,y1=252)
}

model (name="model_pr") {
   select (region="Photoresist")
}

etch (mask="mask_active",model="model_pr",thickness=120)
```

  - Then, etch SiO_2 and Si_3N_4. (In reality, they can have different etch rates.)

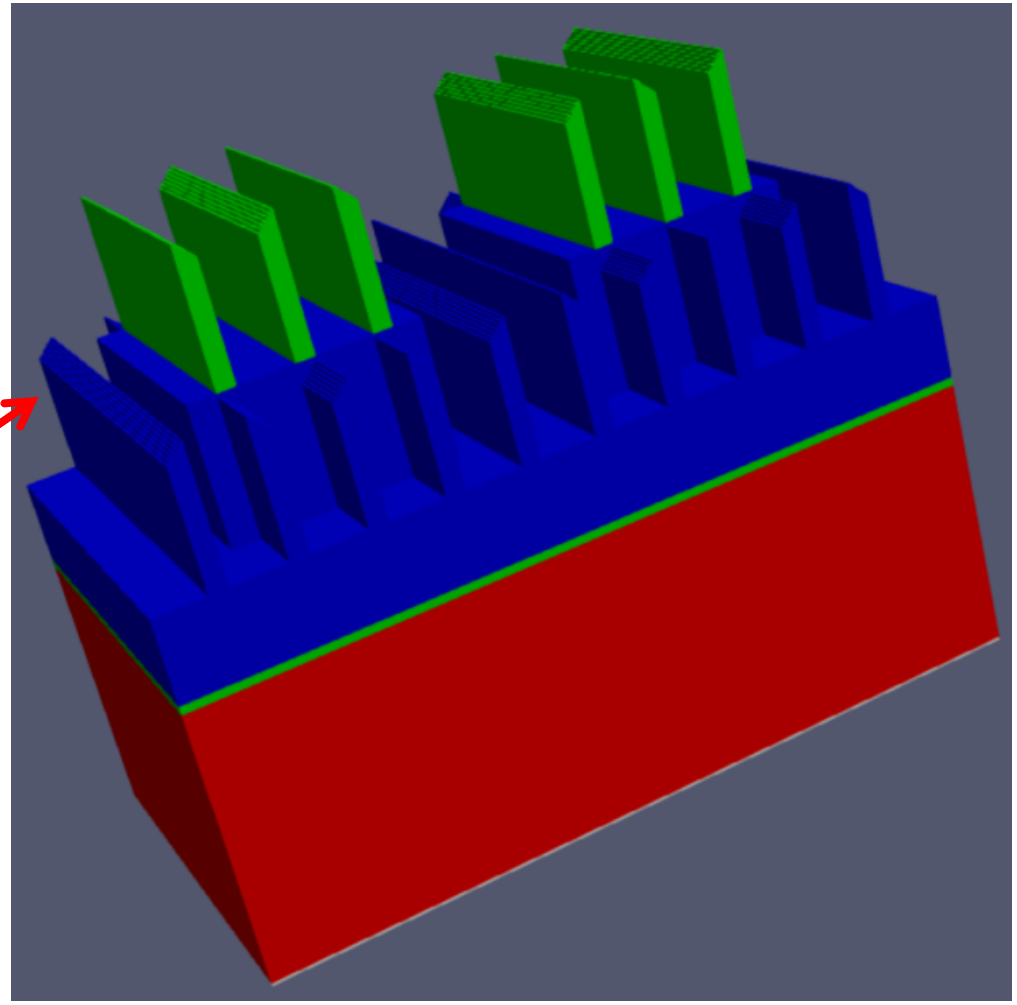


Inverter layout (ASAP7 PDK)

Remaining pattern

- It should be transferred to the silicon region.

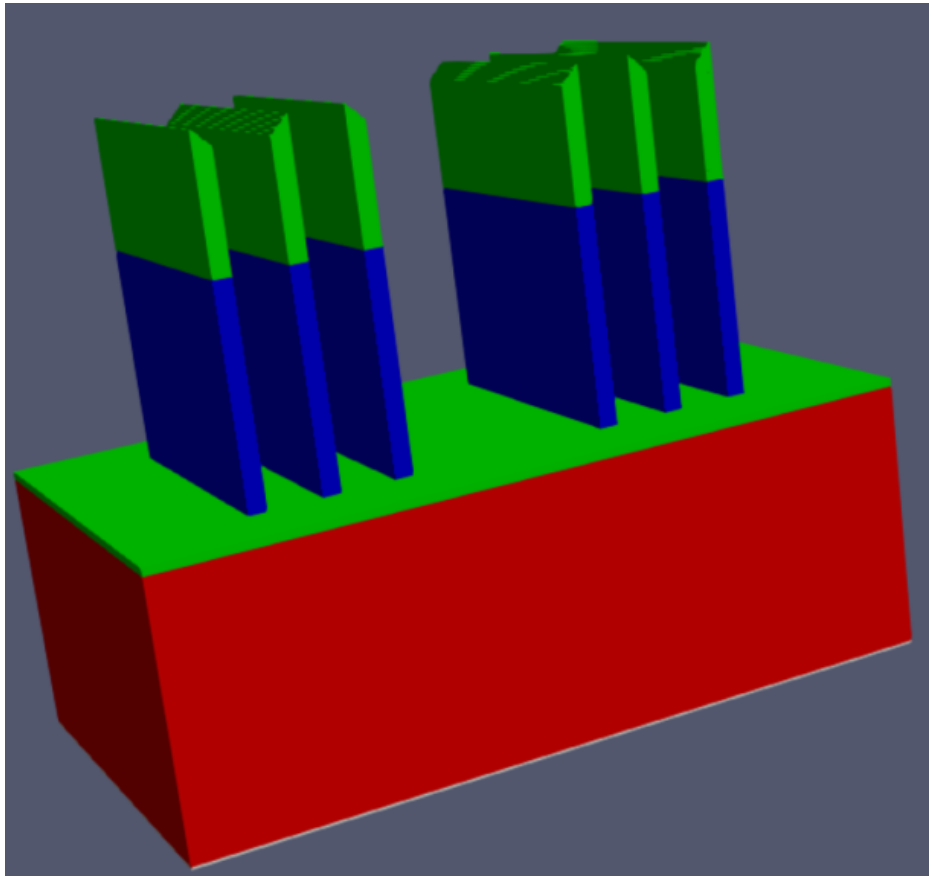
```
model (name="model_fin_block") {
    select (region="SiO2")
    select (region="Si3N4")
}

etch (model="model_fin_block",thickness=50)

etch (model="model_pr",thickness=120)
```

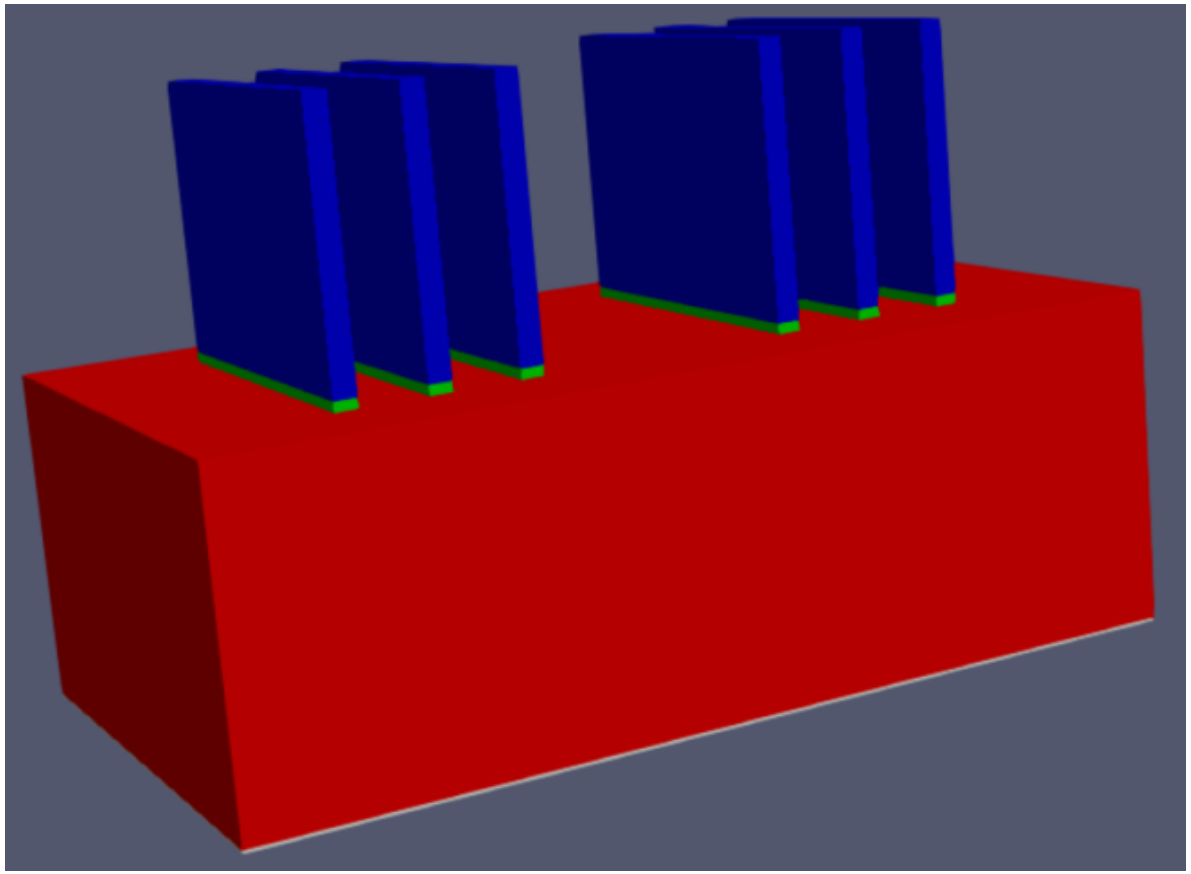


Si_3N_4 surface obtained by the same etch rate
(In reality, it may be smoother.)

Etch only Si_3N_4.

- Pad oxide as the etch stop layer
  - Then, remove the oxide layers.





Homework#8

- Due: 08:00 on Oct. 1
- Submit a report through the GIST LMS system.
  - By using the AngstromCraft code, follow L8 lecture material.
  - Your report must show structures and the input file.

Thank you!