EE410 CMOS PROCESS FLOW

Week 1: Preparation

1. Wafer Start: Starting material is n-type silicon [STEP 00.000]
   - Standard piranha clean

2. Photomask #0: Zero level marks [STEPS 0.00-0.22]
   - Singe and prime (***yes*** oven)
   - Resist coat (***svgcoat1/2,*** program 7)
   - Expose (***asml,*** with reticle 45023981A009, Job Name: ee410LOCOSR1)
   - Post exposure bake (***svgcoat1/2,*** programs 9,1)
   - Develop (***svgde1v/2,*** program 3,1)
   - Inspect and rework as needed

3. Silicon etch [STEPS 0.24-0.26]
   - Hand scribe wafer ID
   - Silicon Oxide etch (***amtetcher***, program 4 for 5 minutes)
   - Standard Hard Resist Strip (***wbnonmetal***, 20 min piranha)

4. Blanket Implant [STEPS 0.28-0.30]
   - Standard pre-diffusion clean (***wbdiff)***
   - Implant: 150 keV, P31, 1.5 X 10^{13} cm $^{-2}$

5. LOCOS Isolation [STEPS 0.32-0.38]
   - Standard pre-diffusion clean (***wbdiff)*** Pad Oxidation (***tylan1/2***): 800°C ramped in 5 minutes to 850°C, followed by a 15 min. steam growth, followed by another 5 minutes in pure O_2, then ramped down to 800°C in 5 minutes in an inert ambient, ≈ 200Å
   - Nitride Deposition (tylan nitride): 45 minutes at 785°C
   - Inspection and thickness measurement

Week 1: Lab Section

6. Photomask #1: Isolation [STEPS 1.00-1.190]
   - Singe and prime (***yes*** oven)
   - Resist coat (***svgcoat1/2,*** program 7)
   - Expose (***asml,*** with reticle EE 410 2008 1, Job Name: ee410LOCOSR1)
   - Post exposure bake (***svgcoat1/2,*** programs 9,1)
   - Develop (***svgde1v/2,*** program 3,1)
   - Inspect and rework as needed

7. Isolation Etch [STEPS 1.24-1.26]
   - Nitride Etch (***drytek2***)
   - Inspection and thickness measurement

Week 2: Preparation

8. Field Oxidation and Nitride Strip [STEPS 1.28-1.40]
   - Field Oxidation (***tylan1/2***): 800°C ramped in 20 minutes to 1000°C for 1hr, 45 min. wet oxide growth then ramped to 800°C in 20 minutes, ≈ 5,400Å.
   - Inspection and thickness measurement
   - Oxidized Nitride Strip (***wbnonmetal***): 6:1 BOE, ~45 sec.
   - Nitride Wet Strip (***wbnonmetal***): Hot Phosphoric Acid, 155°C, ~60 min.

- Inspection and thickness measurement

9. Photomask #2: P-Well [STEPS 2.000-2.20]
    - Singe and prime (***yes*** oven)
    - Resist coat (***svgcoat1/2,*** program 7)
    - Expose (***asml,*** with reticle EE 410 2008 1, Job Name: ee410LOCOSR1)
    - Post exposure bake (***svgcoat1/2,*** programs 9,1)
    - Develop (***svgdev1/2,*** program 3,1)
    - Inspect and rework as needed
    - Postbake @110C, 30 min.

10. P-Well Implant: [STEP 2.22]
    - 180 keV, B^{11}, $4.0x10^{13}$ cm^{-2}

Week 2: Lab Section

11. Kooi Oxidation and Drive-in [STEPS 2.24-2.30]
    - Standard Hard Resist Strip (***gasonics***, program 013, ***wbnonmetal***, 20 min piranha)
    - Standard pre-diffusion clean (***wbdiff)***
    - Kooi Oxidation and Drive-In: (***Thermco1/2***) 15min. wet oxidation at 850°C and 300 min. N_2 @ 1000°C, ~200Å
    - Inspection and thickness measurement

Week 3: Preparation

12. Gate Oxidation/Poly Deposition [STEPS 2.32-2.42]
    - Standard pre-diffusion clean (***wbdiff)***
    - Sacrificial oxide strip (***wbdiff)***
    - Gate Oxidation (***tylan1/2***): 20 min. dry oxidation at 900°C, ~100Å
    - LPCVD Polysilicon Deposition: 1hr, 50min at 560°C, ≈ 5000Å
    - Inspection and thickness measurements

13. Photomask #3: Gate [STEPS 3.00-3.20]
    - Singe and prime (***yes*** oven)
    - Resist coat (***svgcoat1/2,*** program 7)
    - Expose (***asml,*** with reticle EE 410 2008 1, Job Name: ee410LOCOSR1)
    - Post exposure bake (***svgcoat1/2,*** programs 9,1)
    - Develop (***svgdev1/2,*** program 3,1)
    - Inspect and rework as needed

Week 3: Lab Section

14. Poly Etch [STEPS 3.22-3.24]
    - Plasma poly etch (***P5000 ChC***): Cl/HBr
    - Standard Hard Resist Strip (***gasonics***, program 013, ***wbnonmetal***, 20 min piranha)

15. Photomask #4 – N-SELECT [STEPS 4.00-4.22]
    - Singe and prime (***yes*** oven)
    - Resist coat (***svgcoat1/2,*** program 7)
    - Expose (***asml,*** with reticle EE 410 2008 1, Job Name: ee410LOCOSR1)
    - Post exposure bake (***svgcoat1/2,*** programs 9,1)

- Develop (***svgdev1/2,*** program 3,1)
- Inspect/rework as needed
- Postbake @110C, 30 min.

Week 4: Preparation

16. N- Source and P-Dope Implants [STEPS 4.24-5.00]
    - N-Source/Drain Implant: 100 keV, As^{75}, $3x10^{15}$ cm^{-2}
    - Standard Hard Resist Strip (***gasonics***, program 014, ***wbnonmetal***, 20 min piranha)
    - P-Dope Blanket Implant: 80 keV, BF_2^{49}, 5x 10^{14} cm^{-2}

Week 4: Lab Section

17. LTO Deposition [STEPS 5.30-5.32]
    - Standard pre-diffusion clean (***wbdiff)***
    - LTO Deposition (***tylanbpsg***, program "LTO400PC): LPCVD @ 400°C, ≈ 6000Å
    - Oxide thickness measurements

Week 5: Preparation

18. LTO Densification [STEPS 4.320-4.260]
    - Modified pre-diffusion clean (***wbdiff)***
    - LTO Densification (***tylan1/2***, program WET950): Ramped process 30min. in steam at 950°C.
    - Oxide thickness measurements

19. Photolithography #6 – Contact Holes [STEPS 6.00-6.20]
    - Singe and prime (***yes*** oven)
    - Resist coat (***svgcoat1/2,*** program 7)
    - Expose (***asml,*** with reticle EE 410 2008 2, Job Name: ee410LOCOSR1)
    - Post exposure bake (***svgcoat1/2,*** programs 9,1)
    - Develop (***svgdev1/2,*** program 3,1)
    - Inspect and rework as needed

Week 5: Lab Section

20. Plasma Oxide Etch [STEPS 6.22-6.26]
    - SiO_2 RIE in AMT 8100: Program 3, CHF_3/O_2
    - Standard Hard Resist Strip (***gasonics***, program 014, ***wbnonmetal***, 20 min piranha)

Week 6: Preparation

21. Metal Deposition [STEPS 6.28-6.30]
    - Standard pre-metal clean (***wbdiff)***
    - Al/Si Deposition in Gryphon Sputtering System: ≈ 10,000Å
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22. Photolithography #7 – Metal [STEPS 7.00-7.20]
    - Singe and prime (***yes*** oven)
    - Resist coat (***svgcoat1/2,*** program 8)
    - Expose (***asml,*** with reticle EE 410 2008 2, Job Name: ee410LOCOSR1)
    - Post exposure bake (***svgcoat1/2,*** programs 9,2)

- Develop (***svgdev1/2,*** program 4,2)
- Inspect and rework as needed

Week 6: Lab Section

23. Metal Etch [STEPS 7.20-6.240]
    - Al/Si Dry Etch in P5000 ChA: Cl_2
    - Post-Etch Meta Passivation (***wbmetal***, dump rinse for 5 cycles, spin-rinse-dry)
    - Std Metal Resist Strip (***wbmetal***, PRX-127 for 20 min)

Final Preparation

24. Anneal/Alloy [STEPS 7.26-7.30]
    - Pre-furnace Metal Clean (***wbmetal***, PRS1000 @ 40°C, 10', spin-rinse-dry)
    - Anneal/Alloy (***tylanfga)***: 45 min. in forming gas (10% H_2 in N_2) at 400°C

Electrical Test