EBL 950/495 PMMA Bilayer Process for Nano-dipole Antenna

Kevin Nordquist

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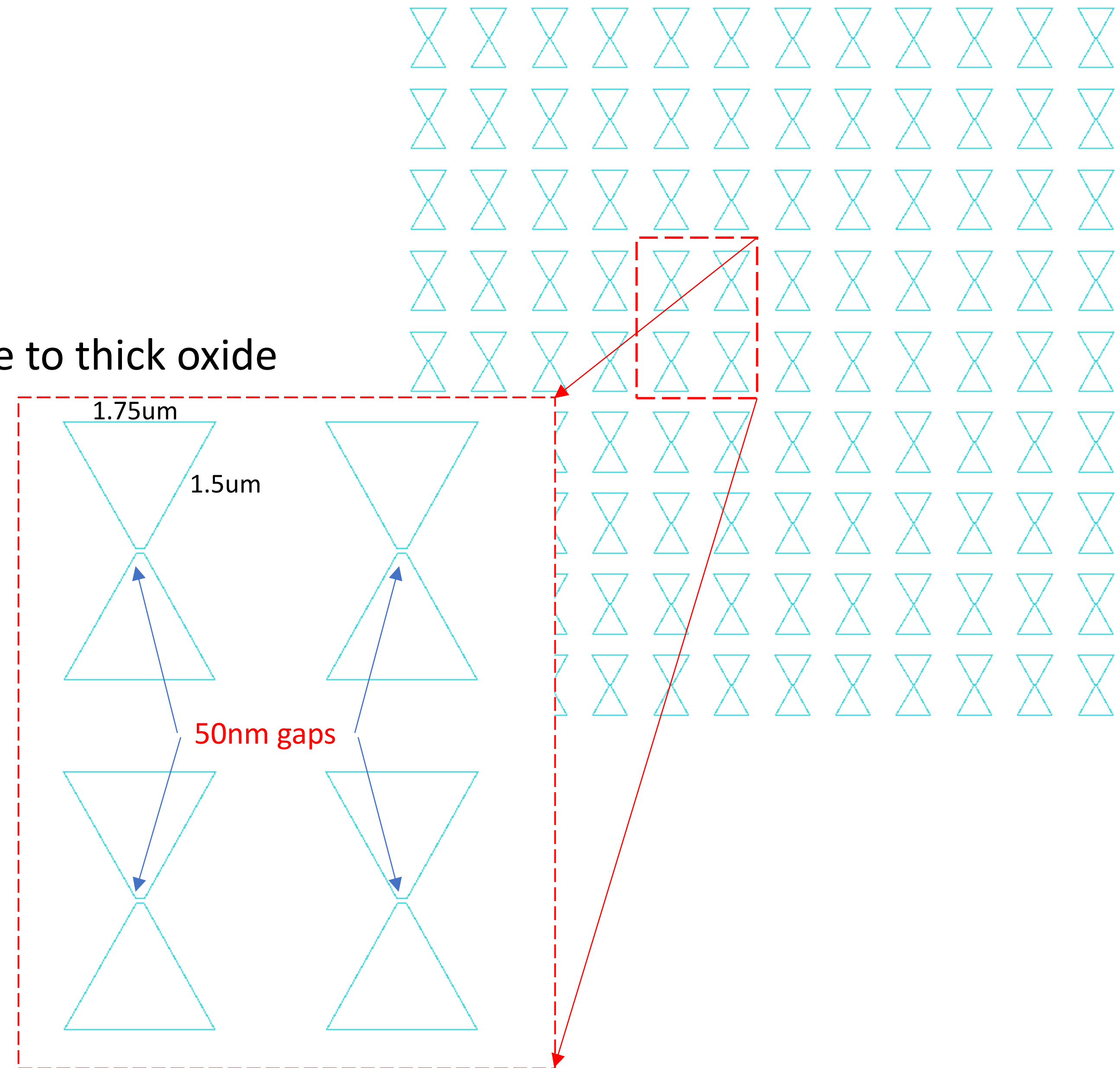
Test Wafer

- 100mm Starting Test Wafer
  - Si with 1μm thermal SiO_2
    - Charge dissipation layer required due to thick oxide

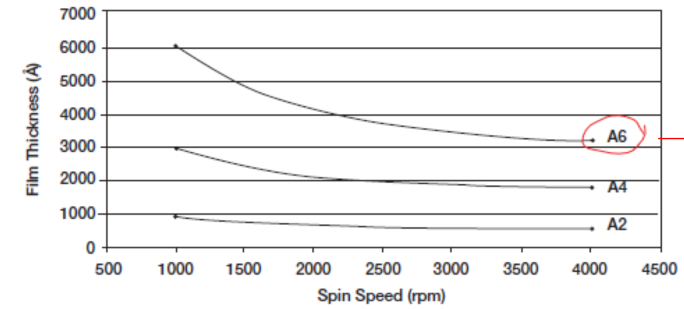
- Pattern
  - Dipole antenna with 50nm gap



950/495 PMMA Bilayer Process

- Coat
  - PMMA 495-A6
    - 6000rpm/30s
    - Bake $180^{o}C$/10m
    - F_t=300nm
  - PMMA 950-A4
    - 6000rpm/30s
    - Bake $180^{o}C$/10m
    - F_t=200nm
  - DisCharge H2O Charge Dissipation layer
    - 1000rpm/30s
    - Air dry
    - F_t=5nm

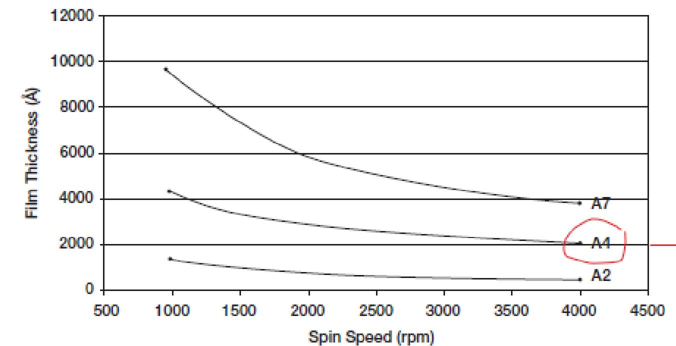
495PMMA A Resists
Solids: 2% - 6% in Anisole



~300nm
@6000rpm

Figure 3

950PMMA A Resists
Solids: 2% - 7% in Anisole



A6
~200nm
@6000rpm

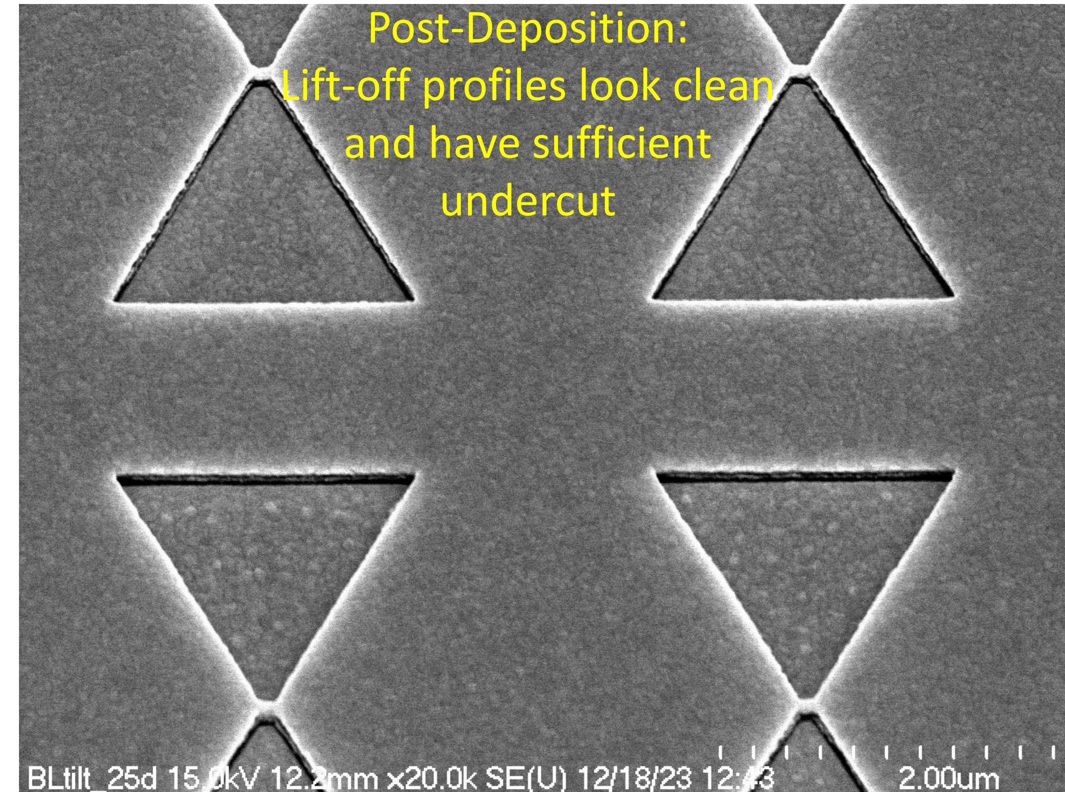
Figure 8

Exposure Dose Series

- Elionix 100keV BODEN
    - Expose antenna array
        - Dose range 1200 to 3000μC/cm^2
            - 100 x 100μm field
            - 1nA Beam I
            - 2.5nm Beam diameter
- Develop
    - Remove DisCharge film
        - Immerse in H_2O for 60s to
        - Blow dry N_2
    - Develop PMMA bilayer
        - Immerse in 1:3 MIBK:IPA, 45s (12°C)
        - Rinse in IPA 10s
        - Blow dry N_2

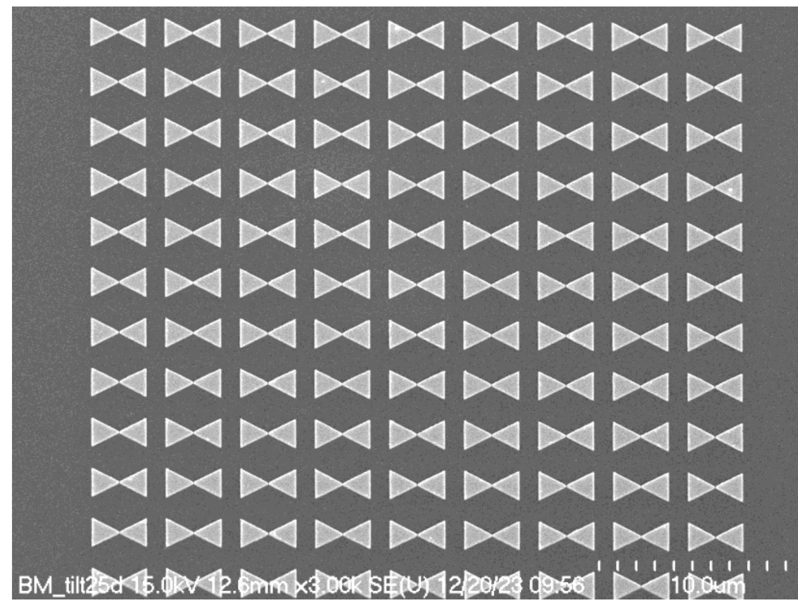
Cr/Au Deposition & Lift-off

- Lesker #3 Evaporation Deposition System
  - 5nm Cr
  - 100nm Au
- Lift-off process
  - Kayaku Remover PG (NMP)
    - Two baths, each @ 70°C
    - H_2O rinse
    - Blow dry N_2



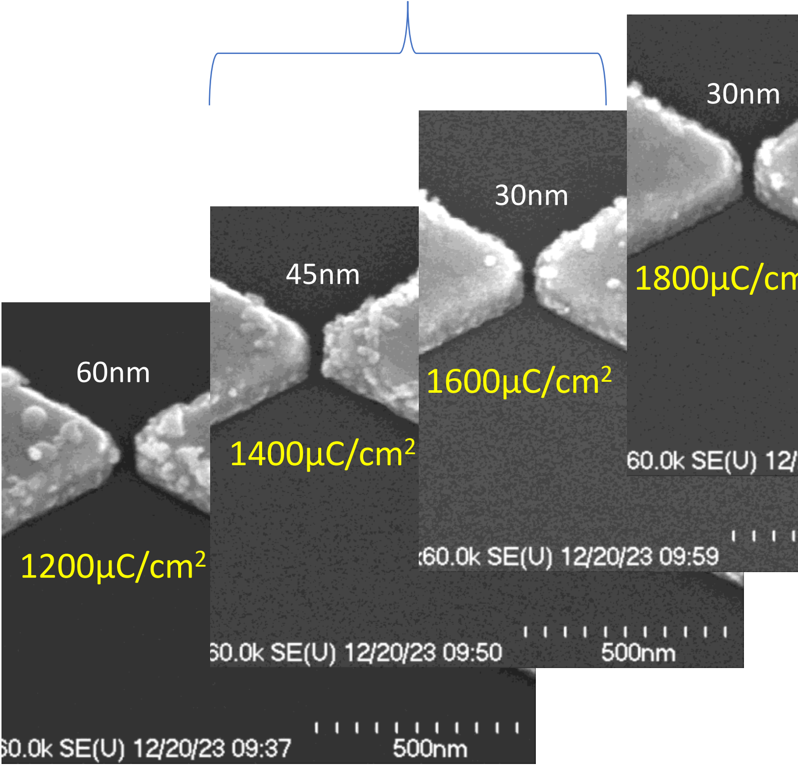
1400µC/cm^2

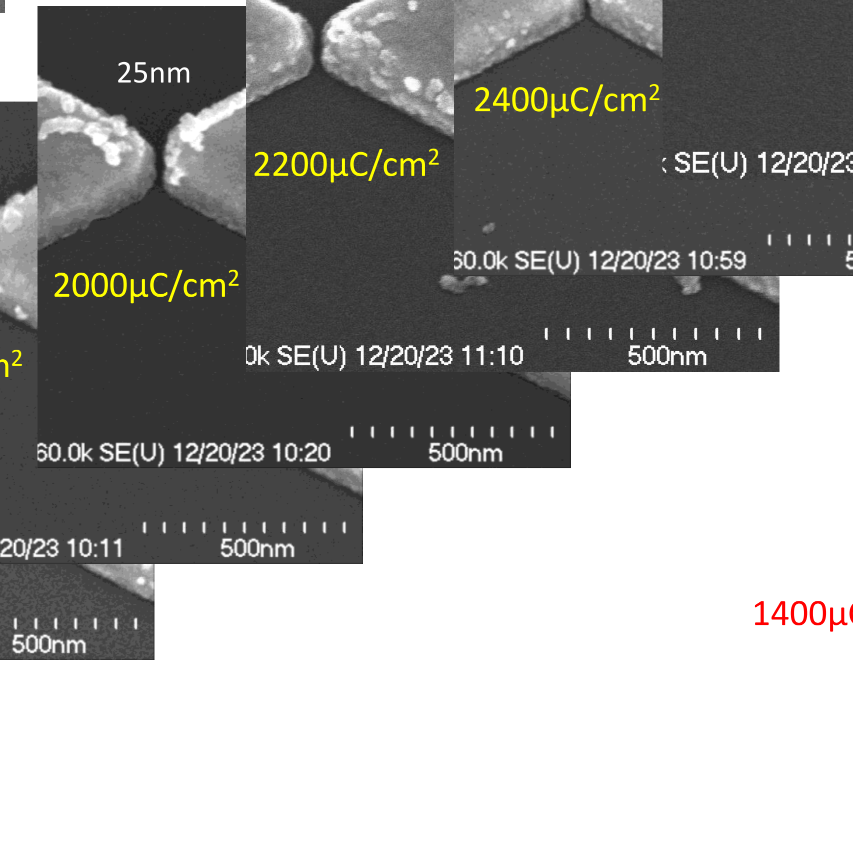
Post-Lift-off

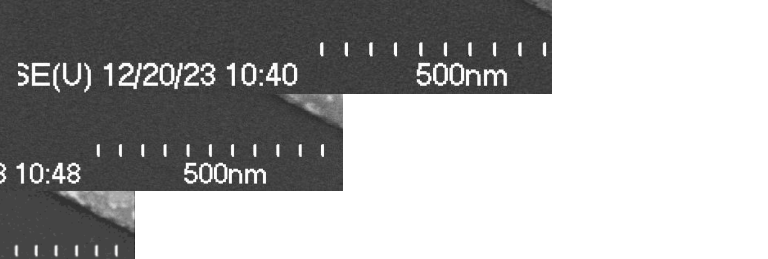


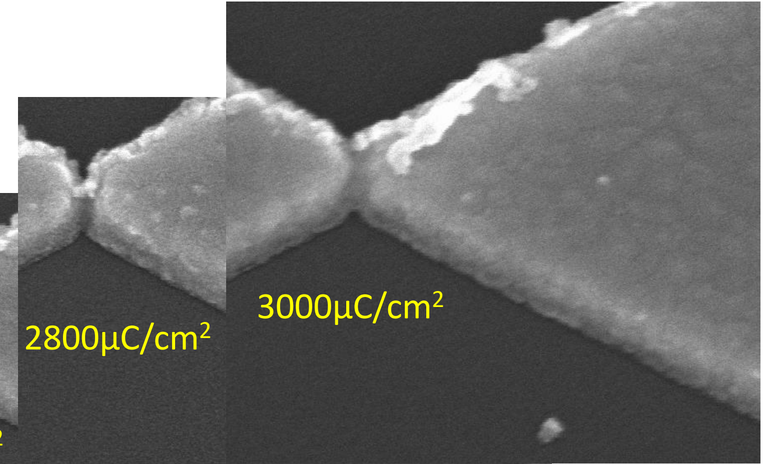
$1600\mu C/cm^2$

$1500\mu C/cm^2$ selected

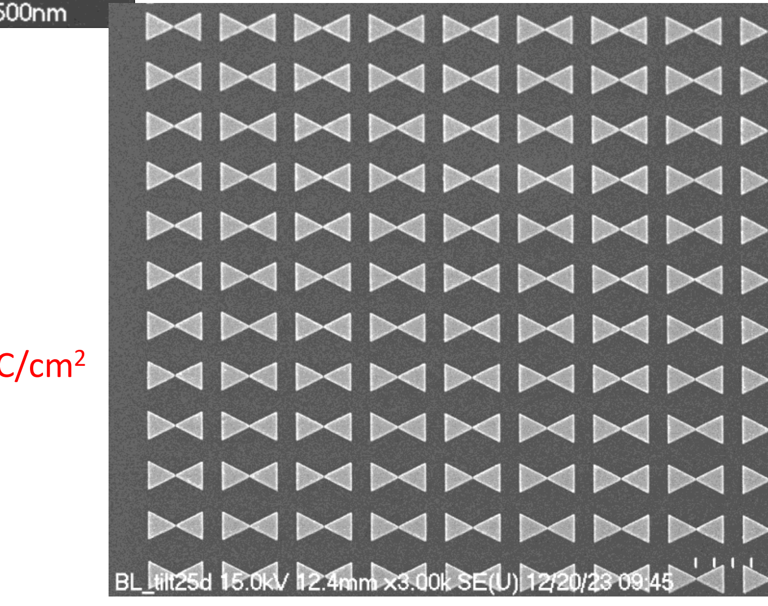








$1400\mu C/cm^2$



Pre-liftoff SEM Inspection (1500μC/cm²)

Location 1 Location 2 Location 3