

Amorphous Silicon Film Deposition at 250°C using Unaxis PM3 ICP Tool (12.5 W Bias)

Objective: we would like to deposit a thick amorphous Si film ($\sim 1.2 \mu\text{m}$) on SiO_2/Si .

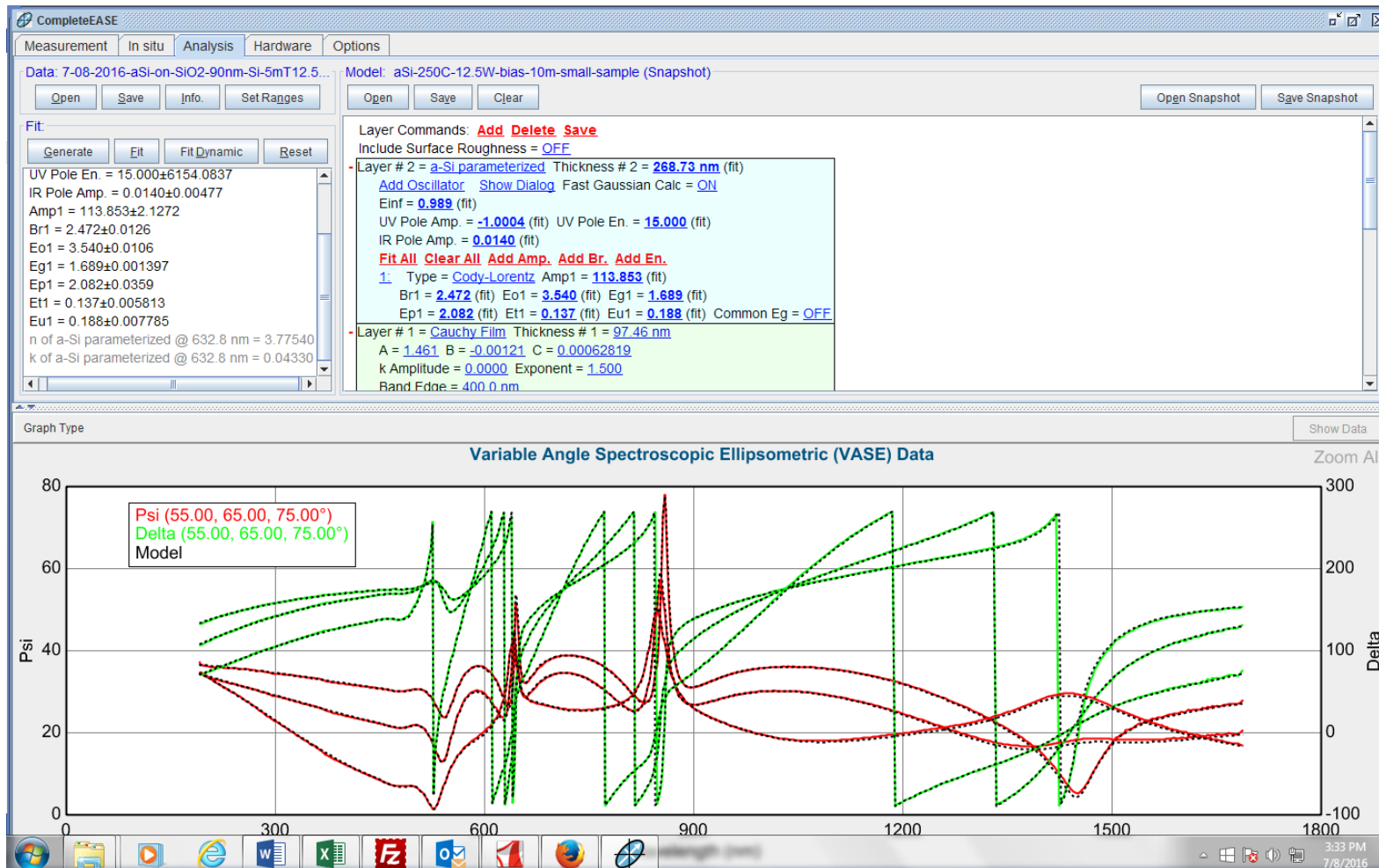
Experimental:

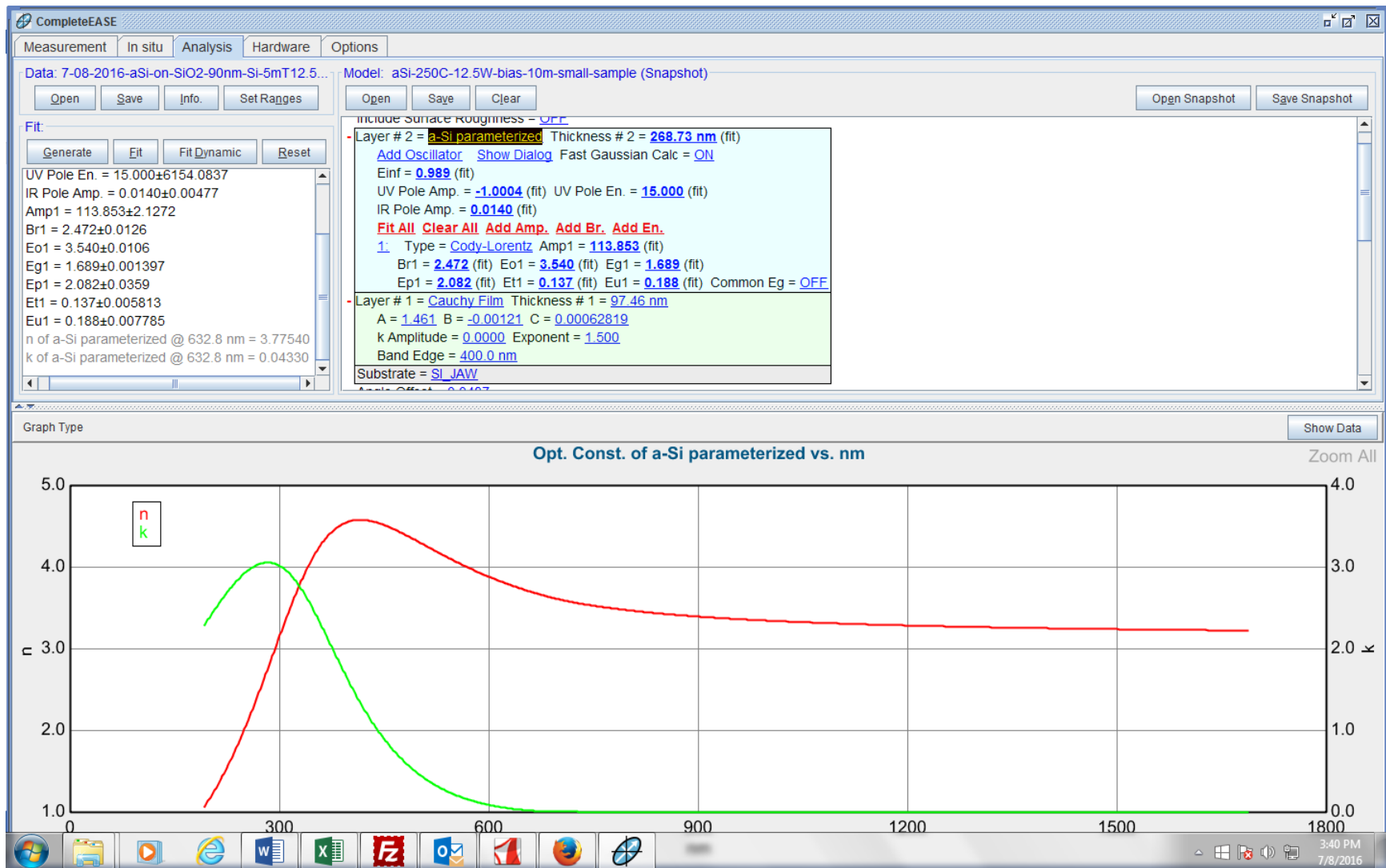
- 1) PM3 chamber plasma clean with 40mT, 20/900W, $\text{SF}_6/\text{Ar}/\text{O}_2$ flow=80/60/20 sccm, and clean time=20 minutes, then, the chamber SiO_2 film coating for 3 minutes.
- 2) Depositing a-Si film on a SiO_2 (3 minutes, 97.5 nm)/Si sample to get the deposition rate.
- 3) Depositing ~ 200 -nm a-Si film on a SiO_2 (3 minutes, 93.8 nm)/Si wafer to get the film stress.
- 4) Depositing ~ 1.19 - μm a-Si film on the SiO_2 (3 minutes, 93.8 nm)/Si wafer to see whether there is film adhesion problem.

Results:

1) a-Si film deposition on a SiO₂/Si sample with 5mT, 12.5/400W, SiH₄/Ar/He flow-rate=10/20/200 sccm, and time=10 minutes.

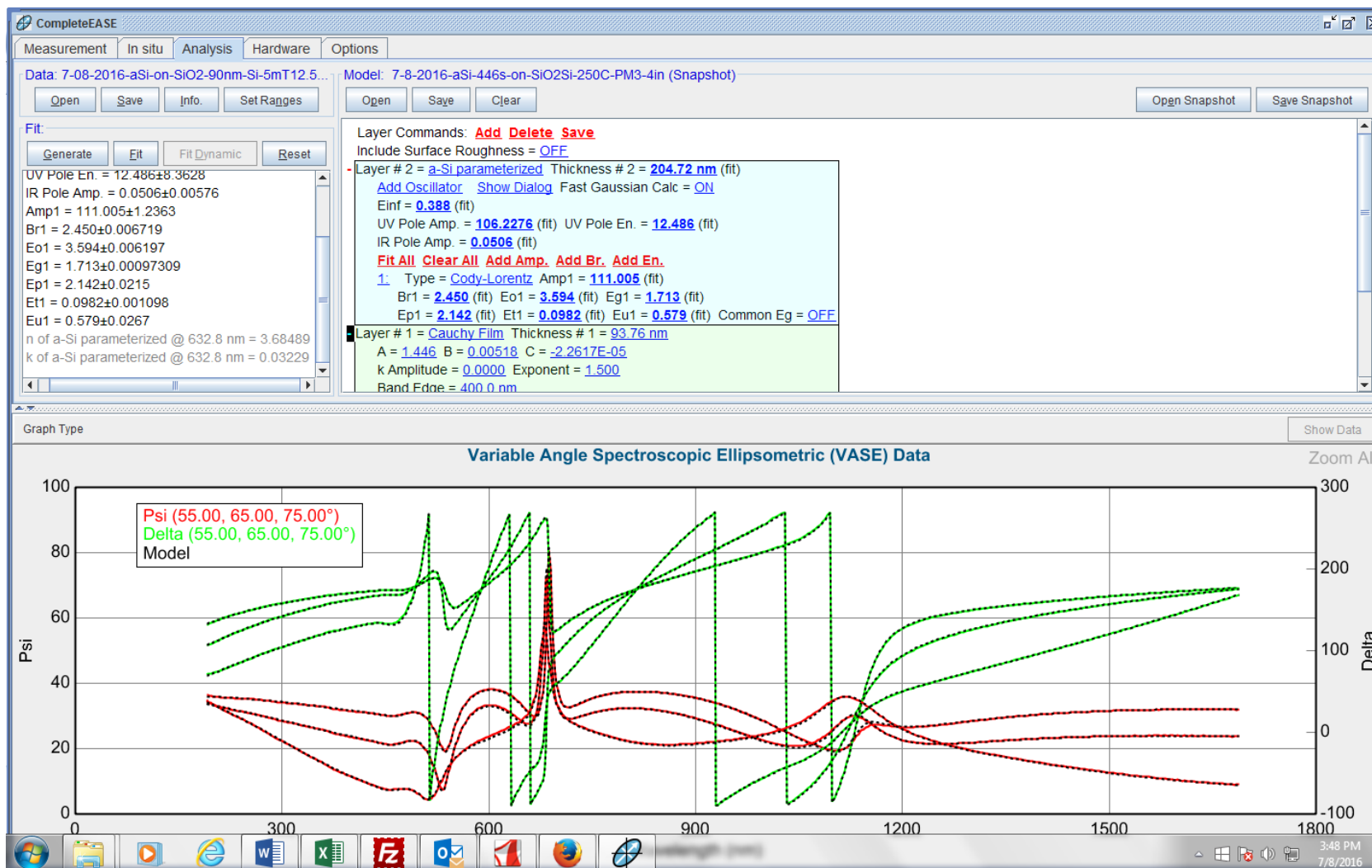
Figure 1 Ellipsometer measurement shows: a-Si film thickness=268.73 nm, n=3.77540 and k=0.04330 at 632.8 nm (underneath SiO₂ thickness=97.5 nm, n=1.461 at 632.8 nm).

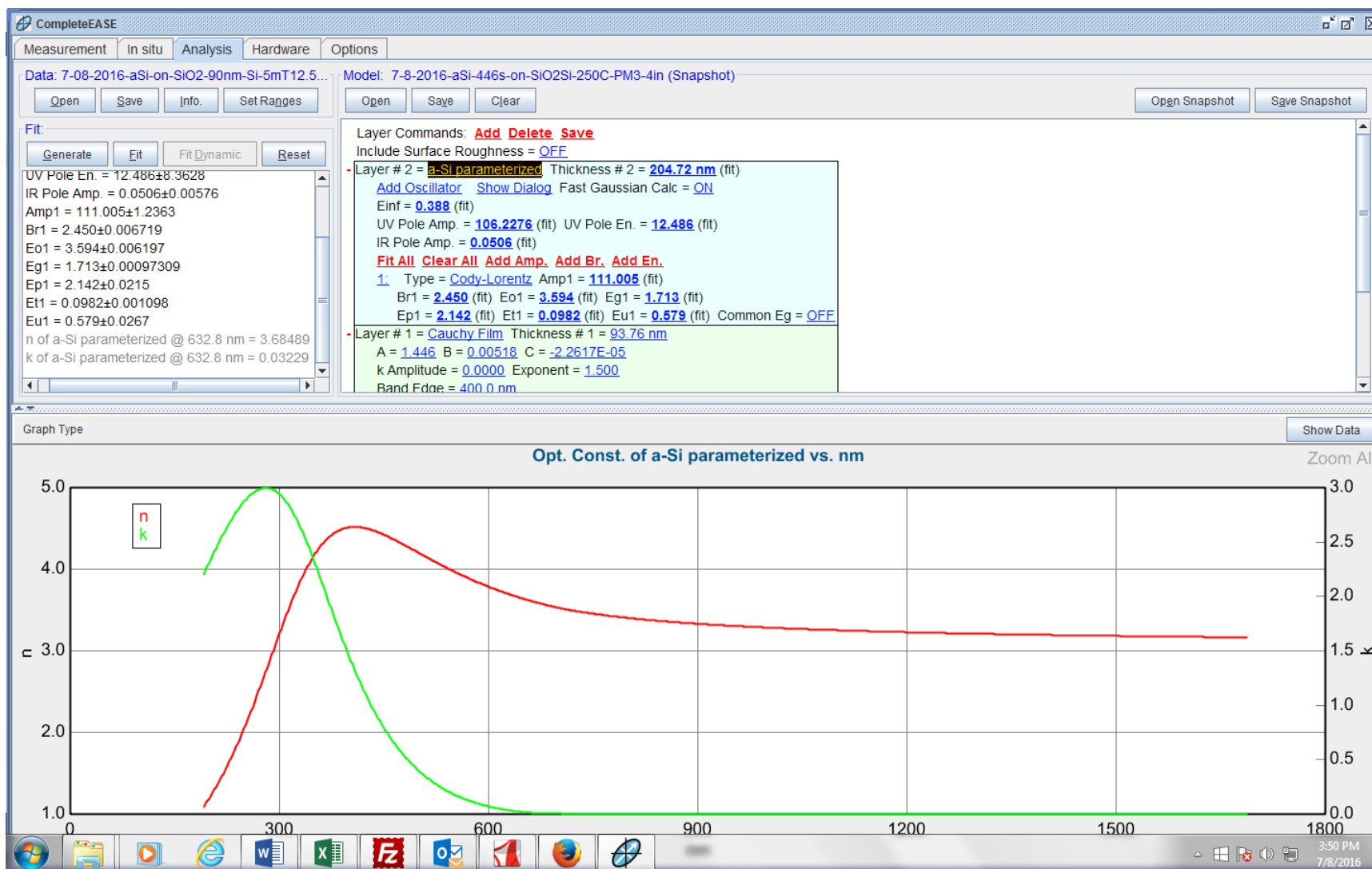




2) a-Si film deposition on a SiO₂/Si wafer with 5mT, 12.5/400W, SiH₄/Ar/He flow-rate=10/20/200 sccm, and time=446 seconds.

Figure 2 Ellipsometer measurement shows: a-Si film thickness=204.72 nm, n=3.68489 and k=0.03229 at 632.8 nm (underneath SiO₂ thickness=93.8 nm, n=1.459 at 632.8 nm).





The aSi film deposition rate is 27.54 nm/min and the a-Si film stress is -691.94 MPa.

Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

3) a-Si film deposition on a SiO₂/Si wafer with 5mT, 12.5/400W, SiH₄/Ar/He flow-rate=10/20/200 sccm, and time=2593 seconds.

Figure 3 Microscopic pictures taken across the thick a-Si film (~1.19 μm) show the film adhesion is good (there is no film bubbling).



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4) a-Si film deposition on the customer's thermal oxide/Si wafer with 5mT, 12.5/400W, SiH₄/Ar/He flow-rate=10/20/200 sccm, and time=2593 seconds.

Figure 4 Microscopic pictures taken across the thick a-Si film (~1.19 μm) show the film adhesion is good (there is no film bubbling).



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

