Xi Group Update

Thrust Meeting 03.31.16

PROJECT 1: Gold/HOPG Substrates for MoS_2 Films

1.5 x 1.5 um^2

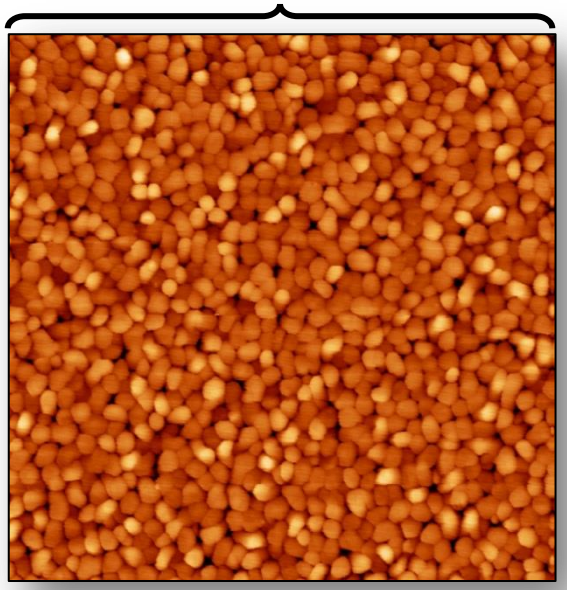
5 x 5 um^2

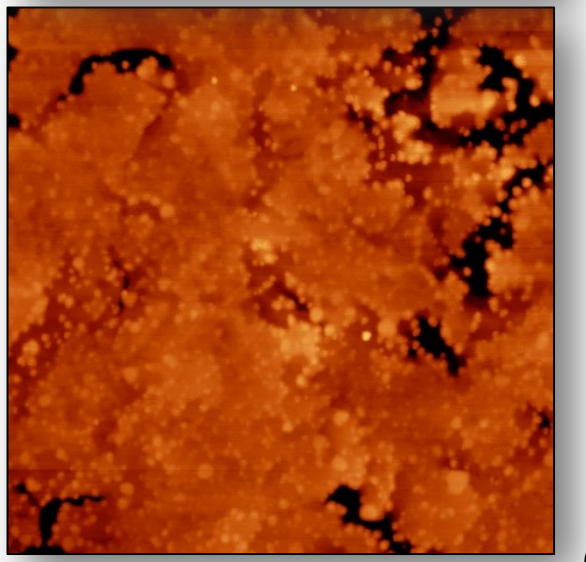
10 x 10 um^2

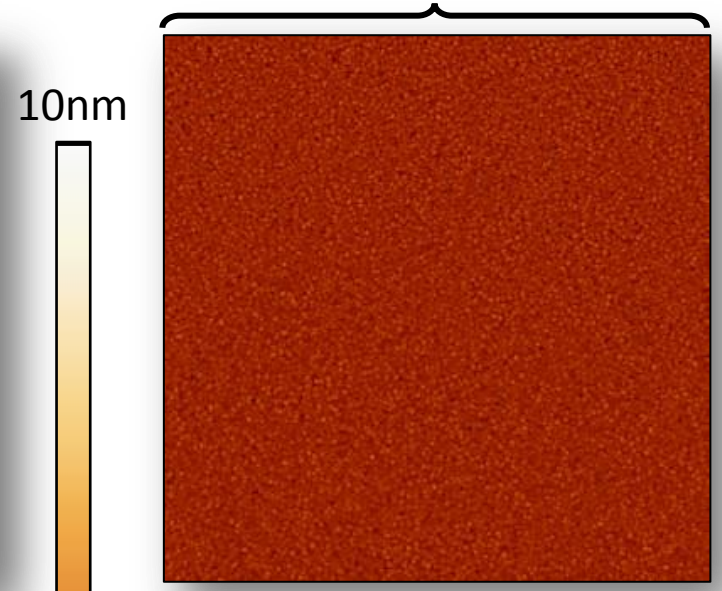
Pre Anneal

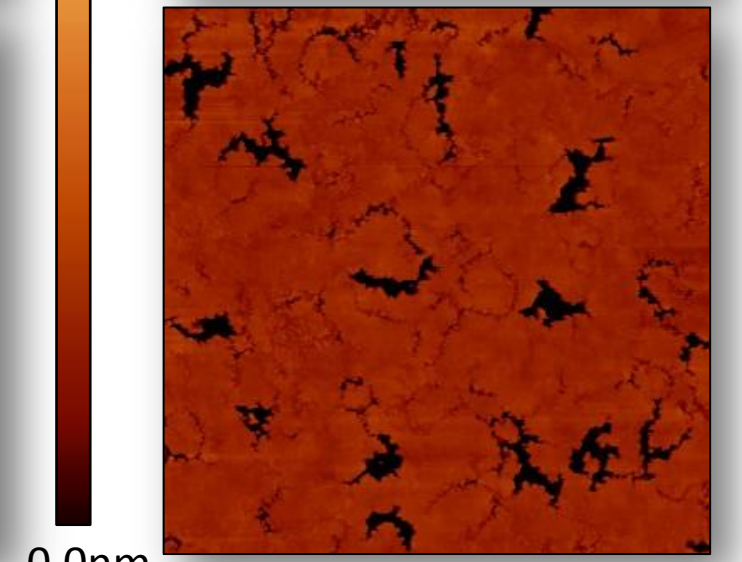
Sputtered:
- 24C
- 10mTorr
- 5min
- 25W

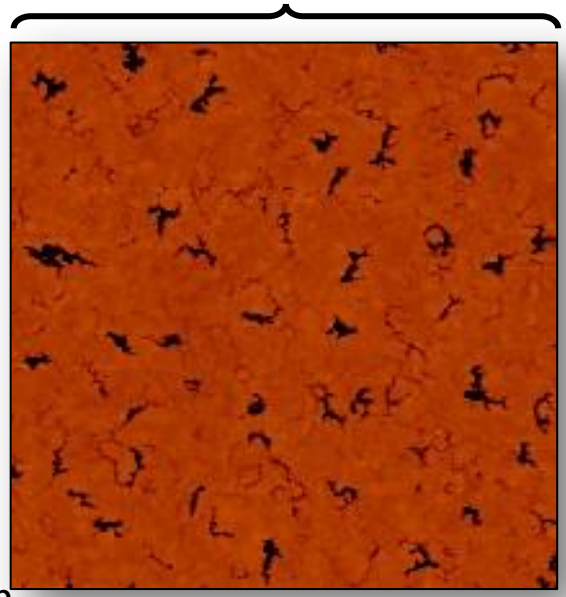
Post Anneal
- 620C
- Atm
- 60min
- 80C/min
- Rapid Cool











10nm

0.0nm

30nm

0.0nm

30nm

0.0nm

- Annealing causes partial coalescing of large grains into flatter surfaces with deep cracks (<10nm – Difference in thermal contraction).

- Cracks may be able to be minimized by annealing at lower temperature for longer time.

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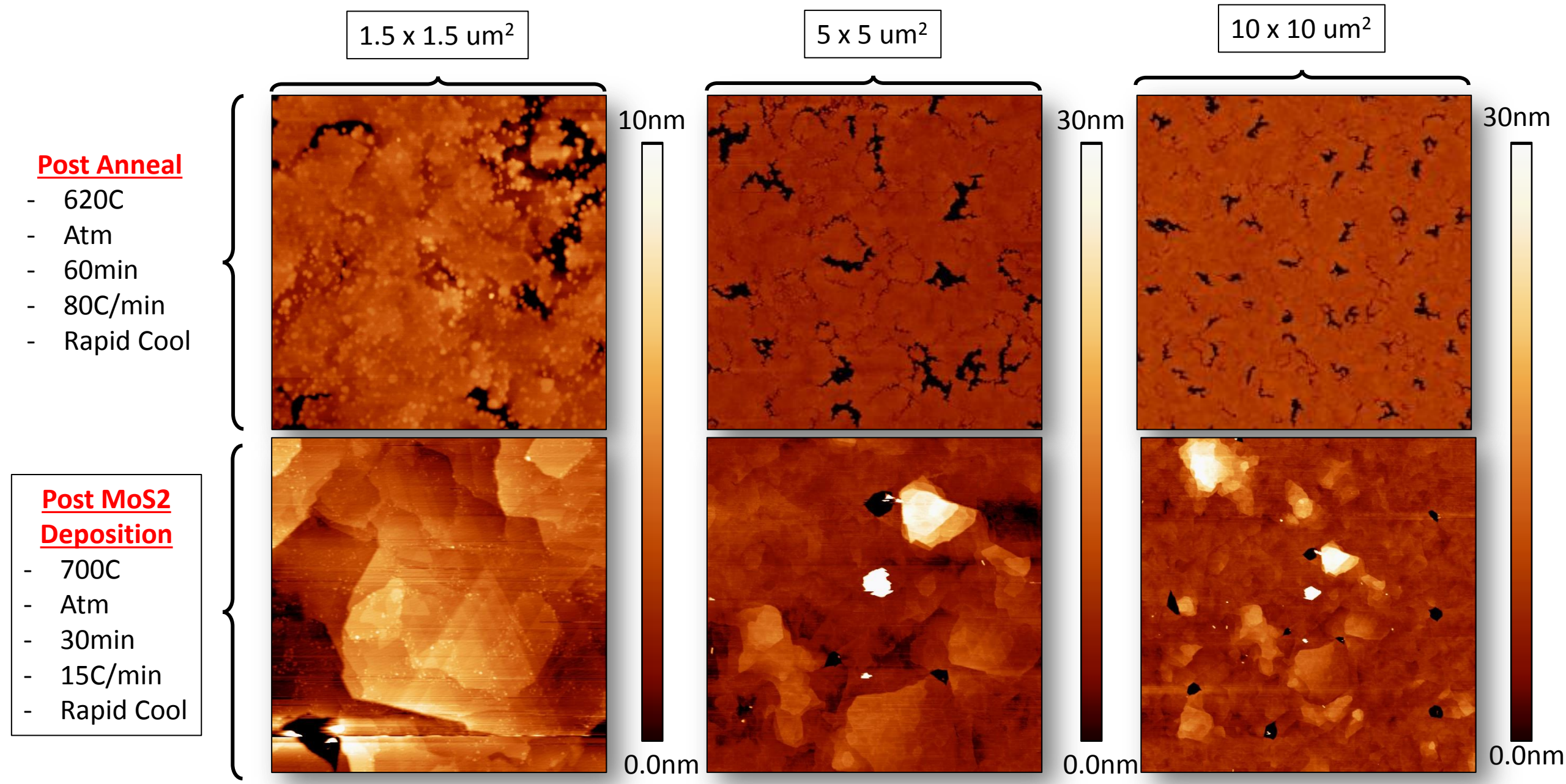
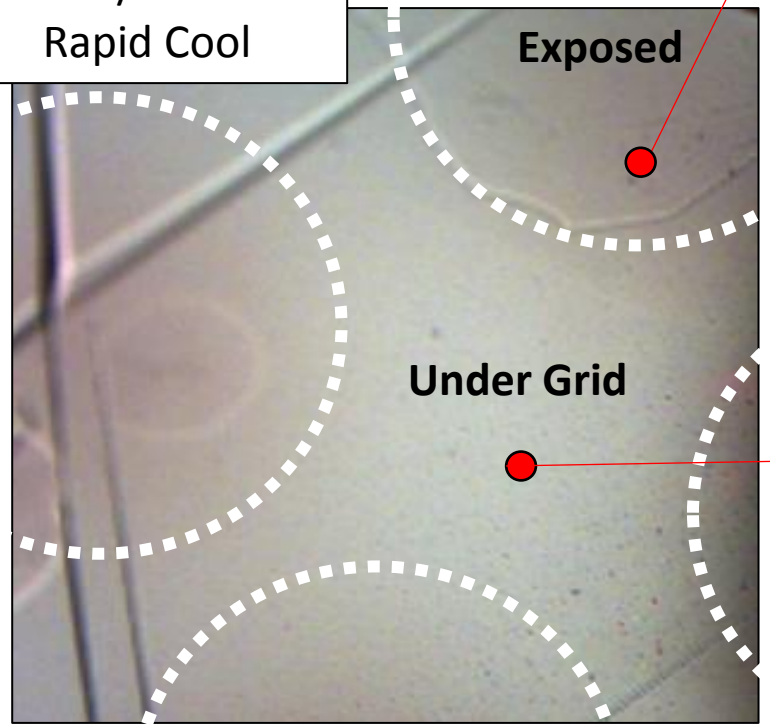


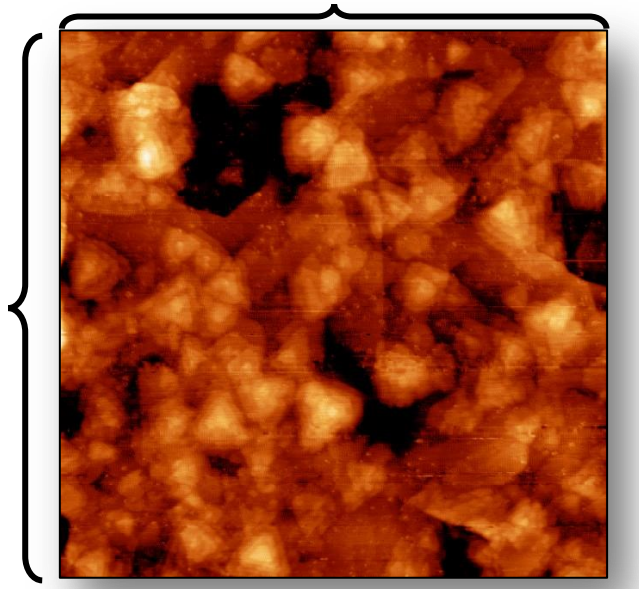
PROJECT 1: Gold/HOPG Substrates for MoS_2 Films

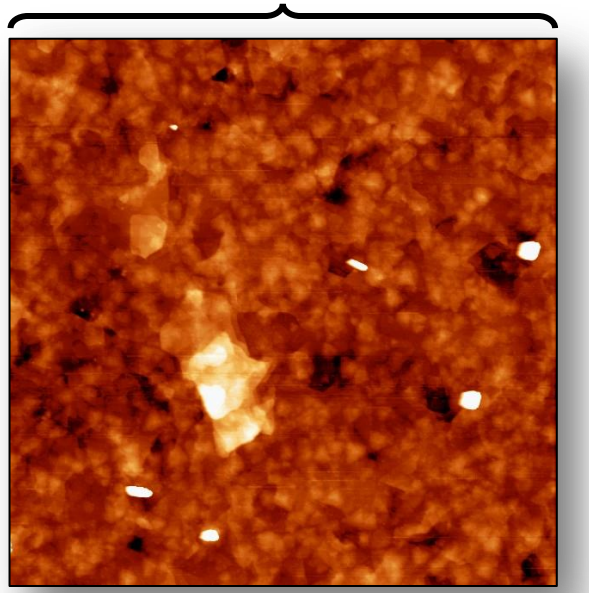
MoS2 Deposition
- MoO_3
- 700°C
- Atm
- 30min
- 15C/min
- Rapid Cool

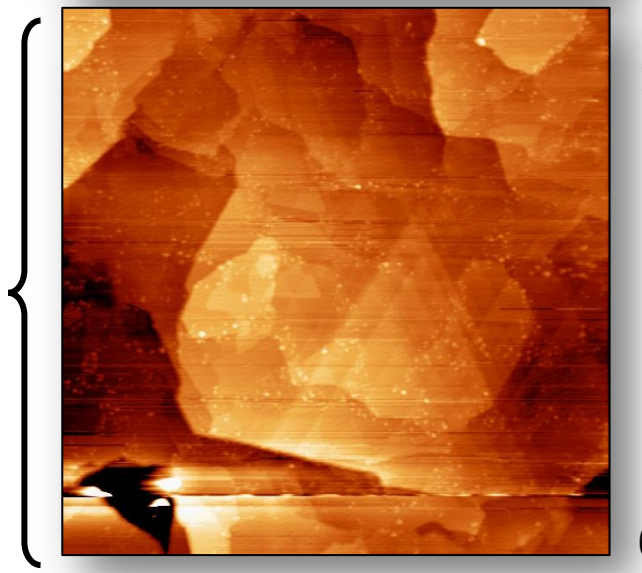


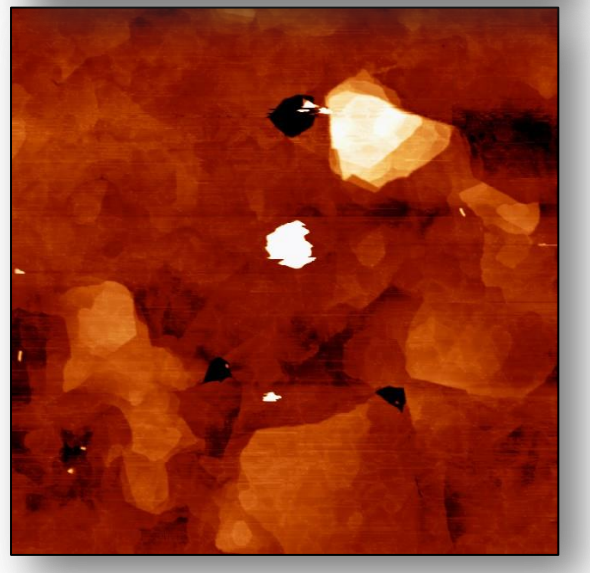
1.5 x 1.5 um²

5 x 5 um²

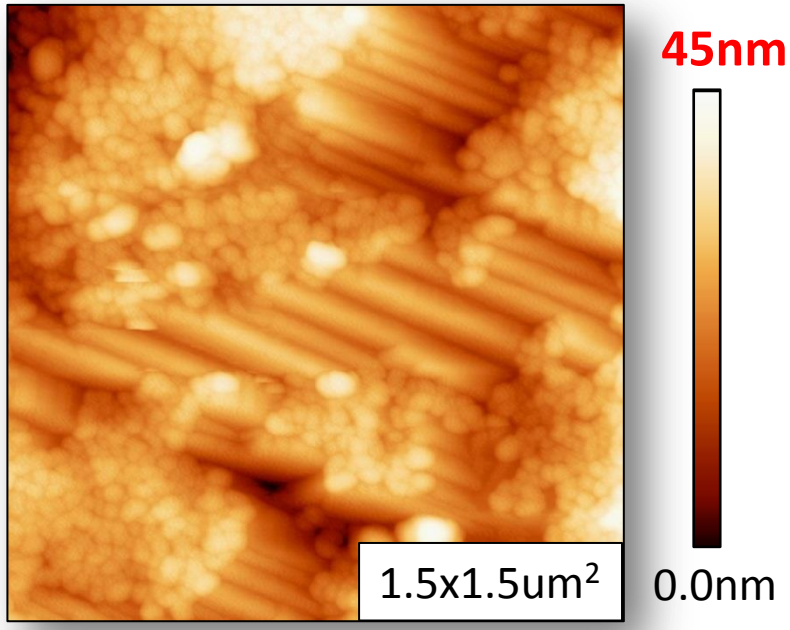


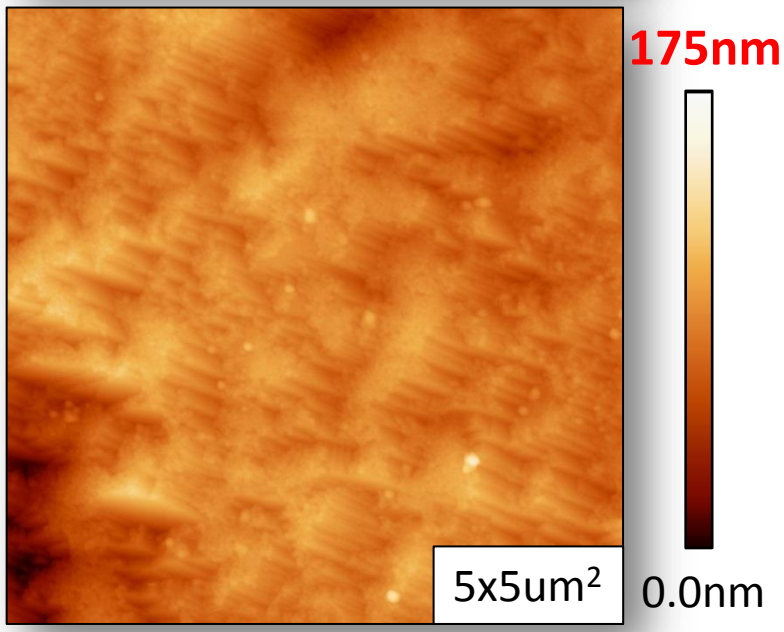




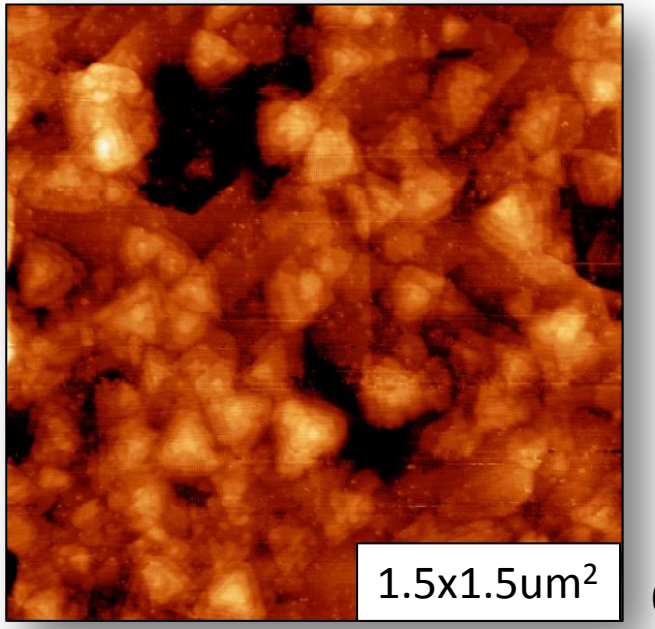


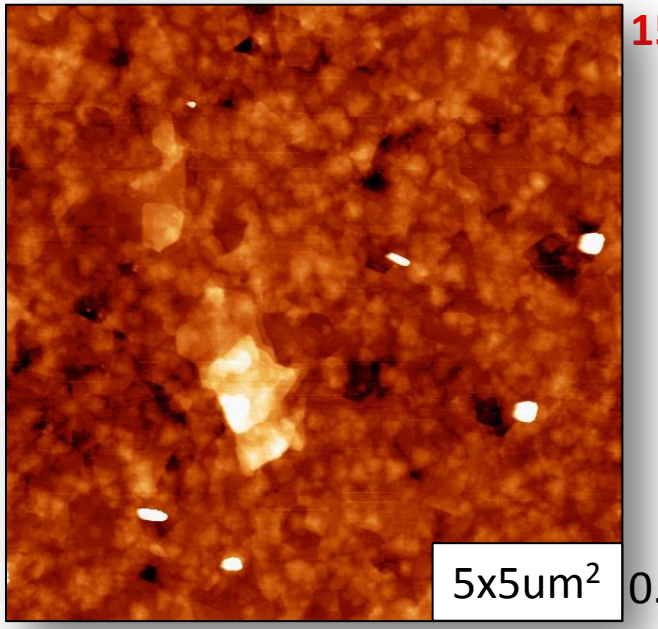
Sample: Cao CVD MoS2/Au Foil

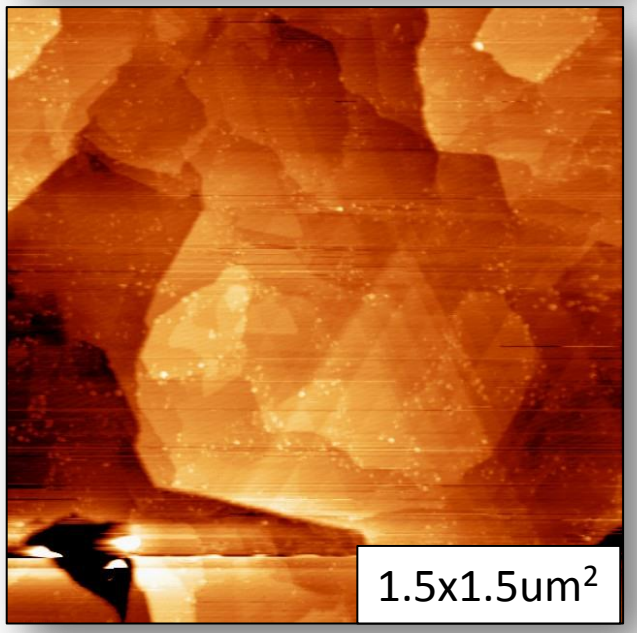


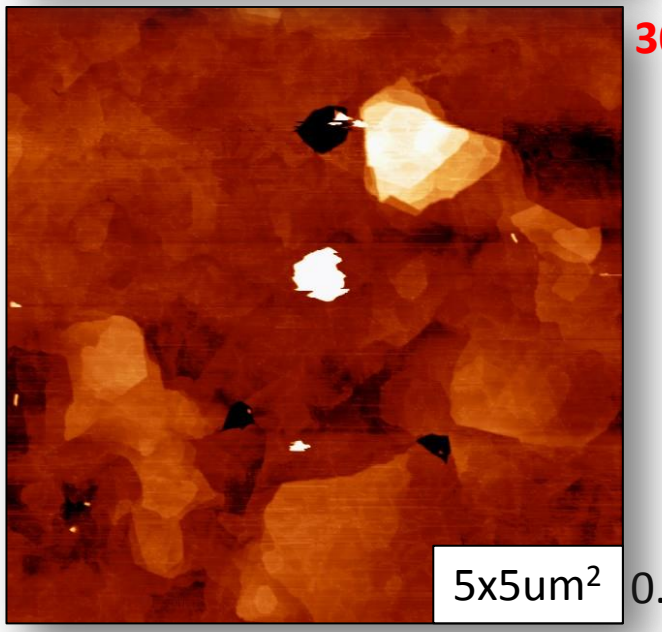


Sample: MoS2 CVD 022216_05 MoS2/Au/HOPG





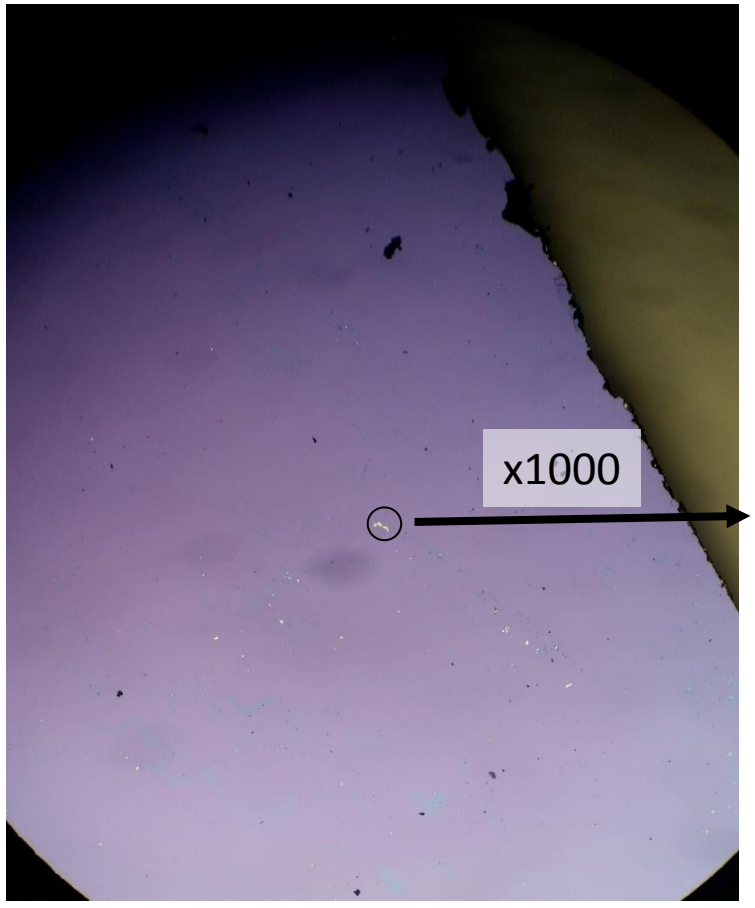


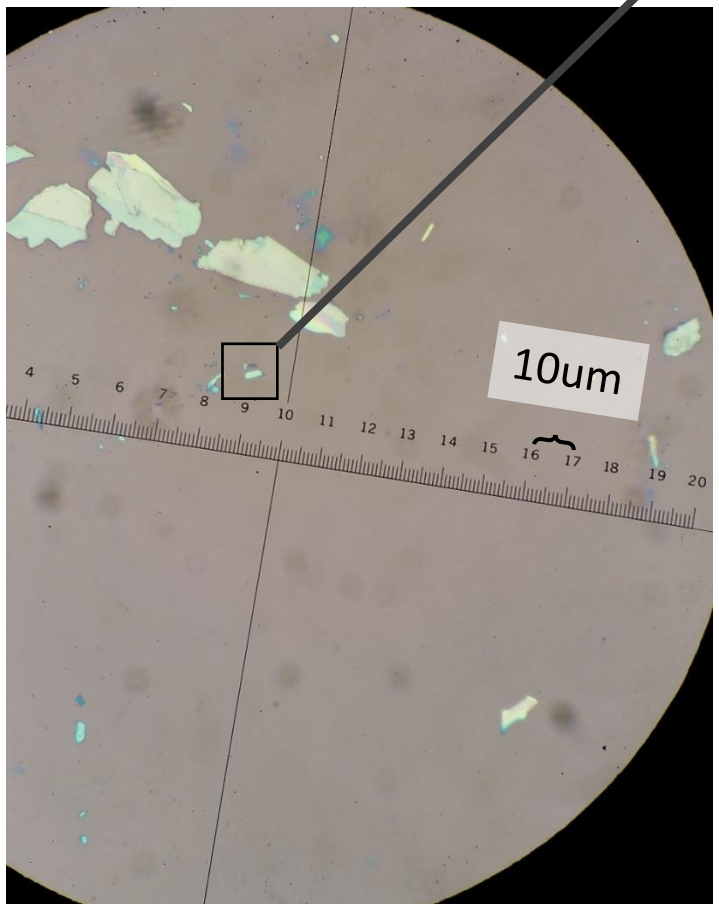


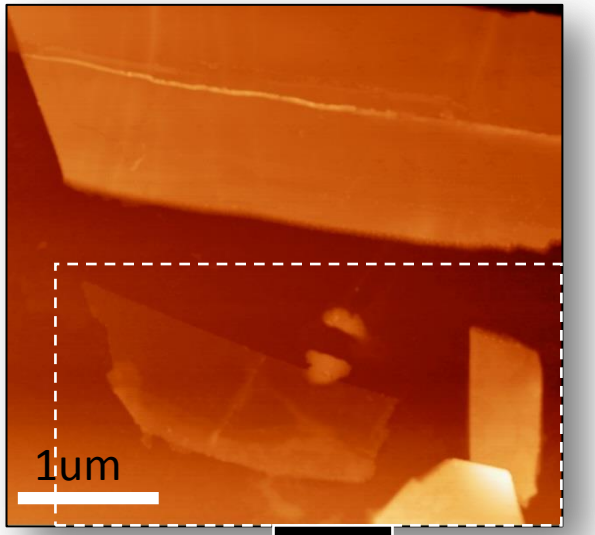
PROJECT 2: Micromechanical Exfoliation MoS_2 Single Crystal

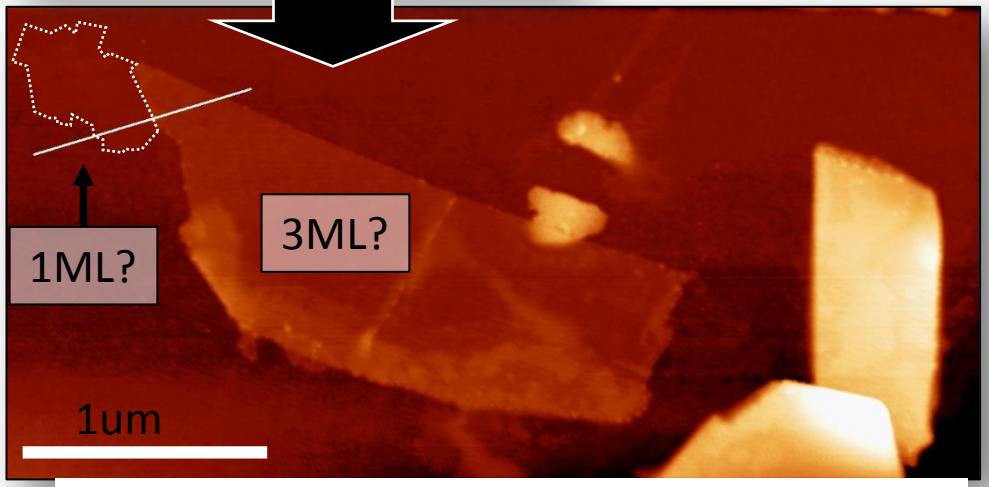
Scotch tape exfoliation from single crystal yields several small flakes on the SiO_2 substrate with potential single layer flakes surrounding them.

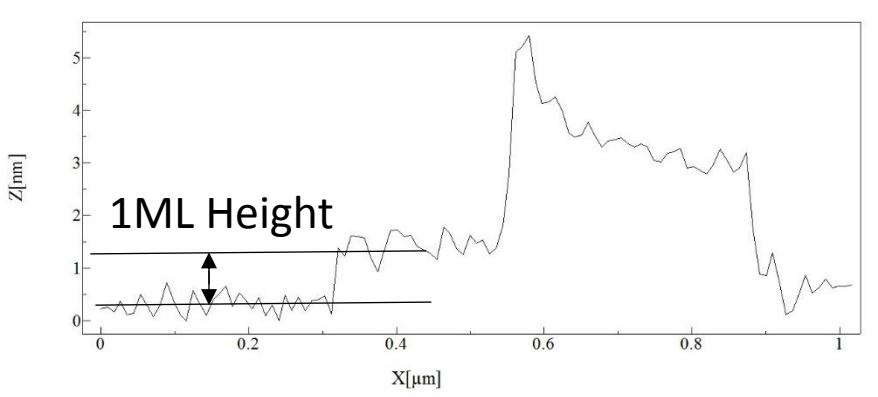
Purpose is to compare PL (BORGUET) with CVD films with small grains.











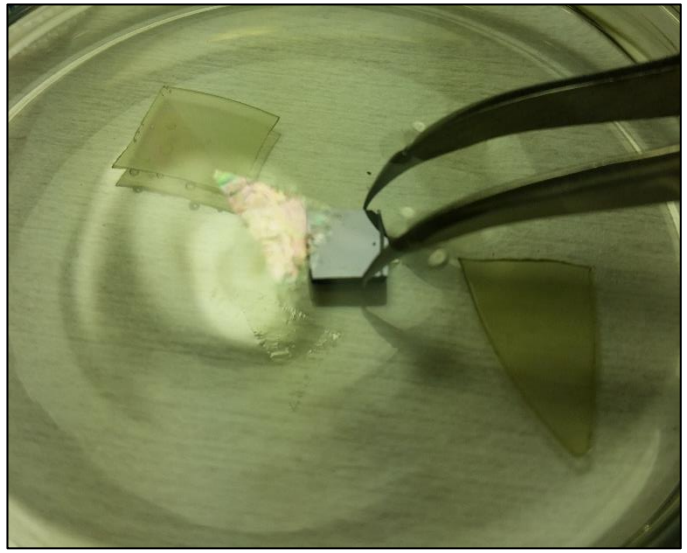
PROJECT 3: Single layer MoS_2 on glassy carbon for CO_2 reduction

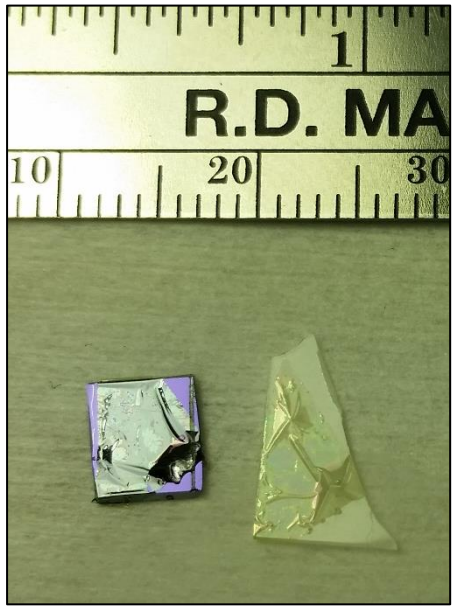
2 Samples fabricated:

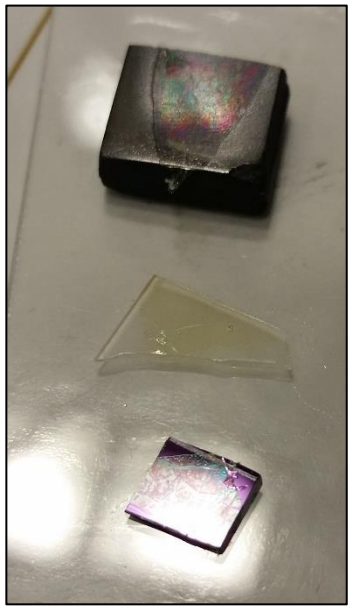
1) Single layer (?) continuous film grown on carbon substrate.

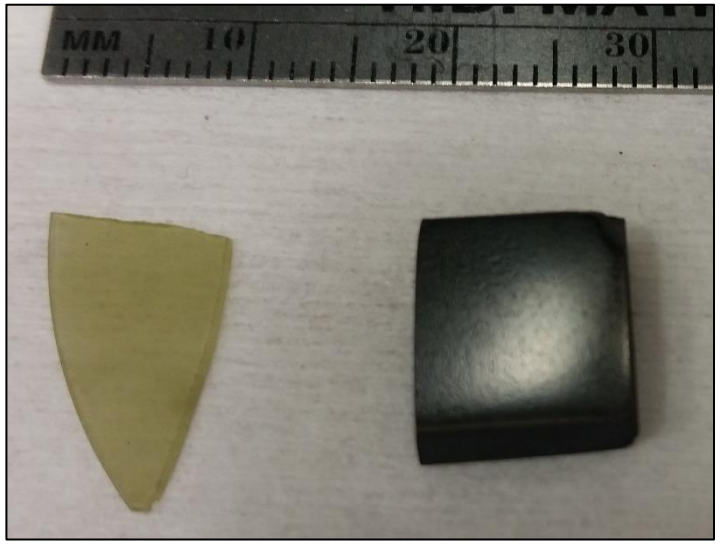
2) Single layer continuous film grown on sapphire and transferred to carbon substrate.

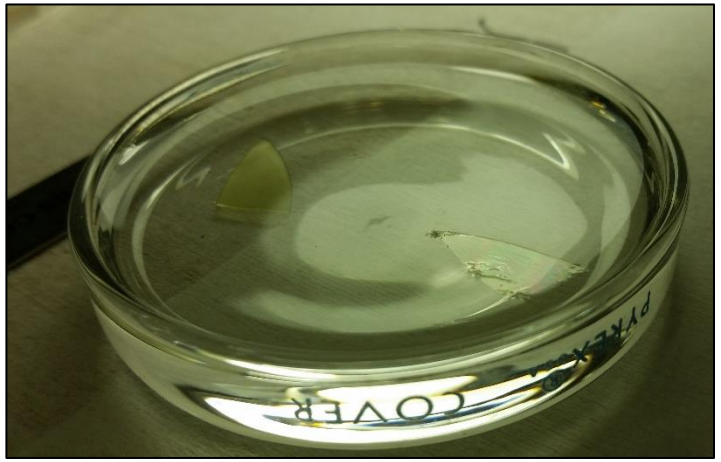
Purpose is to investigate catalytic activity of single layer MoS_2 in CO_2 reduction reaction (STRONGIN)

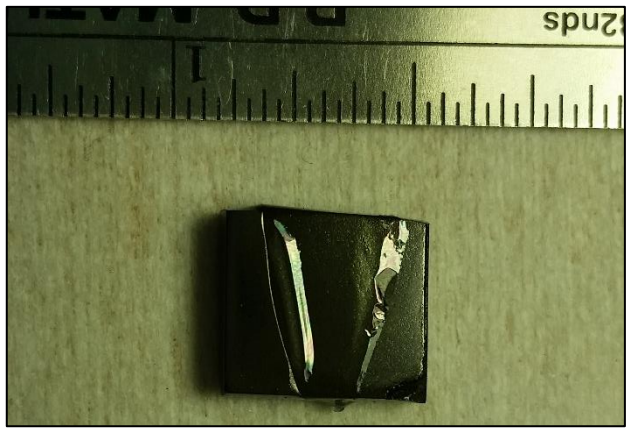








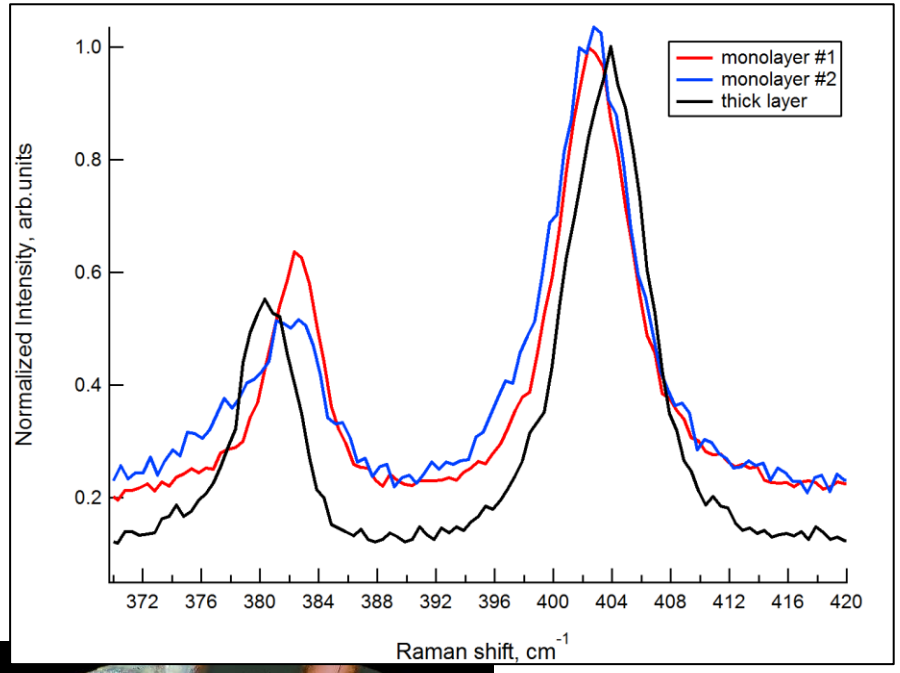


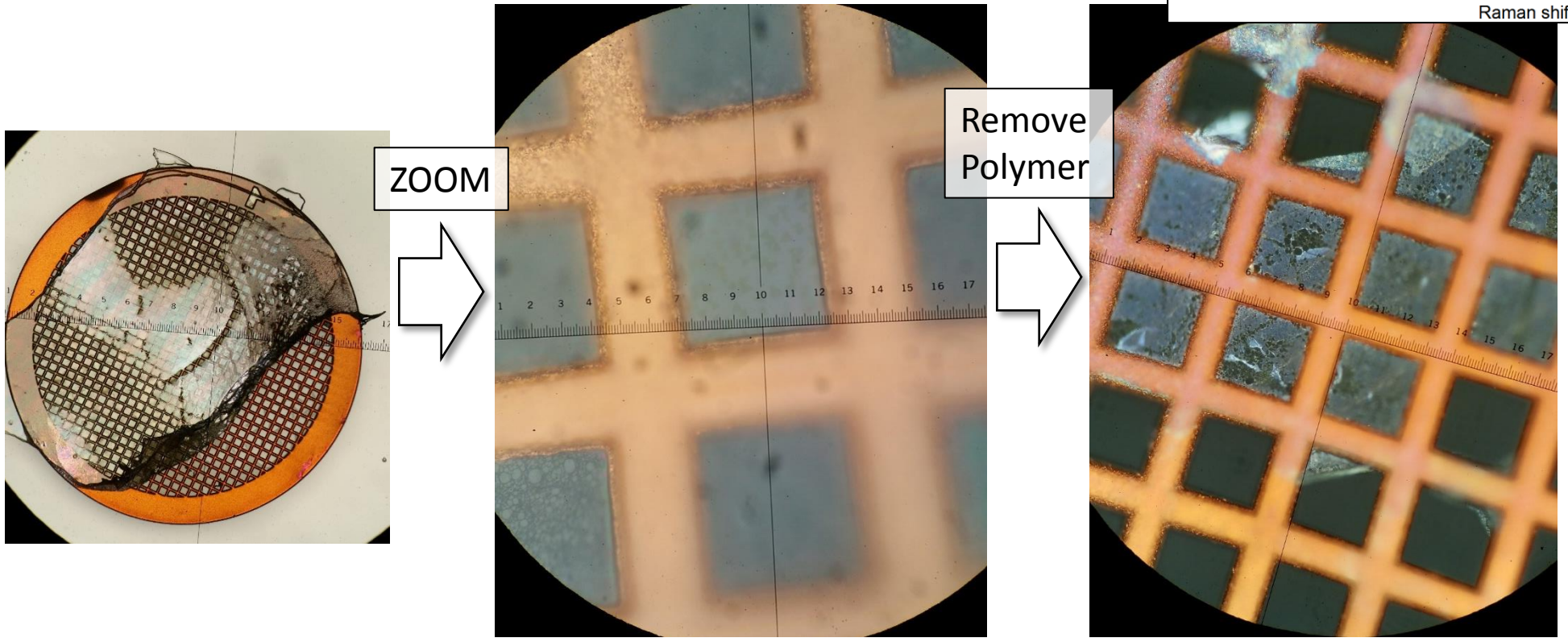


PROJECT 4: TEM of MoS_2 for defect and grain boundary analysis

Single to few layer MoS2 films grown on sapphire substrates and transferred to TEM grids.

Purpose is to investigate atomic construction at grain boundaries and elemental analysis of defect sites (ZHU)

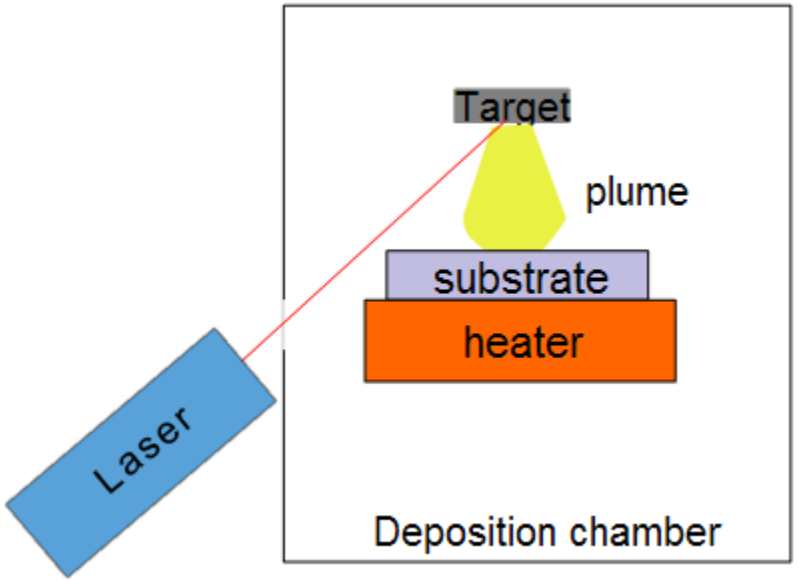


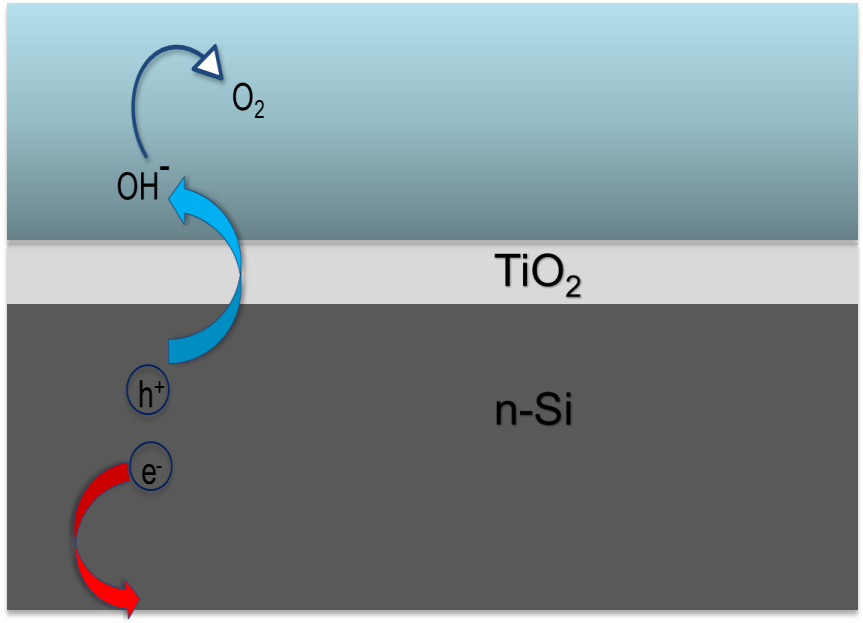


PROJECT 5: PLD of TiO_2

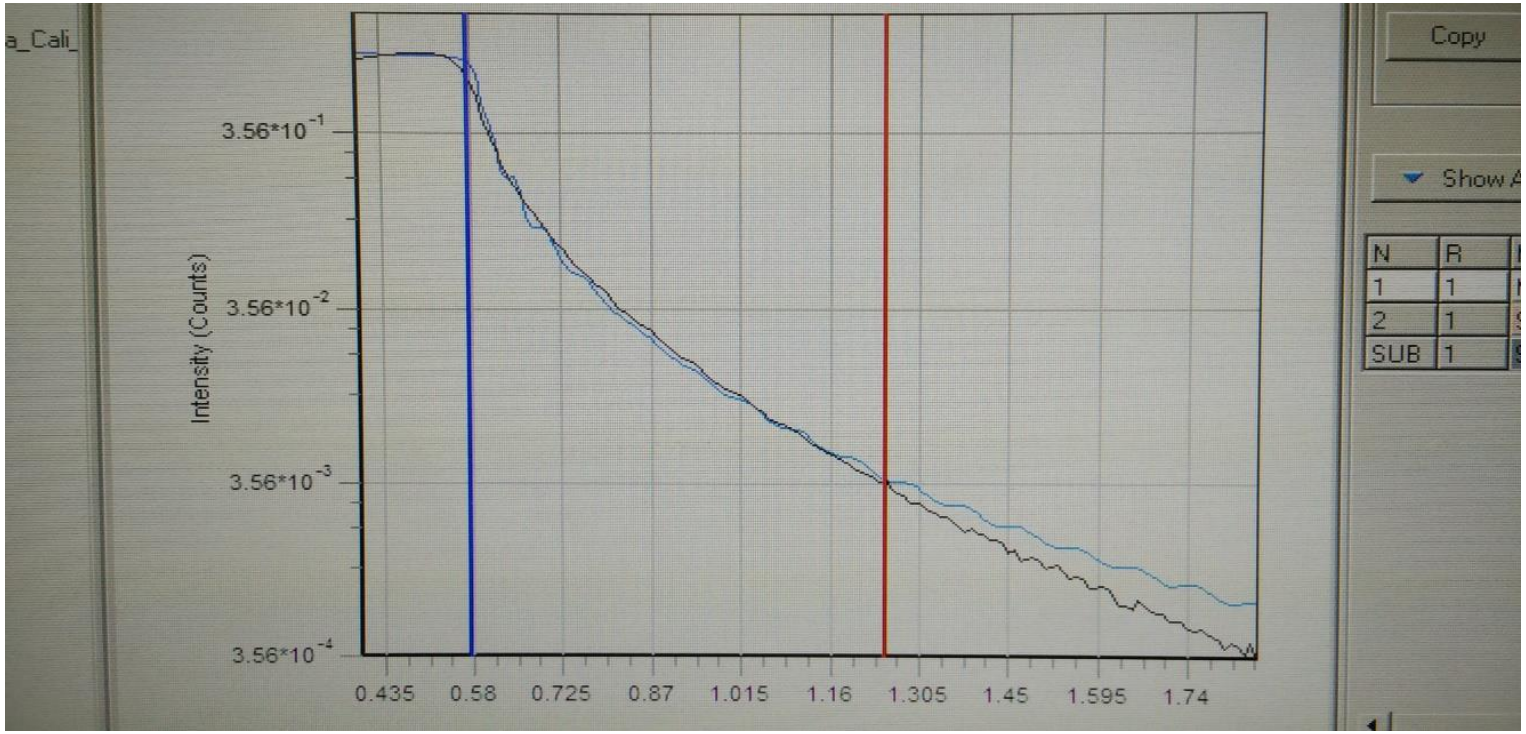
Purpose is to grow a conducting thin film to protect Si surface from forming SiO_2 during PEC water splitting (Strongin Group)

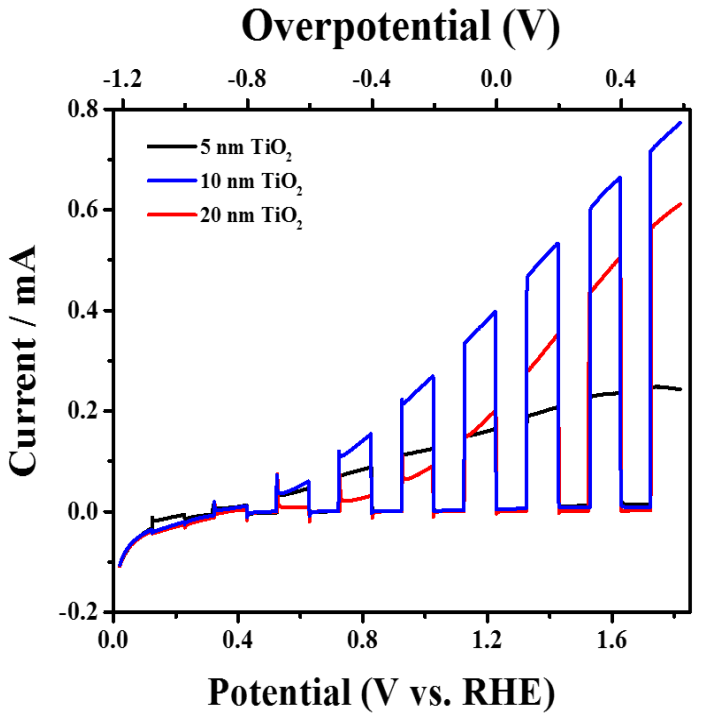
- SiO_2 favorable than O_2 production
- Etched in HF
- Bake at 500^0C
- TiO_2 10nm deposited 300^0C
  - 16 Jcm^{-2}
  - Vacuum





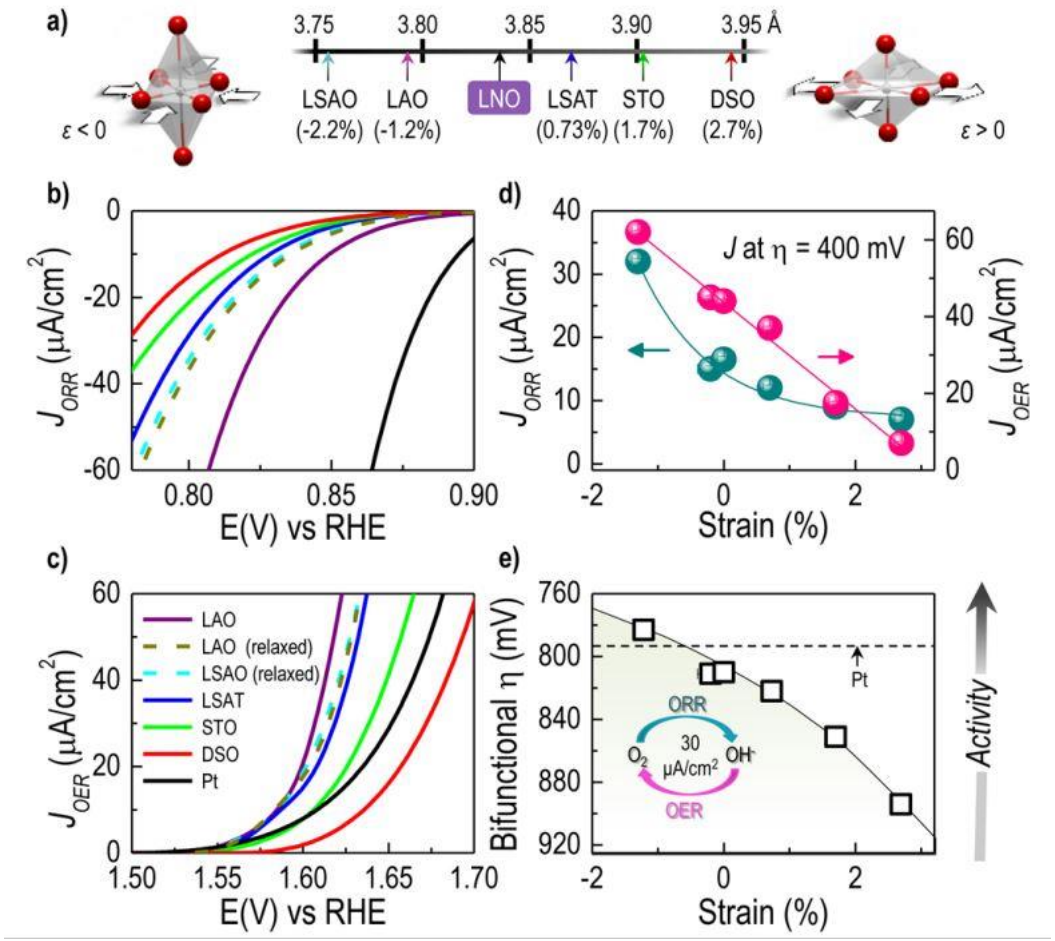
- Thickness calibration (XRR)
  - 332 pulses per 10nm
  - 19.11Hz → 20 sec





PEC on MnO_2 NS/Co^{2+}/NS/PEI/TiO_2@Si

PROJECT 6: Lanthanum Nickel Oxide



Petrie et al, JACS 2016

- Previous growth on Si

<u>Future work</u>

- LNO/LAO : OER versus O_2 vacancy
- LNO/Nb-STO : OER versus LNO thickness
- LNO/Si (n/p+) : PEC/EC study