van der Waals Epitaxy of One-dimensional II-VI Nanostructures

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Outline

- Introduction
- Experimental Setup and Procedures
- Results and Discussions
- Summary and Future Work
- Acknowledgements

Introduction

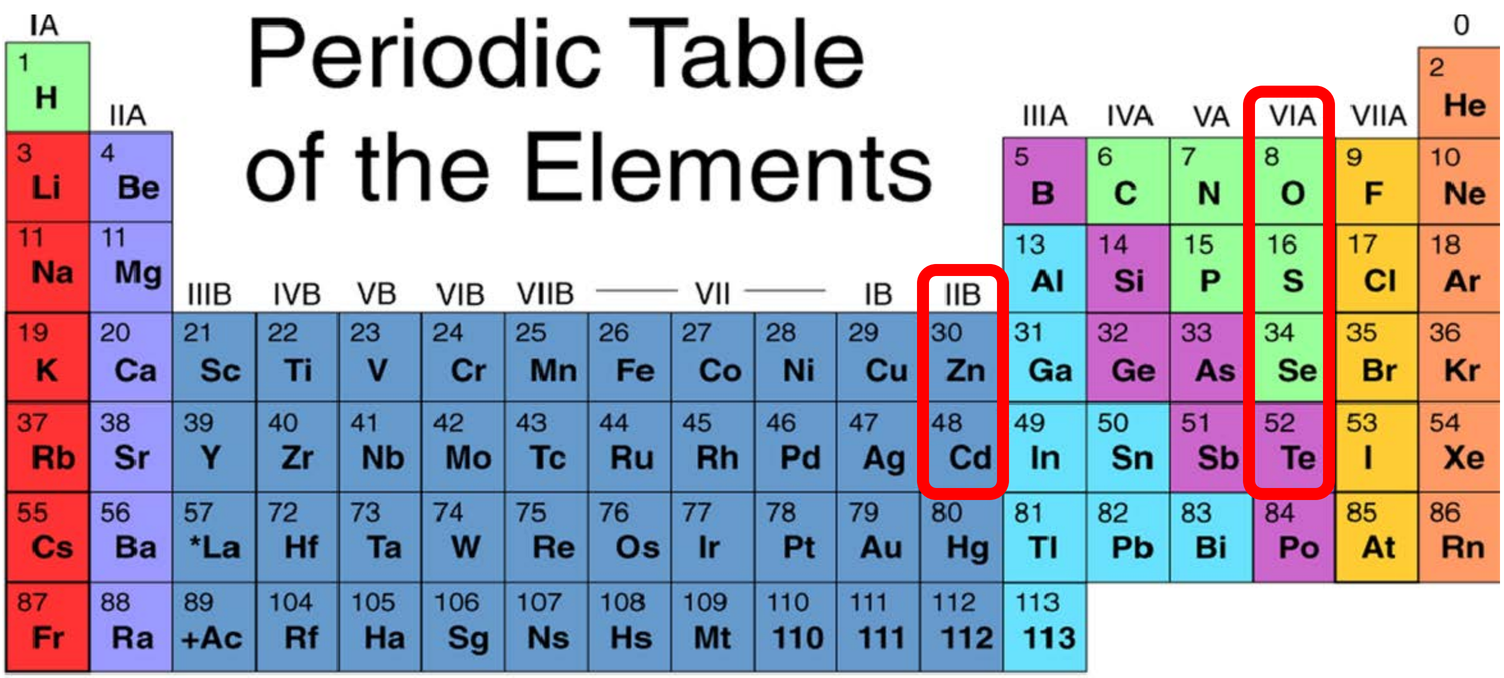
— Objectives

- Achieve high quality and uniform growth
- Employ CVD for heterogeneous growth
- Compare:
  - van der Waals epitaxy
  - Conventional epitaxy

Introduction

— What are II-VI Materials?

II-VI Semiconductors:



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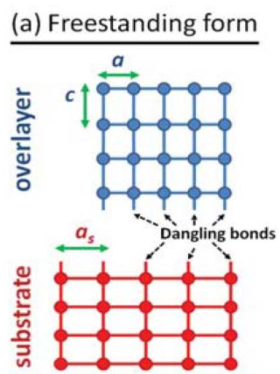
— Applications of II-VI Nanostructures

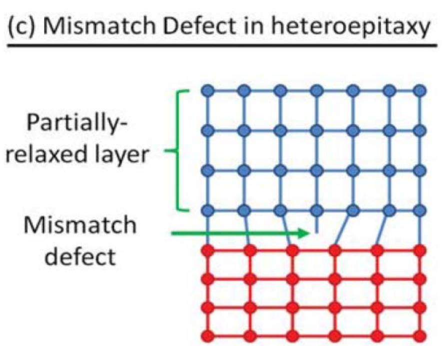
II-VI Nanostructures applications

- Photovoltaic conversion
- Light emission
- Photo detection
- High-energy radiation detection

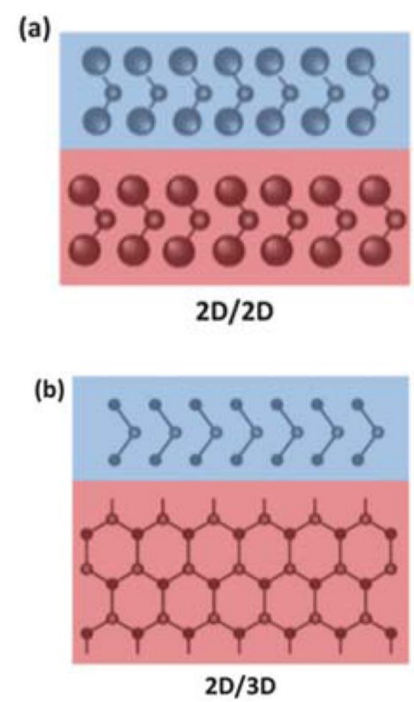
— Epitaxial Growth: van der Waals vs. Conventional

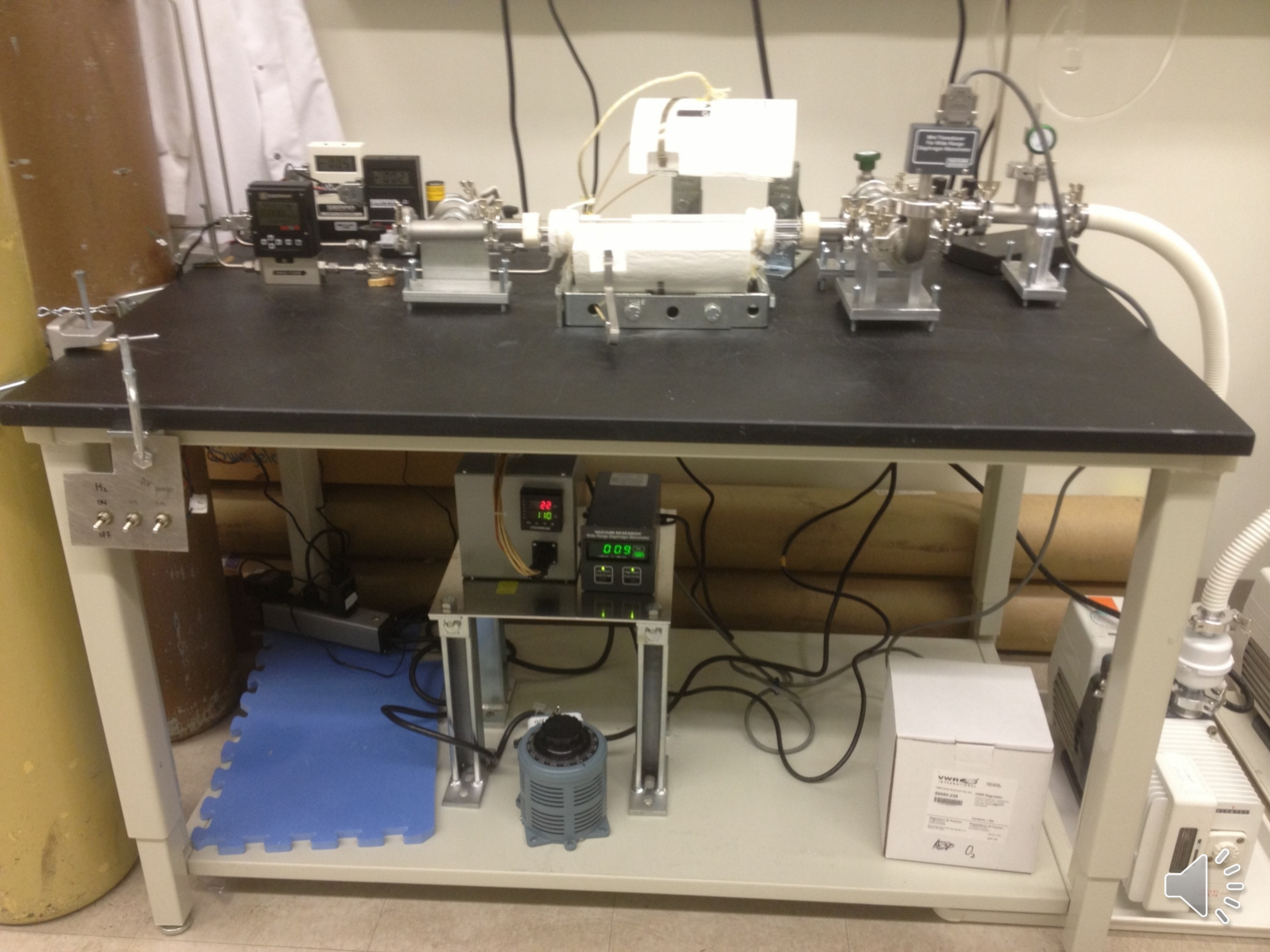
Conventional Epitaxy

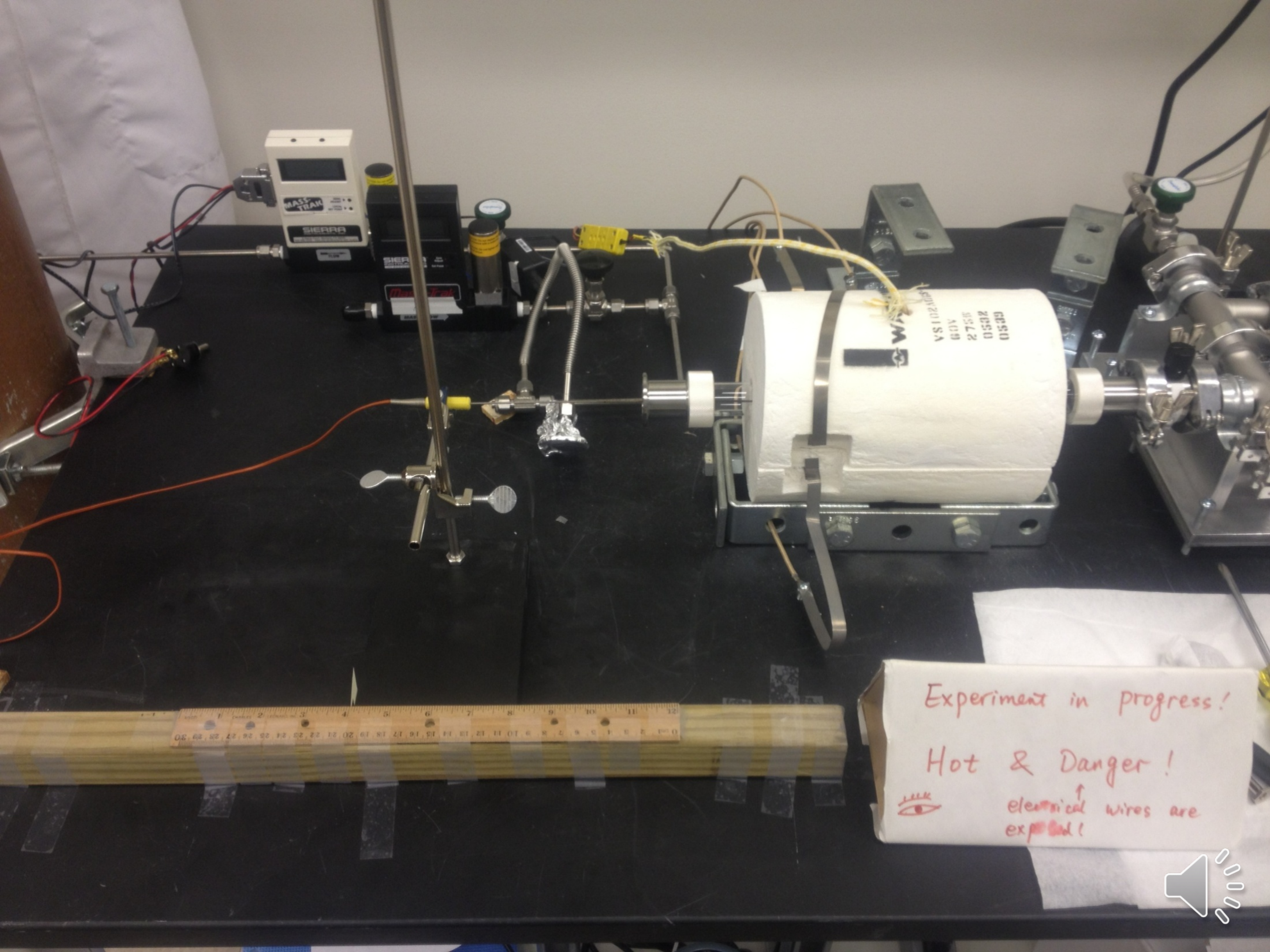




van der Waals Epitaxy



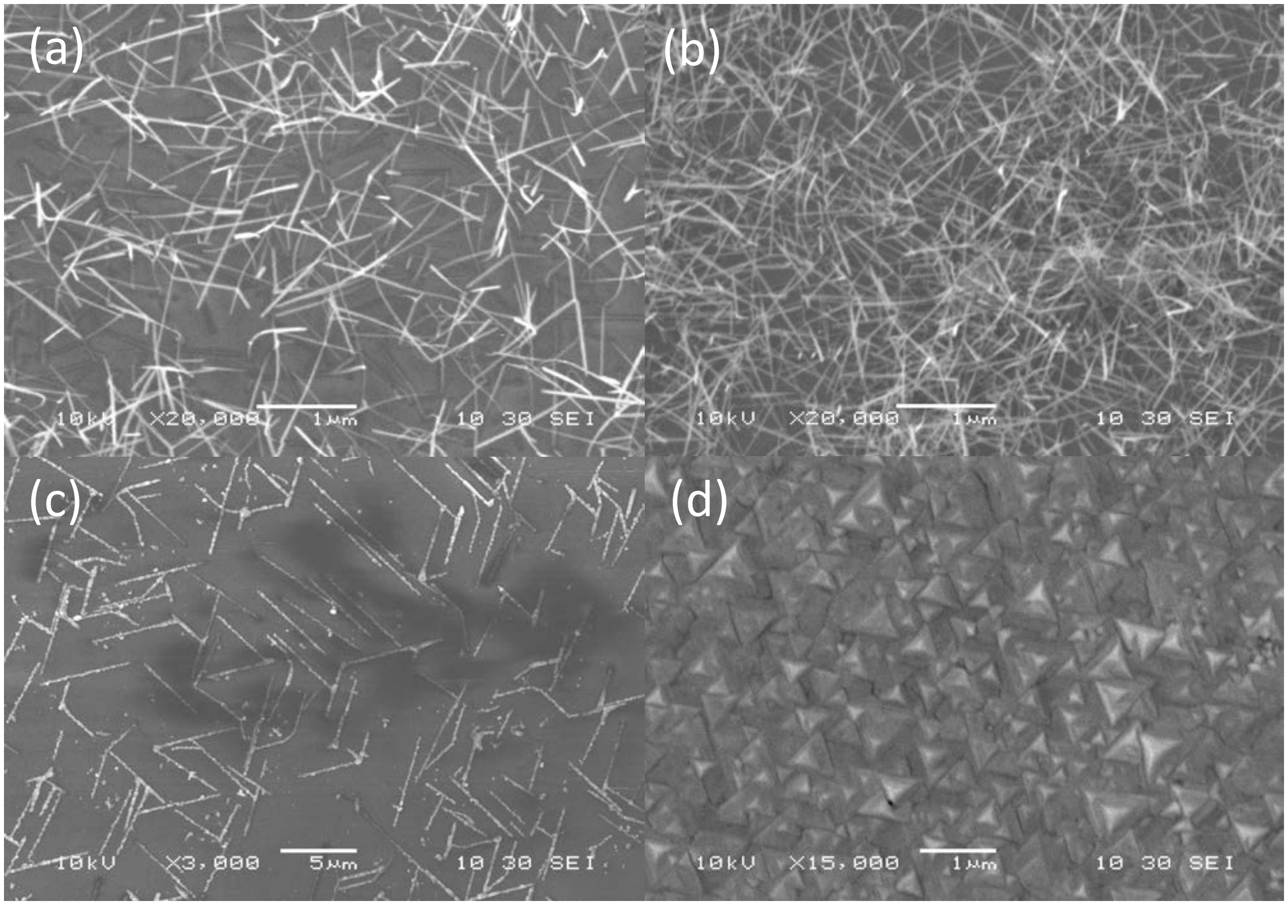

H2
ON
OFF
VWR
O2



MASS-TRAK
SIERRA
Experiment in progress!
Hot & Danger!
wires are

Results and Discussion

— ZnTe on Mica



Pressure

~50 Torr

Temperature

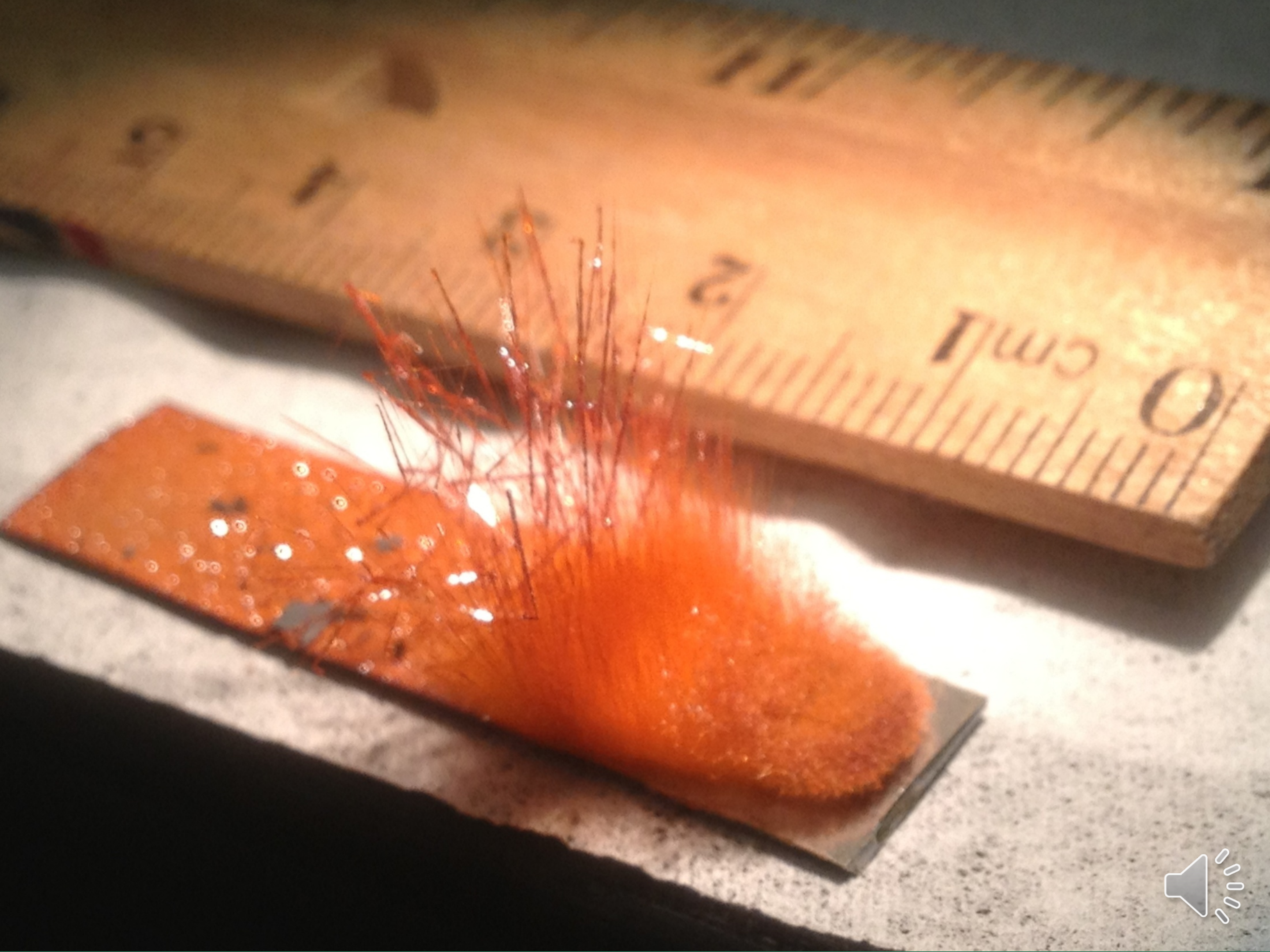
800 ^{o}C

Time

30 min

H_2

1.5 sccm



-ZnTe Flag on 10 nm Au/Si

Summary

- ZnTe on mica
  - Tiny nanowires upstream of the source.
  - Downstream, the growth turned directly to a thick film
  - Film showing epitaxial growth
- ZnTe on Si with Au catalysts
  - Ultra-long micro-wires up to 20mm at high temperature zone: ~680 - 630
  - Ultra-long nanowires up to 10mm at medium temperature zone : ~630 - 575
  - Dandelion-like nanowires at low temperature zone : ~575 - 480
  - Flag structures waving under SEM

Future Work

- Modify temperature profile
- Study crystal structure and epitaxial growth relation
- Investigate the evolution of nanowires
- Improve crystal quality and uniformity
- Core-shell II-VI nanostructure

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