



# 2021「中技社科技獎學金」

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## Modification of monolayer 1T-VSe<sub>2</sub> by selective deposition of V and Te

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### Introduction

#### • MBE Components:

- UHV Chamber: high mean path of evaporated atoms
- Electron gun: materials having higher melting point
- Effusion Cell: material with low melting point
- Manipulator: Facilitated with substrate heating
- RHEED: Monitor layer by layer growth on substrate
- QCM: measures a mass variation per unit area

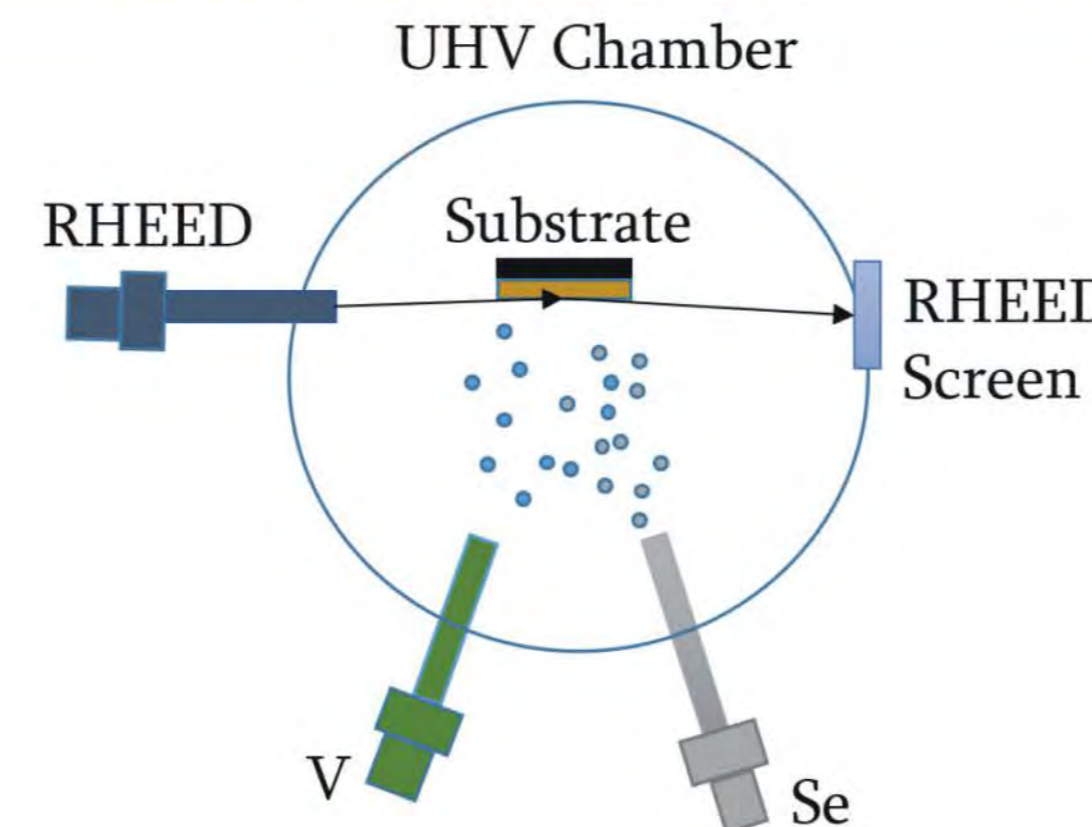


Fig 1: Schematic View of working of MBE setup

#### • MBE Capability:

- Precise control of growth parameters
- Best suited for thin films growth
- Fabrication of artificial heterostructures
- In-situ to LTSTM can facilitate study of
  - low dimension phase transition
  - Local density of states
  - Transition temperature
  - Symmetry breaking

### Monolayer VX<sub>2</sub> (X=Se, Te)

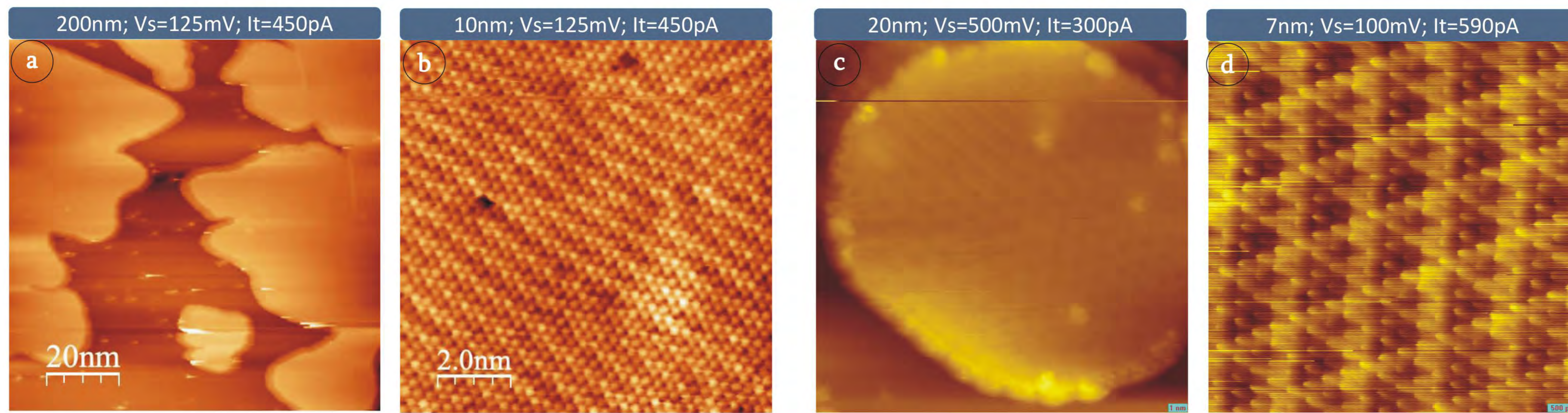


Fig 2: VSe<sub>2</sub> STM image at 78K (a) Monolayer VSe<sub>2</sub> on HOPG substrate (b) atomic resolution showing  $\sqrt{7} \times \sqrt{3}$  CDW periodicity on monolayer 1T-VSe<sub>2</sub>

Fig 3: VTe<sub>2</sub> STM image at 78K (a) Monolayer VTe<sub>2</sub> on HOPG substrate (b) atomic resolution showing (4x4) CDW periodicity on monolayer 1T-VTe<sub>2</sub>

### Topography of 1T-VSe<sub>2</sub> islands upon selective deposition of V and Te

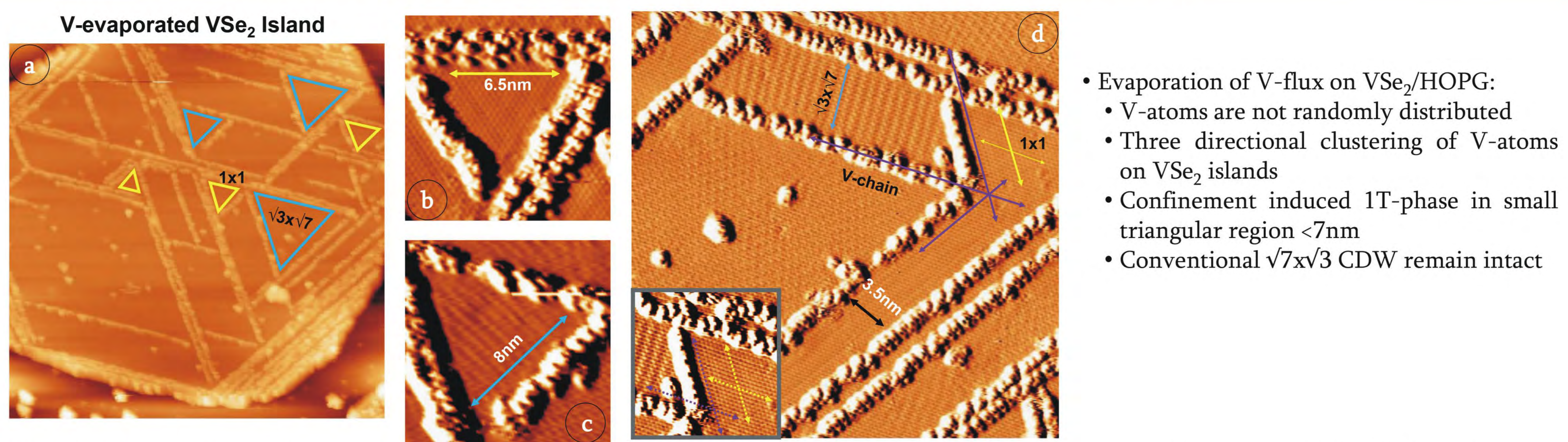


Fig 4: STM image at 78K (a) V-clusters on VSe<sub>2</sub> Island (size: 80 x 80 nm<sup>2</sup>) (b) Transition to 1T-VSe<sub>2</sub> in small confined triangular region (size: 10 x 10 nm<sup>2</sup>) (c)  $\sqrt{7} \times \sqrt{3}$  CDW observation (size: 12 x 12 nm<sup>2</sup>) (d) V-clusters aligned along 1T-Closed packed direction (magnified inset topography) (size: 20 x 20 nm<sup>2</sup>). Tunneling: V<sub>s</sub> = 0.7 V; I<sub>t</sub> = 510 pA

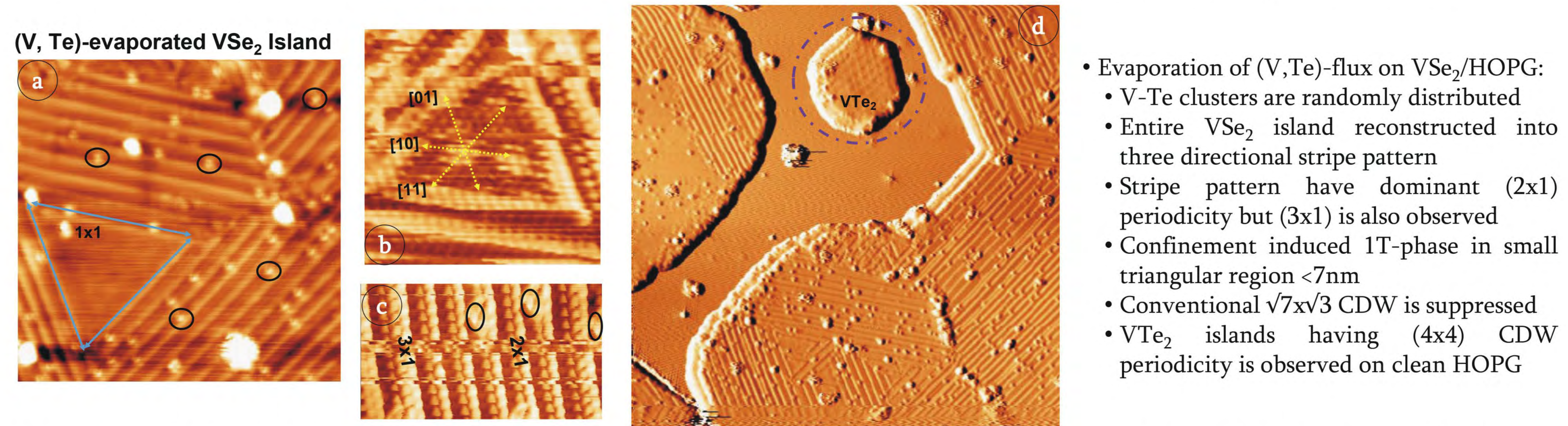


Fig 5: STM image at 78K (a) Surface reconstruction upon codeposition of (V, Te) flux (size: 20 x 20 nm<sup>2</sup>) (b) Small triangular region having 1T-VSe<sub>2</sub> phase (size: 10 x 10 nm<sup>2</sup>) (c) (2x1) and (3x1) periodicity on reconstructed surface (size: 8 x 4.5 nm<sup>2</sup>) (d) VTe<sub>2</sub> island on bare HOPG (size: 80 x 80 nm<sup>2</sup>). Tunneling: V<sub>s</sub> = -1 V; I<sub>t</sub> = 510 pA



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