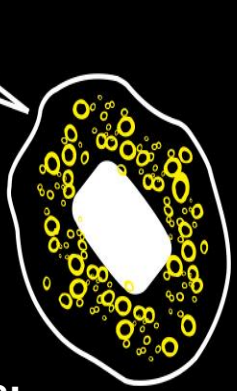
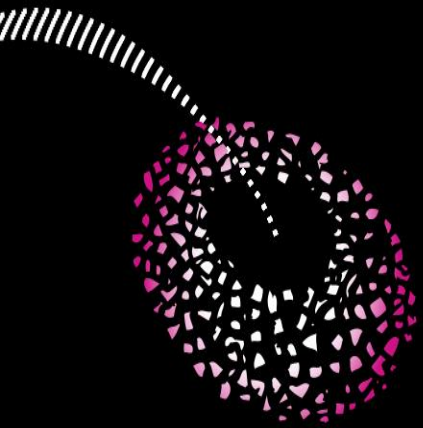
UNIVERSITY OF TWENTE.



Local Conduction in Transition Metal Dichalcogenides: The Role of Stacking Faults, Defects and Alloying



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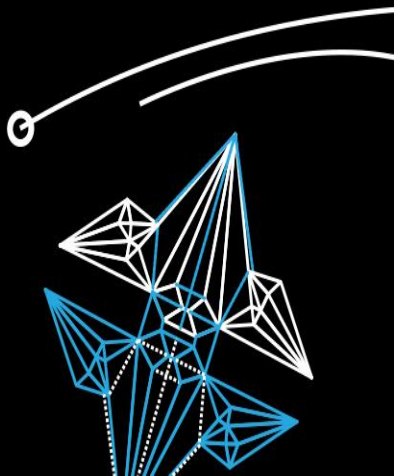
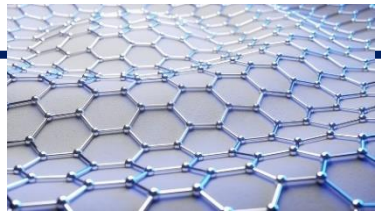
Physics of Interfaces and Nanomaterials
(Chair: H. Zandvliet)

University of Twente, the Netherlands

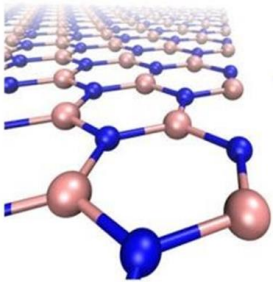


2D materials

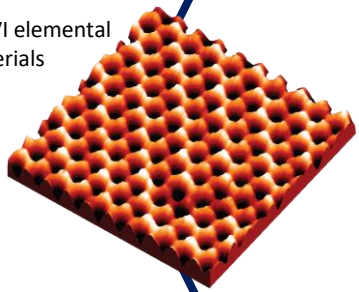
Graphene



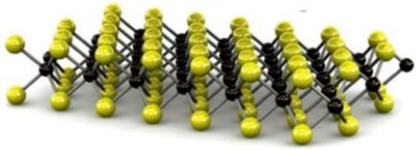
h-BN



Group VI elemental
2D materials



Transition metal dichalcogenides

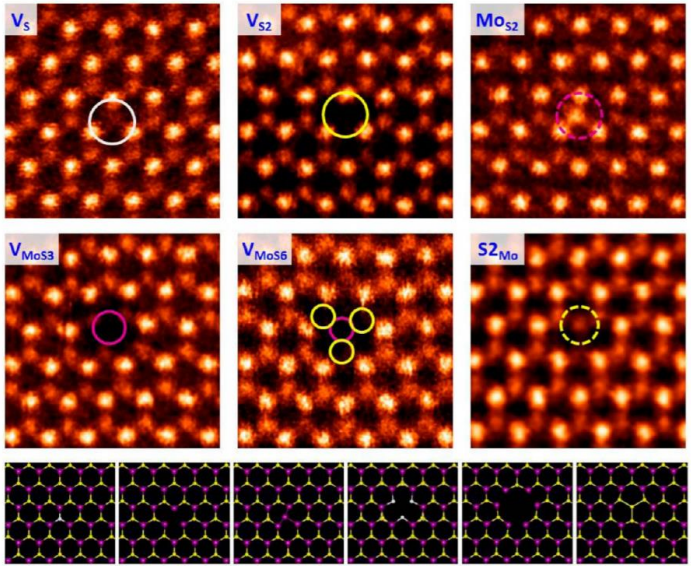


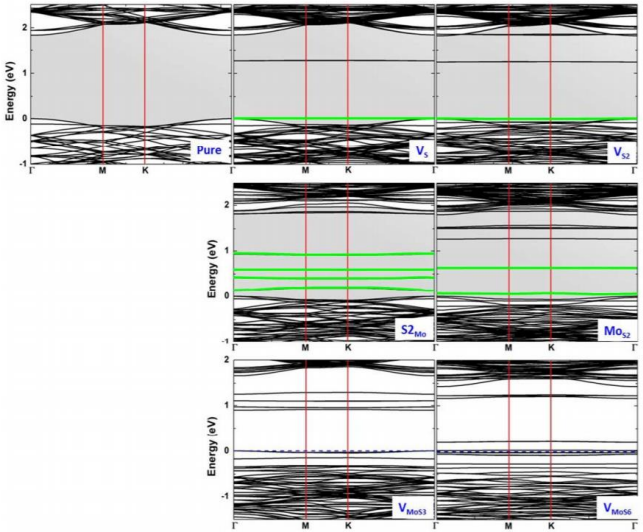
Modification of the Band-structure:

- ✓ Charge
- ✓ Strain
- ✓ Mixing
- ✓ Defects
- ✓ Stacking

2D materials

Defects in MoS_2

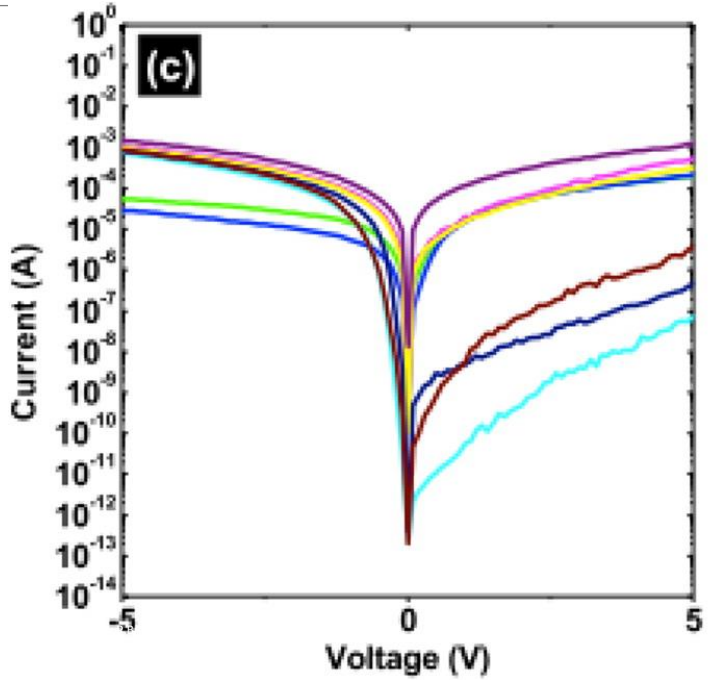




Nano Lett., **2013**, *13* (6), pp 2615–2622

MoS_2-metal contacts

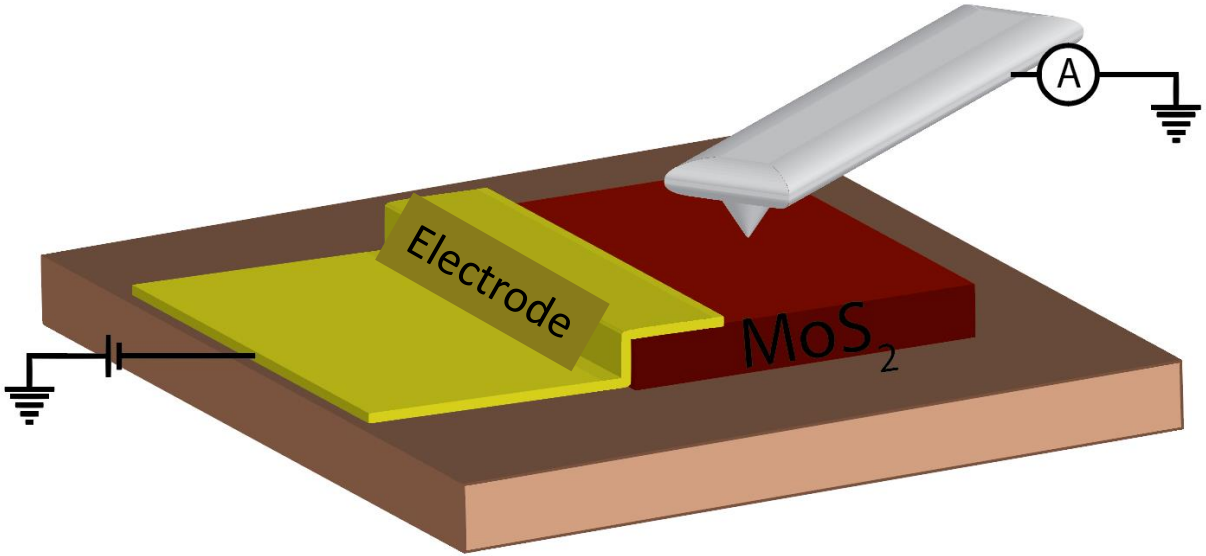
Unpredictable behavior



ACS Nano, 2014, 8 (3), 2880–2888

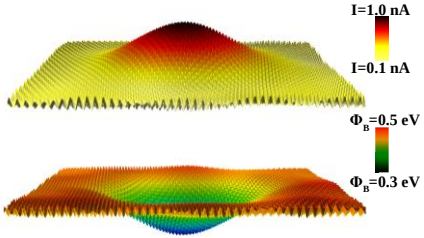
ACS Appl. Mater. Interfaces, **2015**, *7* (22), 11921–11929

Conductive AFM as a nanoscopic tool for electrical characterization



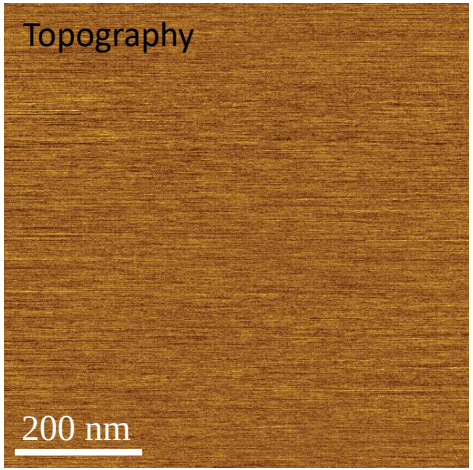
Overview

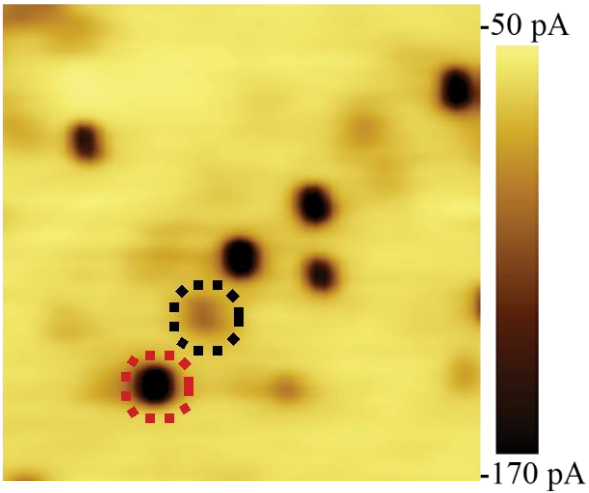
1. Schottky barrier heights in MoS_2/metal contacts



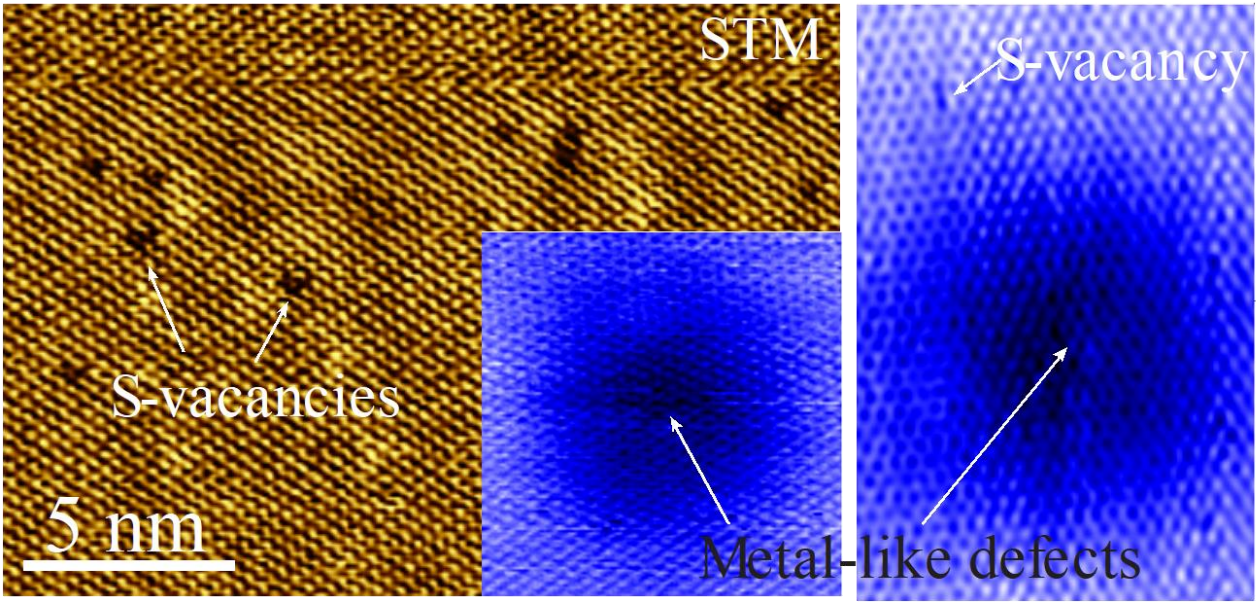
Schottky barrier heights in MoS_2/metal contacts

Visualization of Defects



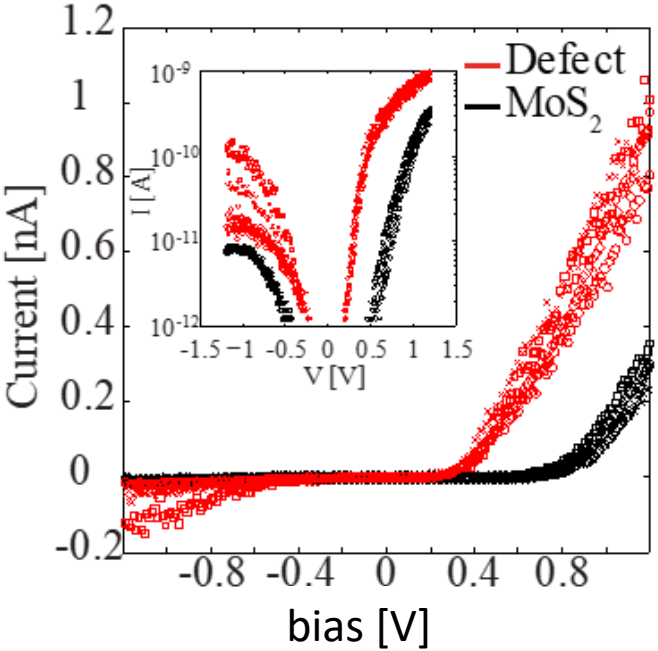


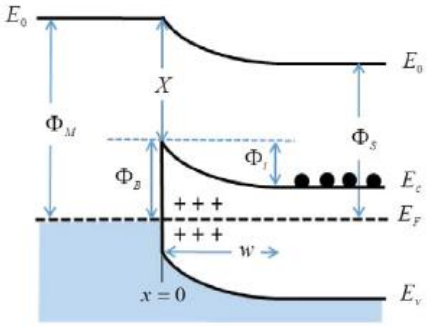
Defects located in the Mo-layer



Charge transport

Metal-Semiconductor contacts





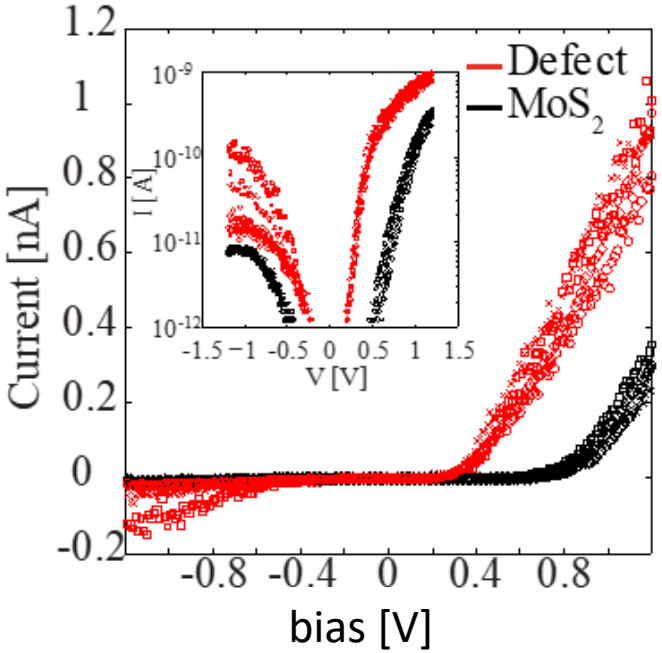
Thermionic emission:

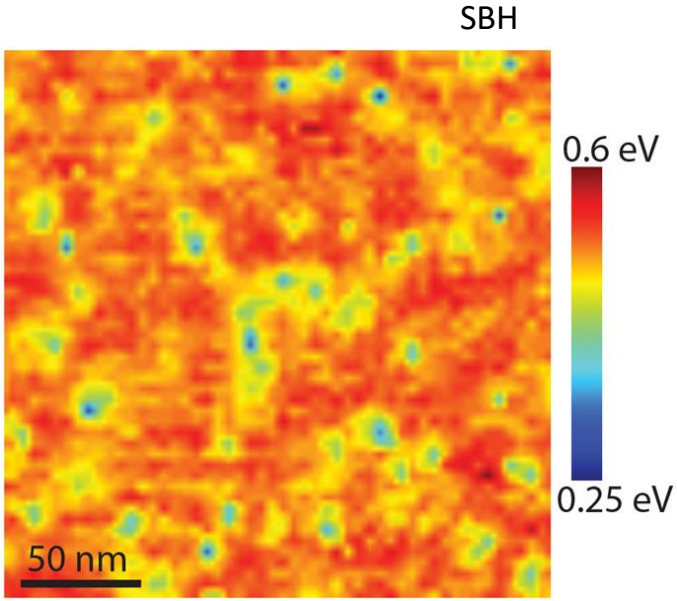
$$I = I_0\left[\exp\left(\frac{qV}{\eta k_B T}\right) - 1\right] \qquad \phi_B = \frac{k_B T}{q}\ln\left(\frac{A^* A T^2}{I_0}\right)$$

$$I_0 = AA^*T^2 \exp\left(-\frac{q\phi_B}{k_B T}\right)$$

Charge transport

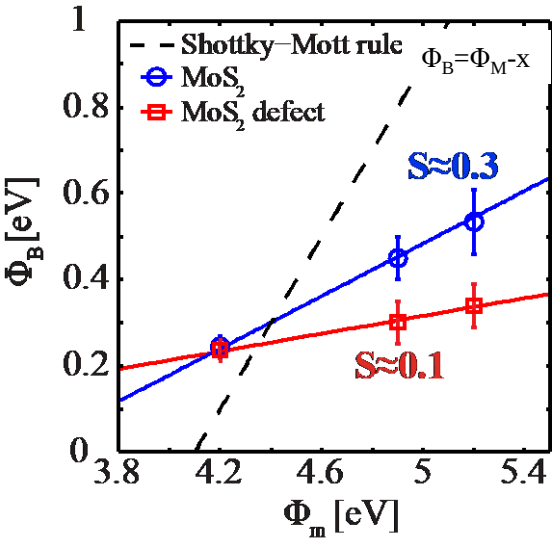
Metal-Semiconductor contacts

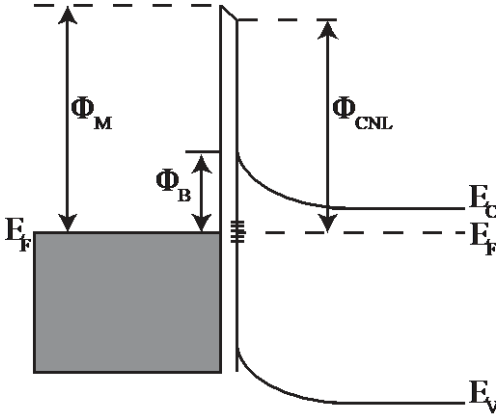




Charge transport

Fermi level pinning





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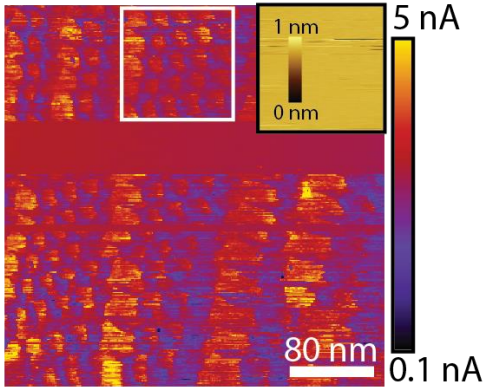
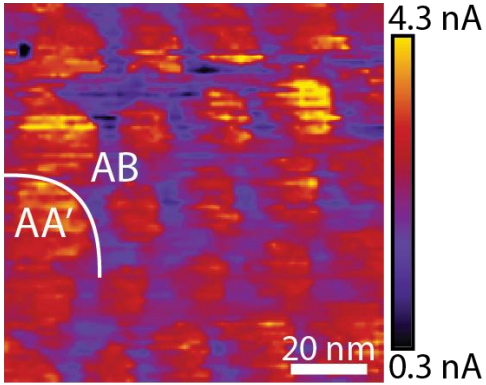
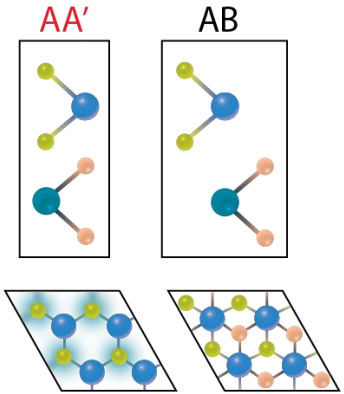
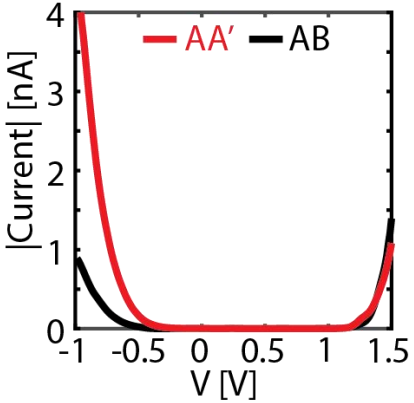
Stacking faults



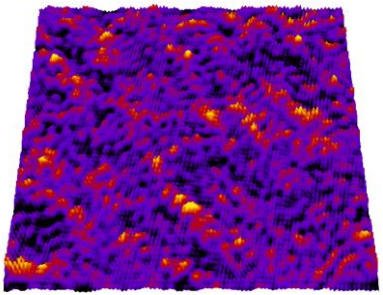






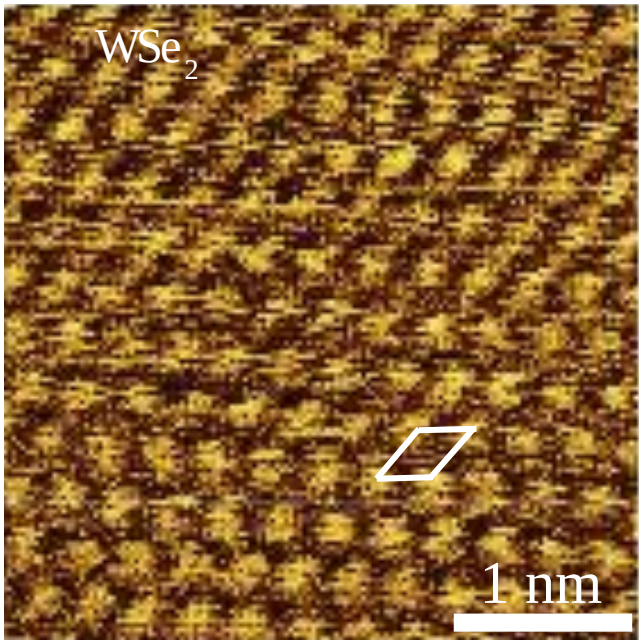
Overview

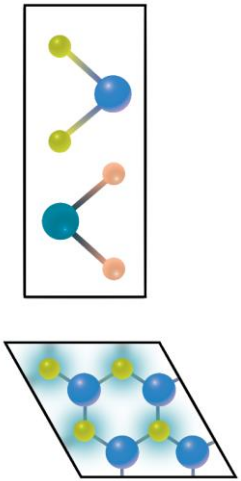
2. Local conduction in $MoWSe_2$ alloys



WSe_2

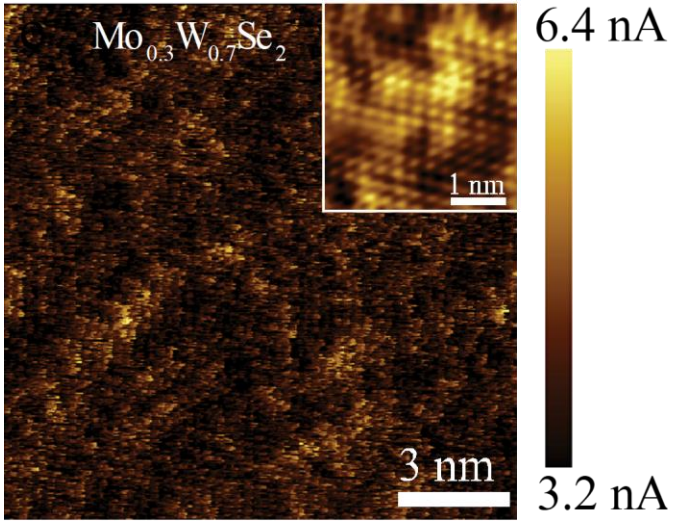
Atomic Periodicity with C-AFM

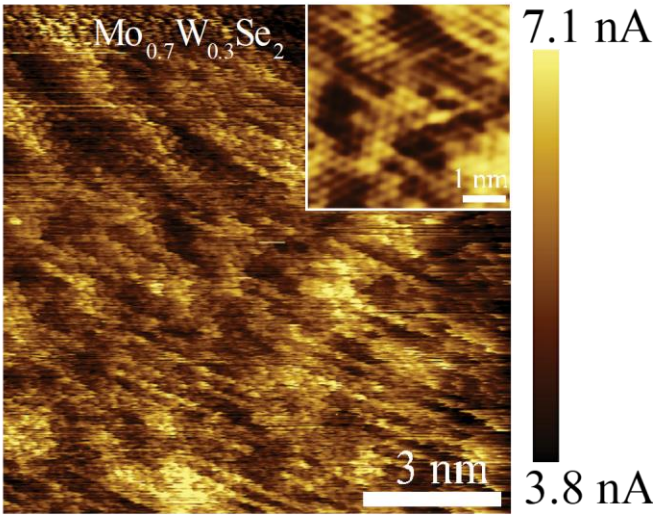




Local conduction in $MoWSe_2$ alloys

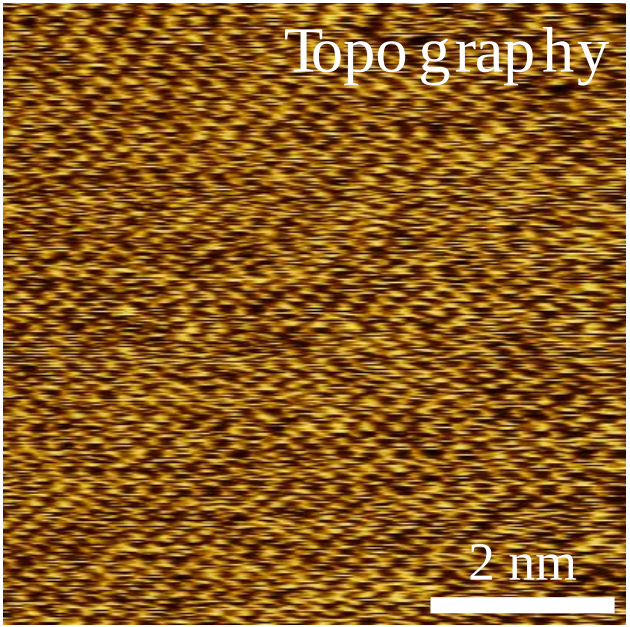
Segregation





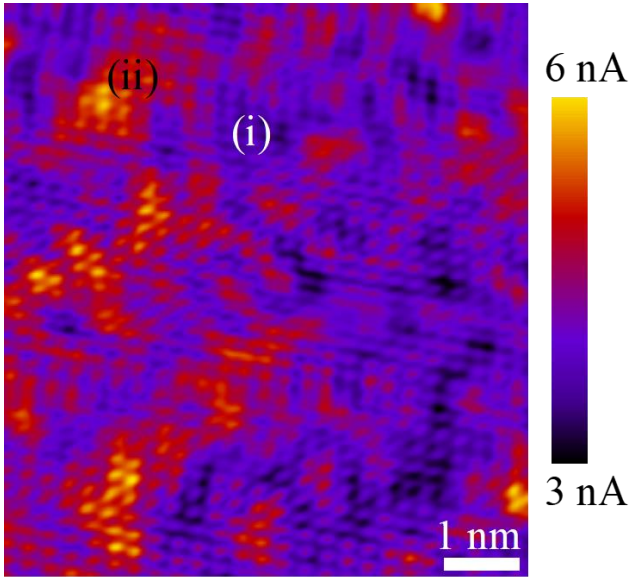
Local conduction in $MoWSe_2$ alloys

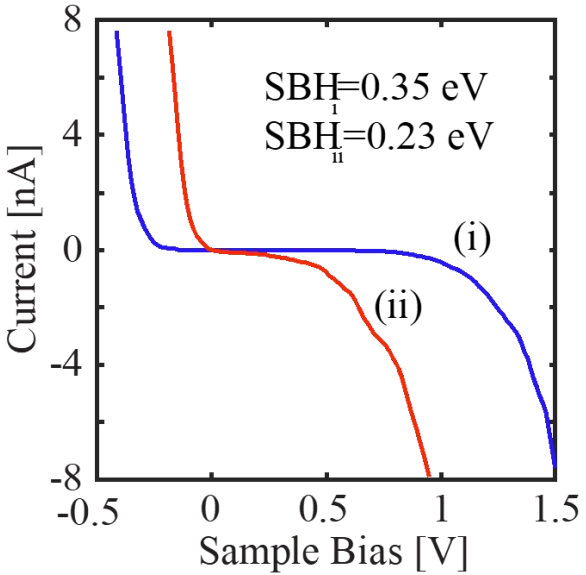
Segregation



Local conduction in $MoWSe_2$ alloys

Segregation



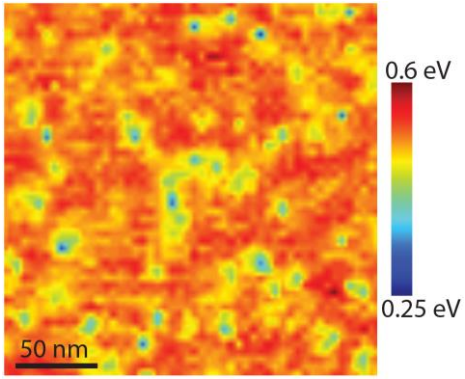


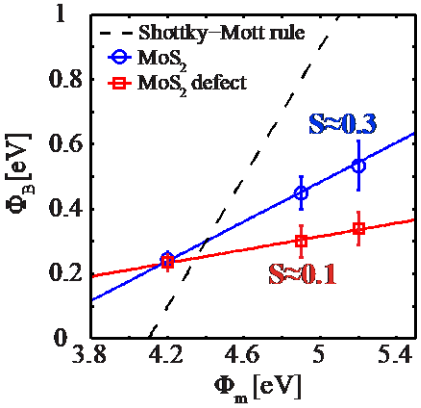
(i) W-rich
(ii) Mo-rich

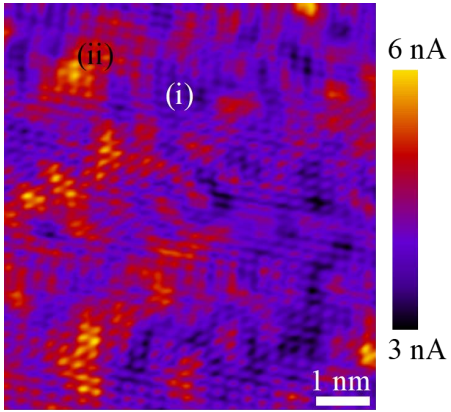
Bampoulis et al. , ACS Appl. Mater. Interfaces 10, 15, 13218-13225, 2018

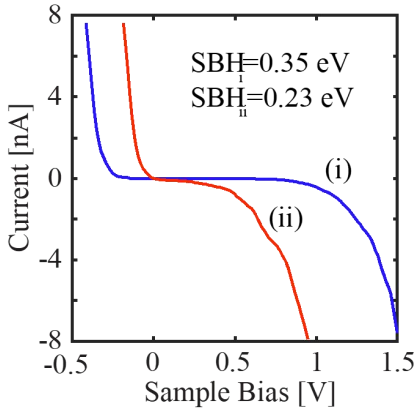
Bampoulis et al. , ACS Appl. Mater. Interfaces 9, 22, 19278-19286, 2017
Bampoulis et al. , ACS Appl. Mater. Interfaces 10, 15, 13218-13225, 2018

Conclusions









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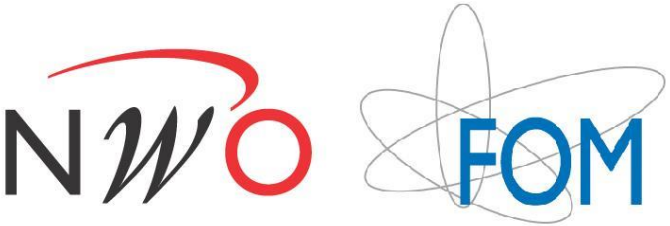

Thank you for your attention