MBE growth of SnTe topological crystalline insulator nanowires and nanoplates on graphene

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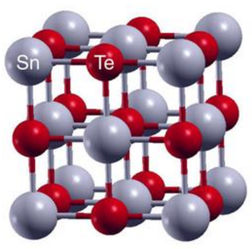
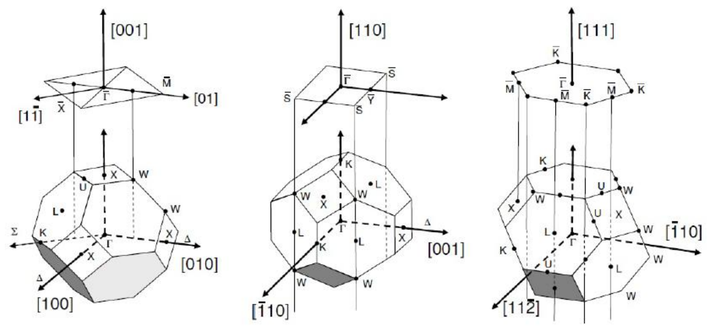
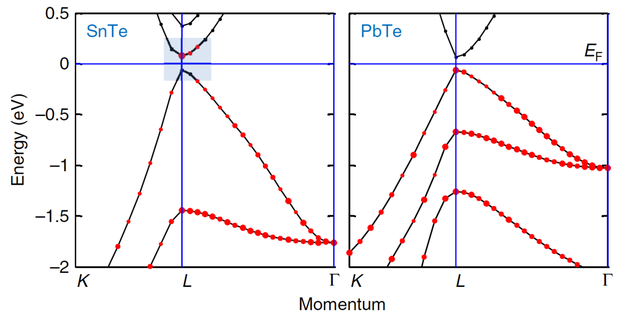
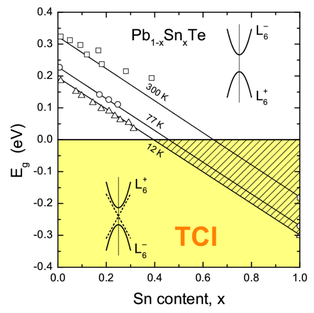
Introduction

In IV-VI topological crystalline insulator (TCI) the topological states are protected by (110) mirror-plane symmetry of the rock-salt crystal structure [*Liang Fu, PRL 106, 106802 (2011)*]. This phase is manifested by gapless Dirac-like surface states observed upon inversion of band symmetries and exhibits specific helical spin texture [*P. Dziawa et al. Nat.Mat. (2012), S.-Y. Xu et al. Nat. Commun. (2012), Y. Tanaka et al. Nat. Phys. (2012)*].



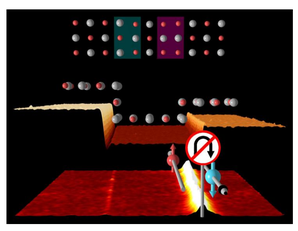






Motivation

- High surface/volume ratio
- Recent results of 1D TCI state
  [P. Sessi et al., Science (2016)]
- Electronic transport studies 1D
- 2D graphene – 1D TCI heterostructure



Conclusions

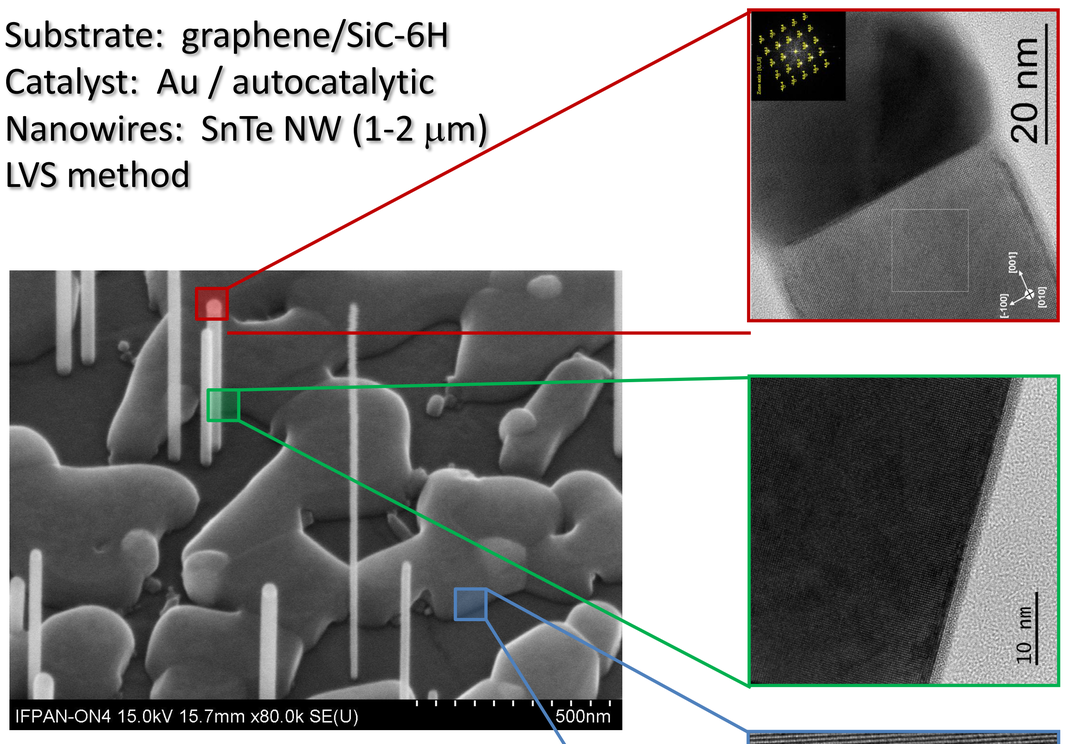
- NW (square-shaped cross-section, <100> direction of growth)
- No stacking faults
- Nanoplates
- Unconctrolled oxidation

Near future

- Ternary compounds $Pb_{1-x}Sn_xTe$
- Core-shell structures
- Nano-litography, electrical contacts
- Transport studies of growth nanostructures

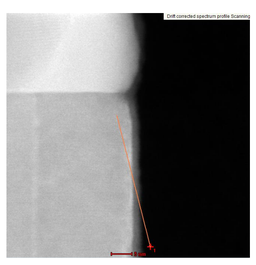
Samples – nanowires

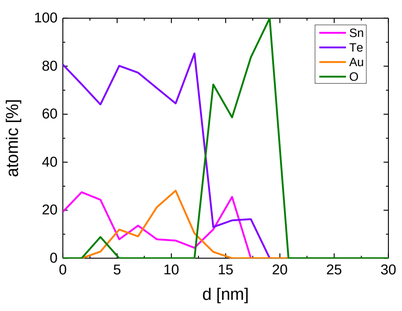
Substrate: graphene/SiC-6H
Catalyst: Au / autocatalytic
Nanowires: SnTe NW (1-2 μm)
LVS method



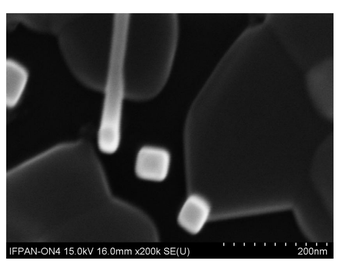
STEM

Surface oxidation

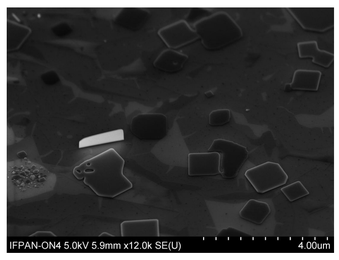


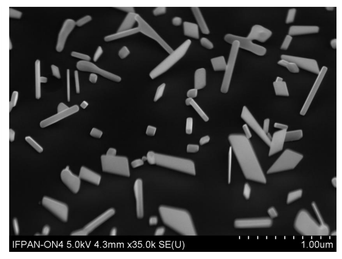


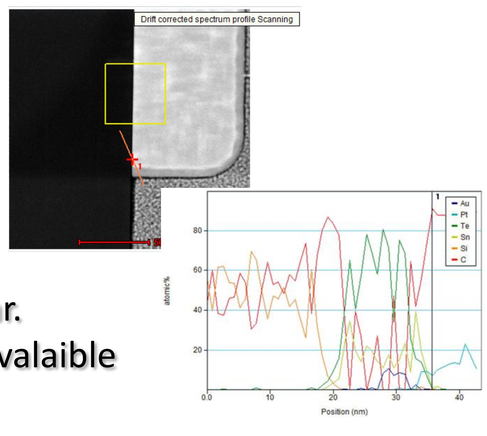
Cross-section



Nanoplates



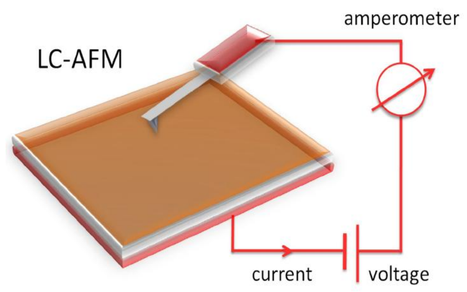


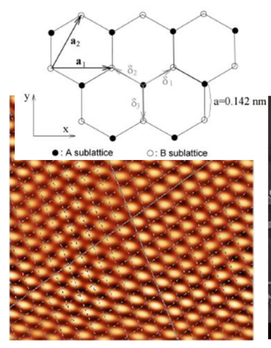


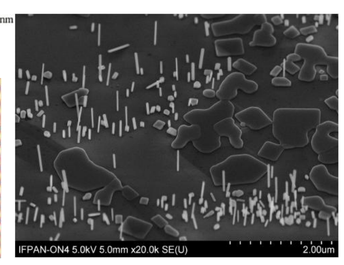
- Two possible orientation: vertical + planar.
- Planar nanplates: (100) and (110) walls avalaible

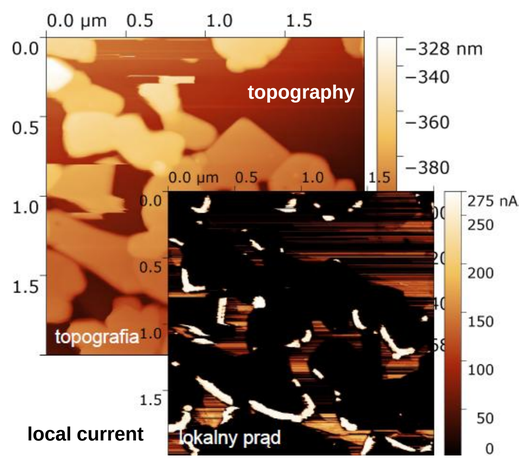
Local conductivity AFM

- contact mode, 5 nN force
- BudgetSensors – Si needles
  covered with thin Pt-Ir
- Voltage +5 mV
- scan speed 1 μm/min
- typical scan range 1 μm x 1 μm









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