Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **1955** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Dimensionality and length scale of defects in epitaxial SnTe topological crystalline insulator films

Tuesday 12 June 2018 13:30 (15 minutes)

Revealing the local electronic properties of surfaces and their link to structural properties is an important problem for topological crystalline insulators (TCI) in which metallic surface states are protected by crystal symmetry. As a first step toward this goal, we have studied the epitaxial growth of SnTe films and characterized their structural and electronic properties by molecular beam epitaxy using scanning probe microscopy, non-contact atomic force microscopy, low-energy and reflection high-energy electron diffraction, X-ray diffraction, Auger electron spectroscopy, and density functional theory [1,2]. Initially, SnTe (111) and (001) surfaces are observed; however, the (001) surface dominates with increasing film thickness. The films grow island-by-island with the [011] direction of SnTe (001) islands rotated up to 7.5° from SrTiO3 [010]. Although films with a mosaic spread in the epitaxial alignment are generally undesirable, in this case they provide a route to creating periodic symmetry breaking defects that may be used to pattern topological states. Microscopy reveals that defects on different length scales and dimensions that affect the electronic properties, including point defects (0D); step edges (1D); grain boundaries between islands rotated up to several degrees; edge-dislocation arrays (2D out-of-plane) that serve as periodic nucleation sites for pit growth (2D in-plane); and screw dislocations (3D). These features cause variations in the surface electronic structure that appear in STM images as standing wave patterns and a non-uniform background superimposed on atomic features. The results indicate that both the growth process and the scanning probe tip can be used to induce symmetry breaking defects that may disrupt the topological states in a controlled way.

[1] O. E. Dagdeviren *et al.*, Advanced Materials Interfaces **4**, 1601011 (2017).

[2] O. E. Dagdeviren *et al.*, Physical Review B **93**, 195303 (2016).

Primary authors: Dr DAGDEVIREN, Omur E. (McGill University); Prof. GRUTTER, Peter (McGill University)

Presenter: Dr DAGDEVIREN, Omur E. (McGill University)

Session Classification: T3-2 Thin Films, Magnetism and Solar Cells (DCMMP) | Films minces, magnétisme et piles solaires (DPMCM)

Track Classification: Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)