Ge_2Pt hut clusters: a substrate for germanene growth

Rik van Bremen
Pantelis Bampoulis, Johannes Aprojanz, Mark Smithers, Bene Poelsema, Harold J.W. Zandvliet

Physics of Interfaces and Nanomaterials, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands

r.vanbremen@utwente.nl

Germanene is a 2D material analogous to graphene. The germanium atoms in germanene form a buckled honeycomb lattice. The germanene on Ge_2Pt system is especially successful, since in this system the honeycomb of germanene was imaged. [1] In addition, the linear dispersion which is characteristic of Dirac materials, has been confirmed for germanene grown on Ge_2Pt clusters by STS. [2]
The next step in germanene growth would be to control the size of the germanene sheets. This requires control over the substrate, i.e. the Ge_2Pt clusters. Here we will study the growth of these clusters and how they act as a substrate for germanene growth. The clusters have been found to grow in a solid-liquid-solid manner. Pt is deposited on a clean Ge(110) substrate. After heating above the eutectic temperature, droplets of Ge-Pt move over the surface. Upon cooling, the droplets solidify into clusters. [3]
By using EDS and EBSD, the crystal structure of these clusters has been determined. The clusters have been found to preferentially grow in a particular shape. This shape is the shape of a hut as can be seen in Figure 1 (a). Some of the huts are more elongated, while others have a square base and resemble pyramids. The clusters can additionally have a flat top.
By using AFM the slope of the facets of the clusters can be measured. Combining these results with the EBSD results, the terminating planes of the Ge_2Pt crystal can be determined to be the {101} and {011} planes. STM results were used to confirm a match with these planes as can be seen in Figures 1 (b) and (c). The germanene honeycomb was sometimes visible instead of the underlying substrate as is shown in Figure 1 (b).
With these results it has been shown how the clusters are used as a substrate for the growth of germanene sheets. These results allow further research in growth control and optimization of the Ge_2Pt substrate and correspondingly the germanene sheets.

References

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Figures

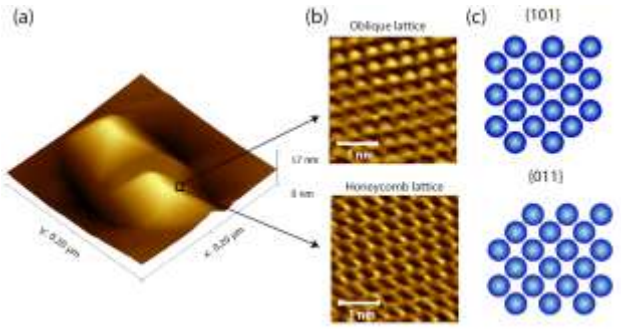

Figure 1: (a) STM topography image of two Ge_2Pt hut clusters next to each other. (b) STM topography images of the long face of the cluster. On top the common oblique lattice is found while at the bottom the more rare honeycomb lattice is shown. (c) A model of the cross-sections of the {101}, {011} planes of Ge_2Pt.