Topological edge states in armchair germanene nanoribbons

Dennis Klaassen*[1], Carolien Castenmiller[1], Jelle Van Mil[1], Bene Poelsema[1], Arie Van Houselt[1], Harold Zandvliet[1], and Pantelis Bampoulis[1]

[1]University of Twente [Netherlands] – Netherlands

Abstract

We have developed a novel approach to growing one-dimensional armchair germanene nanoribbons, Fig. 1a. The nanoribbons grow through diffusion and segregation of germanium on a GePt wetting layer on Ge(110). The nanoribbons run along the (-110) direction and have a distorted honeycomb lattice with lattice constants of 0.46 nm and 0.42 nm, Fig. 1b. The ribbons are armchair terminated, their widths scale with units of 1.12 nm, i.e. the lattice constant of the wetting layer along the (001) direction, and their lengths extend up to hundreds of nanometers. The nanoribbons are characterized by a large bandgap of about 200 meV at their interior and a pronounced electronic edge state localized exactly in the middle of the band gap, Fig. 1c. The edge state is robust to disorder as it runs uninterrupted along the armchair edges, Fig. 1d, with only minor intensity variations, suggesting protection by topology. The large interior band gap and the robust, one-dimensional metallic edge state indicate that we are dealing with a topological insulator.

*Speaker