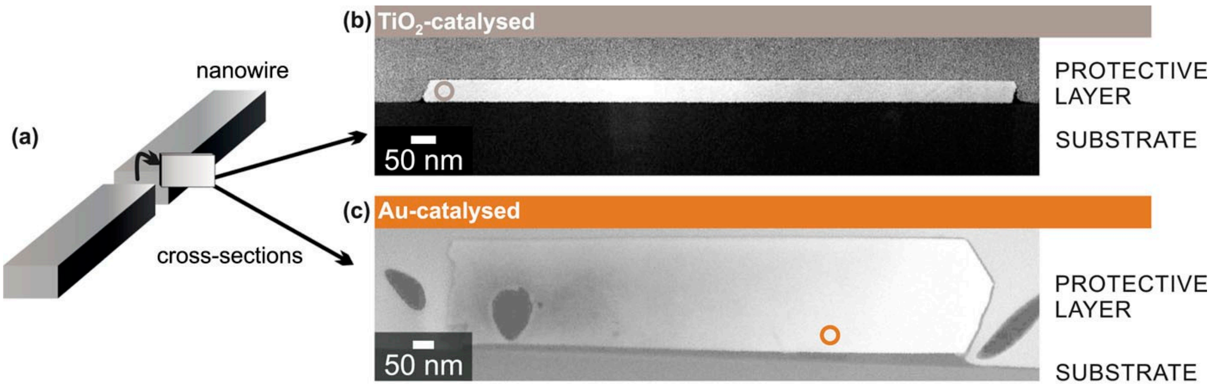
Perfect quintuple layer Bi_2Te_3 nanowires: Growth and thermoelectric properties

P. Schönherr, D. Kojda, V. Srot, S. F. Fischer , P. A. Van Aken, and T. Hesjedal

APL Mat. **5**, 086110 (2017).

Short Abstract

Bi_2Te_3 nanowires are promising candidates for thermoelectric applications. Vapour-liquid-solid growth of these nanowires is straightforward but the traditional Au-catalysed method often leads to Au contamination and crystal defects. Here, we compare the Au-catalyzed growth method with an alternative method using TiO_2. The latter approach yields perfect quintuple layer nanowires, whilst using Au leads to mixed quintuple and septuple layer structures. While Bi_2Te_3 has a high thermoelectric efficiency one obstacle on the road to more efficient thermoelectric Bi_2Te_3 nanowires is a high intrinsic doping by antisite defects, which can be reduced through annealing. Here, we demonstrate how to control the crystal structure of Bi_2Te_3 nanowires through the choice of catalyst, and present measurements of the basic thermoelectric properties.



Above. Sketch of a cross section taken from a Bi_2Te_3 nanowire. The cross section is taken perpendicularly to the long axis. (b) HAADF-STEM image of a cross section taken from a TiO_2-catalyzed Bi_2Te_3 nanowire. A circle indicated the location of the high-resolution scan. (c) HAADF-STEM image of a cross section taken from an Au-catalyzed Bi_2Te_3 nanowire. Dark holes are caused by thinning the samples through ion milling. A circle indicated the location of the high-resolution scan.