

Electronic Supplementary Information

A Facile Low-Temperature Growth of Large-Scale Uniform Two-End-Open Ge Nanotubes with Hierarchical Branches

Xiangdong Li,^a Guowen Meng,^{*a,b} An-Ping Li,^{*c} Zhaoqin Chu,^a Xiaoguang Zhu^a and Mingguang Kong^a

^a *Key Laboratory of Materials Physics and Anhui Key Laboratory of Nanomaterials and Nanostructures, Institute of Solid State Physics, Chinese Academy of Sciences, Hefei 230031, People's Republic of China. Fax: (+86) 0551-65591434; Tel: (+86) 0551-65592749; E-mail: gwmeng@issp.ac.cn*

^b *University of Science and Technology of China, Hefei, 230026, P. R. China*

^c *Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, United States. Fax: 8655741753; Tel: 8655766502; E-mail: apli@ornl.gov*

The Supplementary Information includes:

Part S1: Thermal reduction of catalyst precursors

Part S2: Figures S1 to S4

Part S1: Thermal reduction of catalyst precursors

The thermal reductions of catalyst precursor powders including nickel nitrate, silver nitrate, cobalt nitrate and copper sulphate were studied under a 60 standard cubic centimeter per minute (SCCM) flow of Ar in tandem with a 10 SCCM flow of H₂. About 1 g of each of the metal salts were placed in a sample pan and heated gradually from room temperature to 300 °C at 10 °C/min for 4 h. After that the post-annealed catalyst precursors were naturally cooled to room temperature.

Part S2: Figures S1 to S4

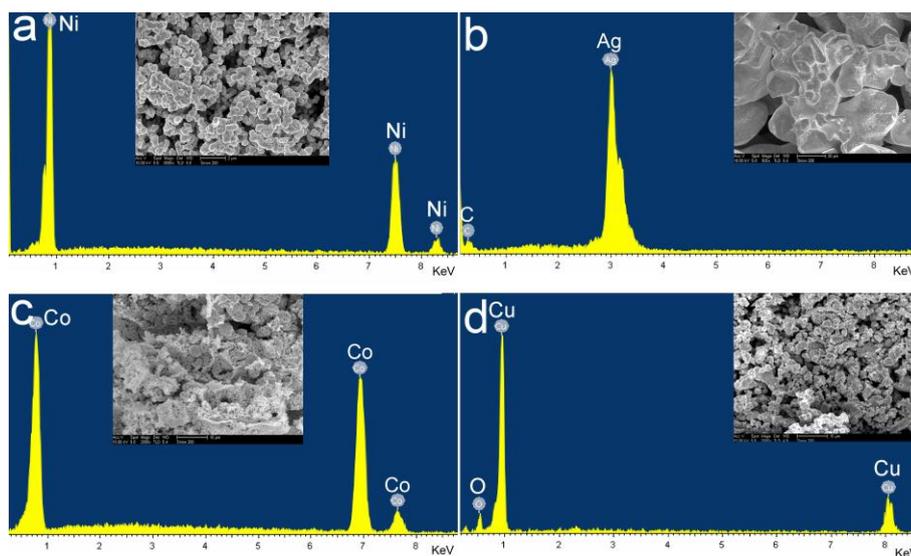


Figure S1. EDS measurements of the post-annealed (a) nickel nitrate, (b) silver nitrate, (c) cobalt nitrate, and (d) copper sulphate. The insets of (a-d) are the corresponding SEM images of post-annealed metal salt precursors. The EDS analysis demonstrates that all of the metal salts precursors were completely reduced to the corresponding metal atoms at 300 °C.

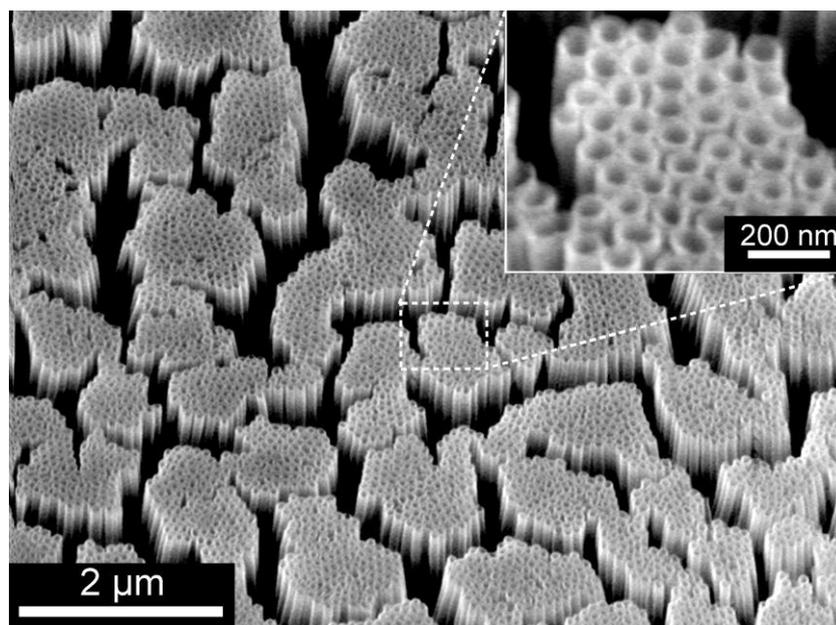


Figure S2. SEM images of GeNTs with large quantities and open ends.

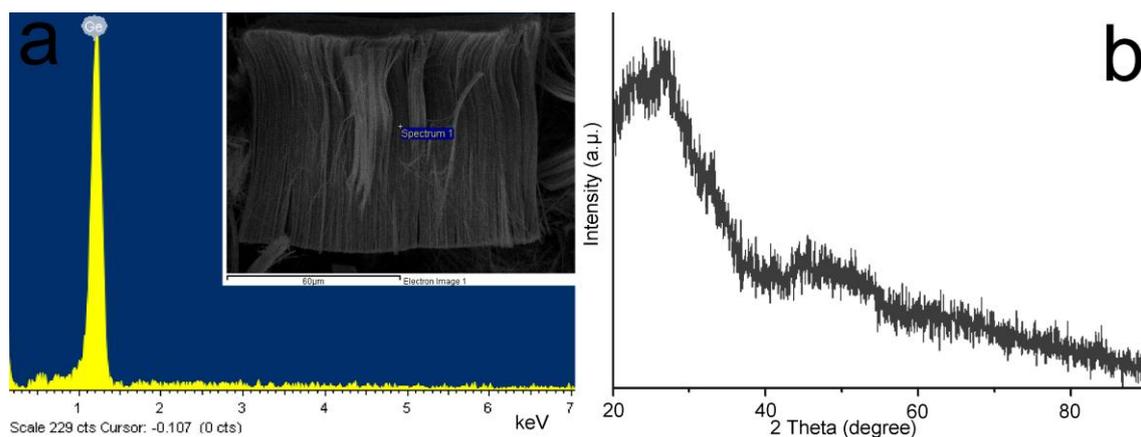


Figure S3. (a) EDS measurement of the as-grown GeNT arrays. (b) X-ray diffraction (XRD) pattern of the GeNTs embedded in the AAO template.

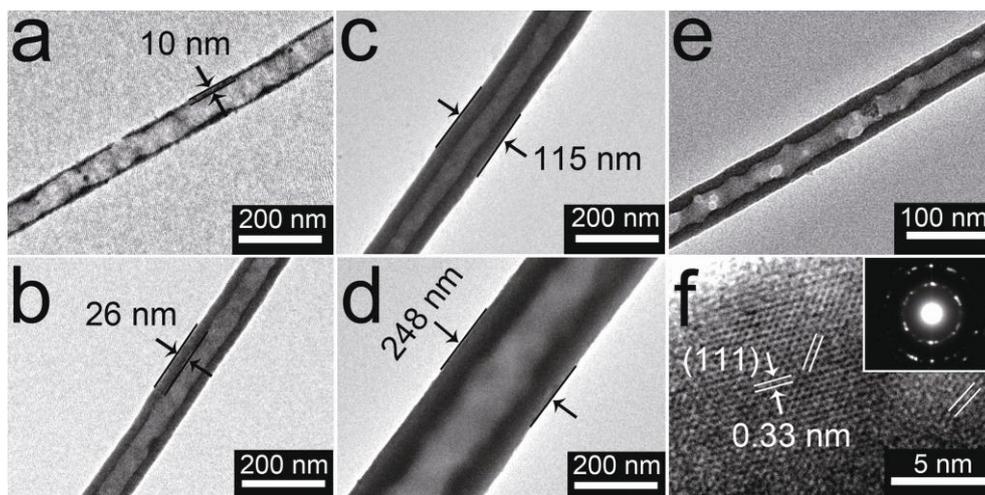


Figure S4. TEM images of nickel nitrate assisted GeNTs grown for (a) 10 min, (b) 30 min, (c) 30 min in template anodized at 60 V in 0.3 M oxalic acid aqueous solution, (d) 30 min in template anodized at 150 V in 0.3 M phosphoric acid aqueous solution. (e) and (f) TEM and HRTEM images of the post-annealed GeNTs at 400 °C for 2 h. The inset of (f) is the corresponding SAED pattern.