Electronic Supplementary Information

Morphology-Controlled Growth of Chromium Silicide Nanostructures and their Field Emission Properties

Yongliang Zhang, Qiang Wu,* Weijin Qian, Ning Liu, Xizhang Wang, Xingtai Qin, Leshu Yu, and Zheng Hu

Key Laboratory of Mesoscopic Chemistry of MOE, School of Chemistry and Chemical Engineering, Nanjing University 210093, China.

* E-mail: wqchem@nju.edu.cn.

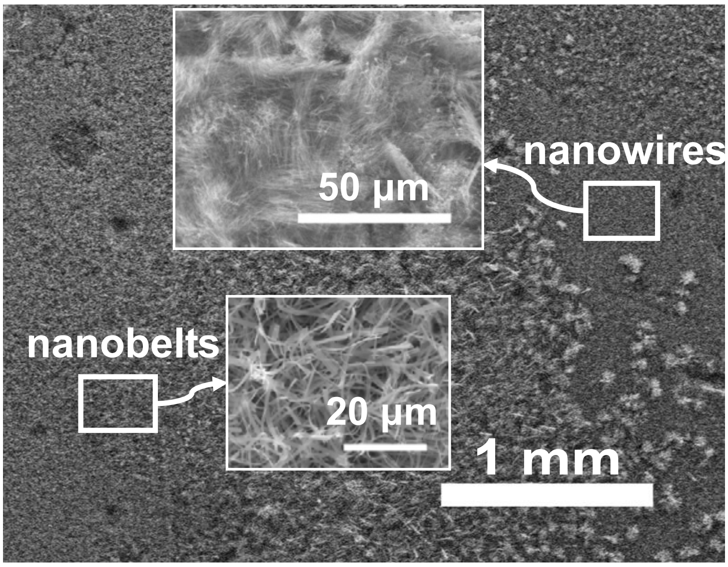

Fig. S1 SEM images of the nanobelts together with the nanowires. The nanowires laid underneath the nanobelts.

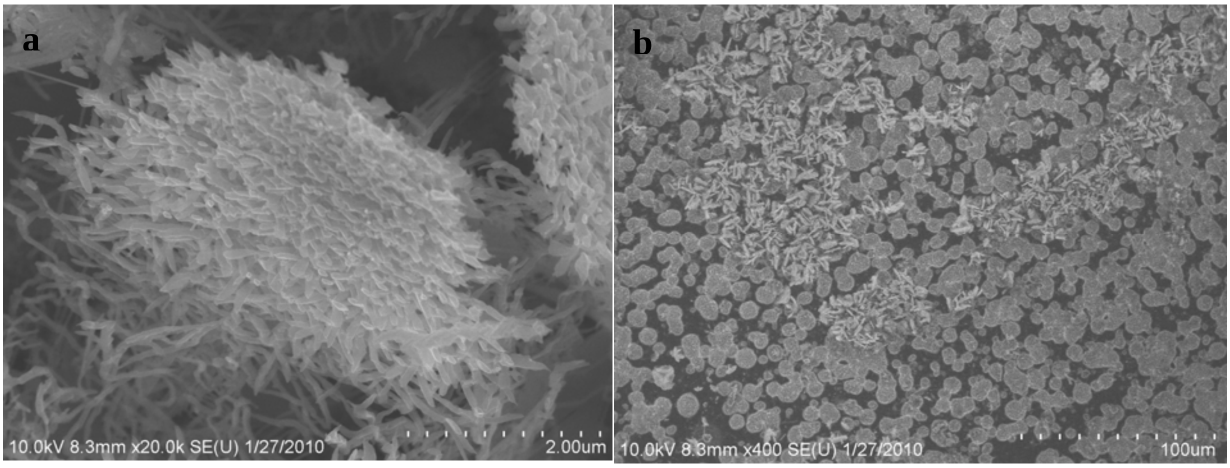

Fig. S2 (a) Magnified SEM image of a representative $CrSi_2$ microdisk with a cattail hassock-like morphology. It was clearly observed the microdisk was composed of numerous curled nanowires. (b) SEM image of sample after partially removing the $CrSi_2$ microdisks by Ar blowing (Ar pressure is about 0. 3 MPa). It was found the microdisks can be easily removed from the substrate, indicating that the disks just deposited on the substrate surface with poor adhesion. In addition, a great deal of etching caves could be observed on the substrate surface.

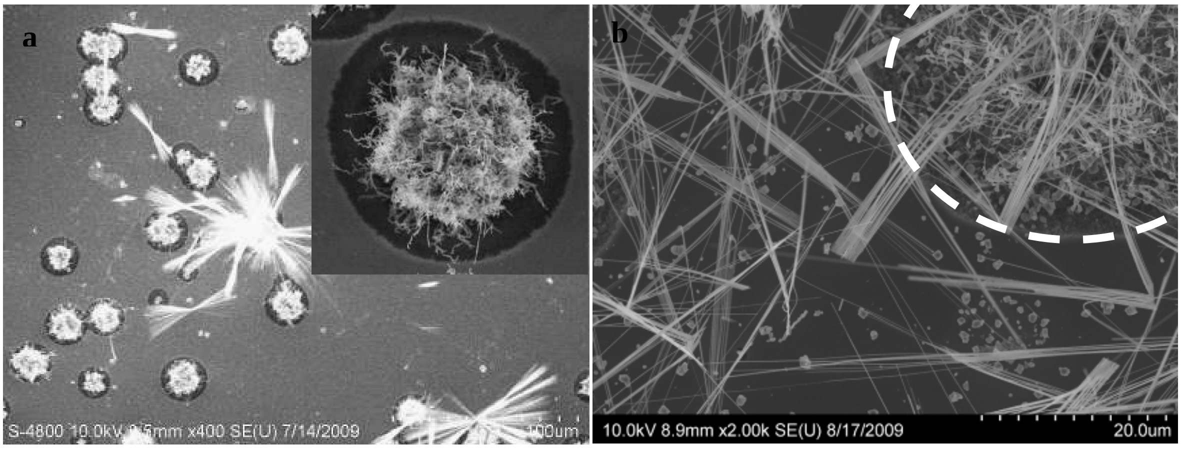

Fig. S3 SEM images of the product synthesized at 750 °C with longer distance between Cr source and Si wafer. Some etching caves were present on the Si substrate, and curled nanowires and nanoparticles formed in the caves (Some nanoparticles were deposited on the smooth surface of Si substrate as shown in b). In addition, some straight nanowire bundles could be observed near the etching caves, which clearly had different formation mechanism relative to the curled nanowires. This result revealed that the reaction between $CrCl_3$ and Si can produce $CrSi_2$ nanowires and nanoparticles, and the simultaneously produced $SiCl_4$ species can react with $CrCl_3$ to produce straight nanowire bundles.

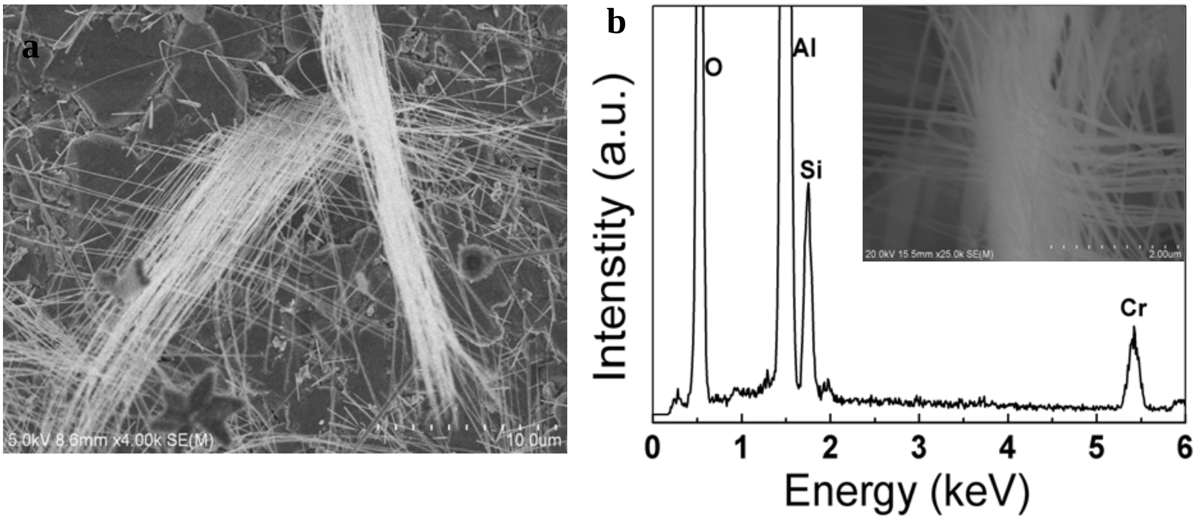

Fig. S4 (a) SEM image of $CrSi_2$ nanowire bundles deposited on Al_2O_3 substrate in a comparative experiment. (b) EDX spectrum of the nanowires. Inset was the corresponding SEM image. In the synthesis, gaseous $SiCl_4$ was generated via the gas-solid reaction 4 $CrCl_3$ (g) + 11 Si (s) → 4 $CrSi_2$ (s) + 3 $SiCl_4$ (g) and then it reacted with $CrCl_3$ through gas-gas reaction 2 $CrCl_3$ (g) + 4 $SiCl_4$ (g) → 2 $CrSi_2$ (s) + 11 Cl_2 (g), resulting in the formation of straight $CrSi_2$ nanowire bundles. Because no Si species could be released from the Al_2O_3 substrate, these straight $CrSi_2$ nanowire bundles must be produced from the gas-gas reaction.