Supporting Information For

Template- and catalyst–Free Synthesis, Growth Mechanism and Excellent Field Emission Properties of Large-scale Single-Crystalline Tubular β-SiC

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1. Experiment section

The synthesis of tubular SiC nanosystems is carried out in a conventional high-temperature horizontal tube furnace (see ESI Fig. S1†). The commercially available C_{60} (Peking university, China, 98%, see ESI Fig. S2†) used as the source materials, and the p-type single-crystal silicon wafer (1 0 0) used as the substrates. The C_{60} and the Si substrates locate at constant temperature zone of furnace. The furnace is heated up to 1350℃ and kept for 5~60 min under a pressure of 5×10^4 Pa, and a constant argon gas flow of 100 sccm as the carrier gas. After the growth, the substrates are taken from the furnace for characterization. Here, we employ the field

emission scanning electron microscopy (FESEM), X-ray diffraction (XRD), Raman spectrum, and high-resolution transmission electron microscopy (HR-TEM, JEOL2010, operated at 200 kV accelerating voltage at room temperature.) to examine the product.

2. Field emission test

The field emission I-V characteristics of the tubular single-crystal β-SiC are measured in a vacuum chamber at a pressure of $6\sim7\times10^{-8}$ mbar at room temperature. A stainless-steel probe with top diameter (2R) 0.40 mm is used as anode and the single-crystal tubular β-SiC growing on p-type Si wafer (1 0 0) are used as cathode. The cathode is connected to a 51.6 MΩ resistor. A voltage up to 6000V is applied to the probe to collect emitted electrons from the cathode samples. The separation distance (d) between anode and emitting surface is fixed at 200 μm. The effective emission area (S) used to evaluate the current density and hopping field, can be approximately calculated by $S = 2\pi Rd(2^{\frac{1}{n}} - 1)$, where $n = \frac{d\ln I}{d\ln V}$. The emission current density (J)-electric field (E) curve is obtained after sweeping the voltage several times until the electron emission is stable.

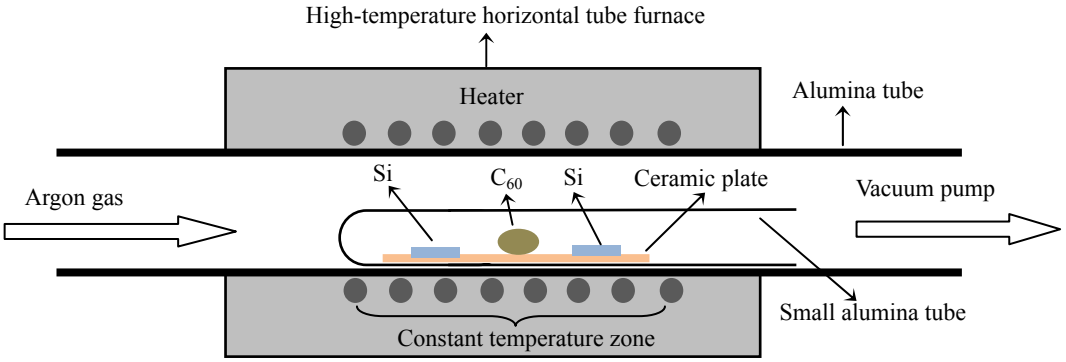

Fig. S1 The schematic diagram of the synthesis apparatus.

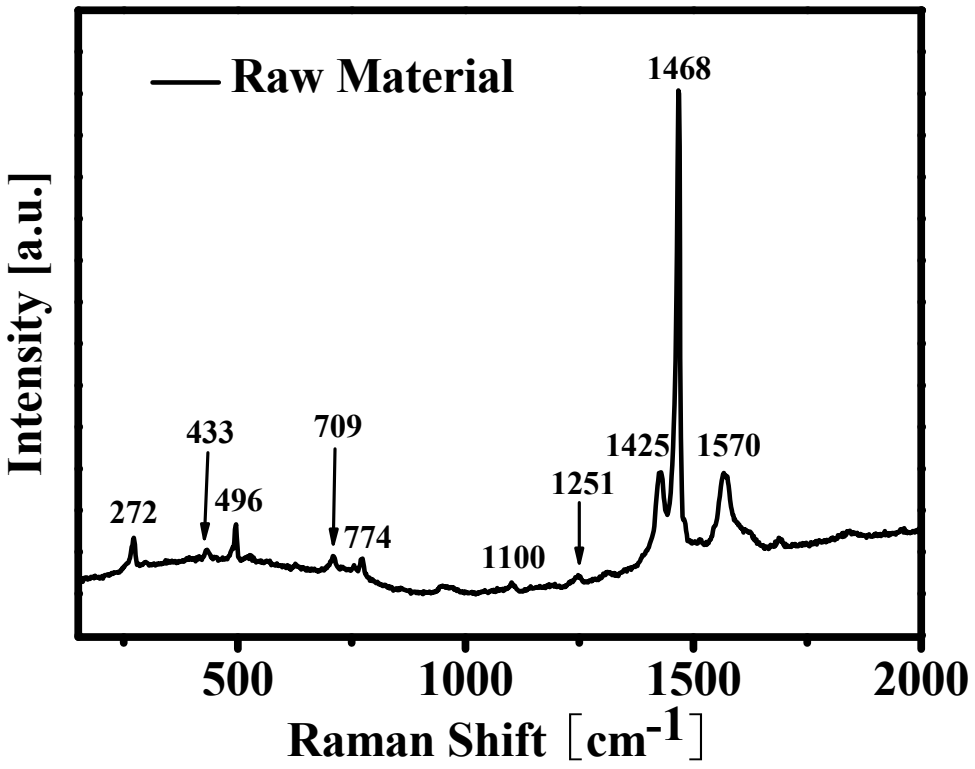

Fig. S2 Raman spectrum of carbon source (C_{60}). The analysis of Raman spectrum shows the raw material mainly consist of C_{60}.[1, 2]

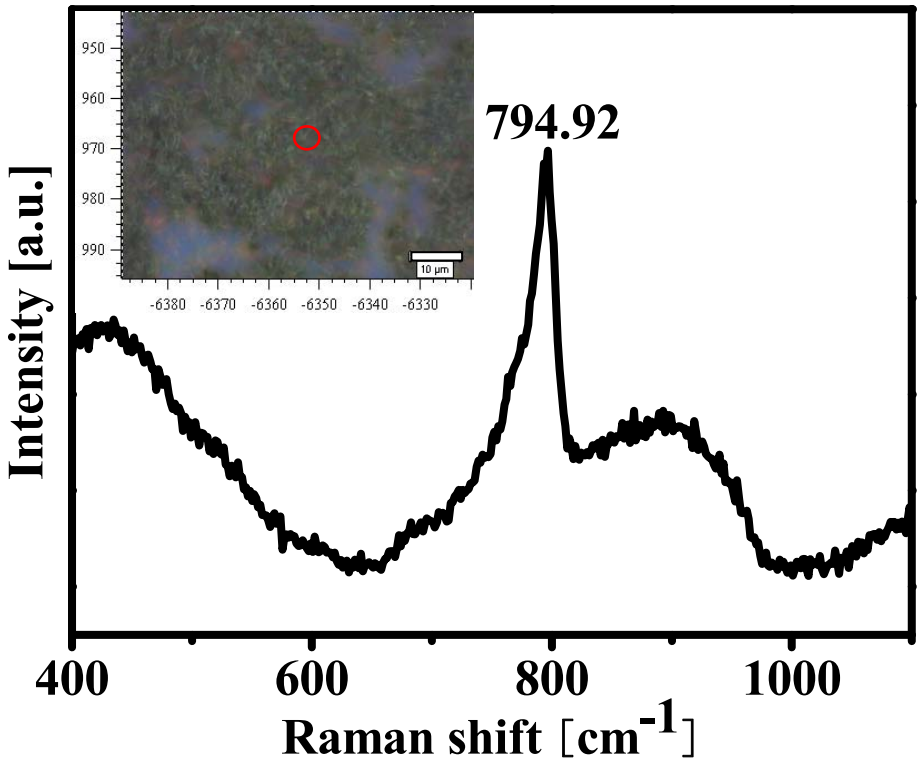

Fig. S3 Raman spectrum of the as-synthesized products. The inset is the optic photograph, and the circle shows the position where Raman signal is obtained.

T1 The product with different reaction temperature and time

Temperature (℃)	Time (min)	Tubular SiC
1350	60	√ (large-scale)
1350	30	√ (large-scale)
1350	5	√ (large-scale)
1310	60	√ (large-scale)
1310	30	√ (large-scale)
1290	30	√ (large-scale)
1270	30	√ (a few)
1270	5	√ (a few)
1250	60	×

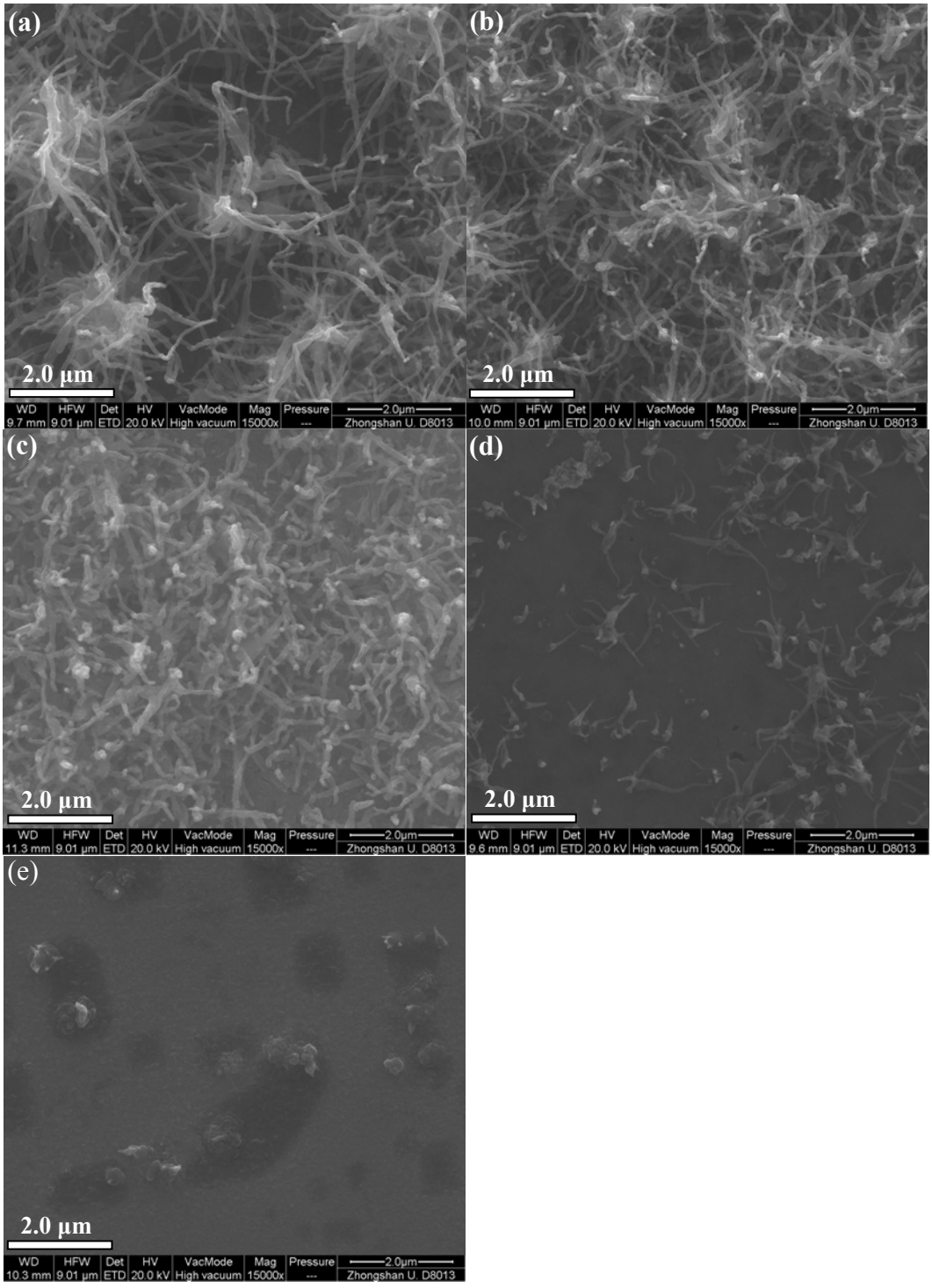

Fig. S4 The FE-SEM images of product under same reaction time 30 min and different temperature: (a) 1350℃; (b) 1310℃; (c) 1290℃; (d) 1270℃; (e) 1250℃.

Reference

1. M. S. Dresselhaus, G. Dresselhaus and P. C. Eklund, J. Raman Spetrosc. **1996**, 27, 351.
2. Y. Hamanaka, S. Nakashima, M. Hangyo, H. Shinohara and Y. Saito, Phys. Rev. B **1993**, 48, 8510.