Supporting Information (SI)

Novel Approaches to Synthesize Self-supported Ultrathin Carbon Nanowire Arrays Templated by MCM-41

Bozhi Tian¹, Shunai Che², Zheng Liu³, Xiaoying Liu¹, Weibin Fan², Takashi Tatsumi²,⁴, Osamu Terasaki⁵ and Dongyuan Zhao¹

1, Synthesis of as-made conventional MCM-41.

The gel composition is, expressed as mass ratios, 0.4 cetyltrimethylammonium (CTAB); 18 H₂O; 10 concentrated NH₃·H₂O (28 %); 2.08 TEOS. The slurry was stirred at ambient temperature for 1d and hydrothermally treated at 80 °C for 2d. The product was filtered off, dried at 80 °C for 10 h.

2, Microwave Digestion (MWD)

Microwave digestion of the samples was done with a microwave preparation system model MK-III for 10 min. The system was equipped with Teflon sample vessels which were transparent for microwave energy, operated at approximately 1200 W. The working frequency was 2450 MHz and the working voltage was 220 V. The sample amount was approximately 0.5 ~ 0.6 g with 4 ml of 15 M HNO₃ and 2 ml of concentrated H₂O₂ (30 wt%) as a solvent. The digested samples were then washed with distilled water and ethanol for several times followed by air drying at ambient temperature. The digestion was conducted at 10 atm for 20 min or at 20 atm for 10 min.
3. TEM images of carbon nanowire arrays (C1) templated by microwave digested MCM-41, viewed a) along and c) perpendicular to c direction. b) is the HRTEM image of the carbon nanowire arrays. The carbon nanowires are marked by arrows in b).
4. SEM (A) and TEM (B) images of leaf-like MCM-41.
5. FESEM images of carbon nanowire arrays templated by leaf-like MCM-41. Carbon nanotubes can also be observed. It can be observed that the ends of carbon nanowires are covered by thin carbon layers (see enlarged A and B).
N$_2$ sorption curves (A) and pore size distributions (B) of S1 (MWD-MCM-41) and S2 (leaf-like MCM-41).
7, N₂ sorption curves (A) and pore size distributions (B) of C1 (templated by MWD-MCM-41) and C2 (templated by leaf-like MCM-41).

A1, microwave digestion; A2, impregnation, carbonization and silica etching; B1, calcination; B2, impregnation, carbonization and silica etching.