Supplementary Data for

Spatial Confined Growth of Carbon Nanotubes in Pore Channels of Microporous Ceramic

Supports with improved filtration efficiency

Kai Yuan, Qilin Gu, Feng Zhang, Zhaoxiang Zhong*, Weihong Xing

State Key Laboratory of Materials-Oriented Chemical Engineering, National Engineering Research

Center for Special Separation Membrane, Nanjing Tech University, Nanjing 210009, China

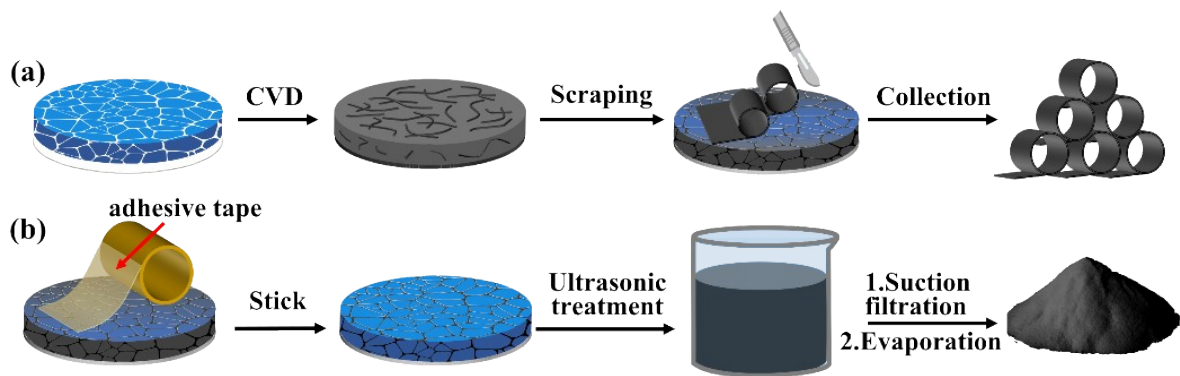*E-mail: zhongzx@njtech.edu.cn (Zhong Z).*

Fig. S1 The collection processes of CNTs samples on different sites of SiC supports for characterization: (a) on the surface, (b) in the pore.
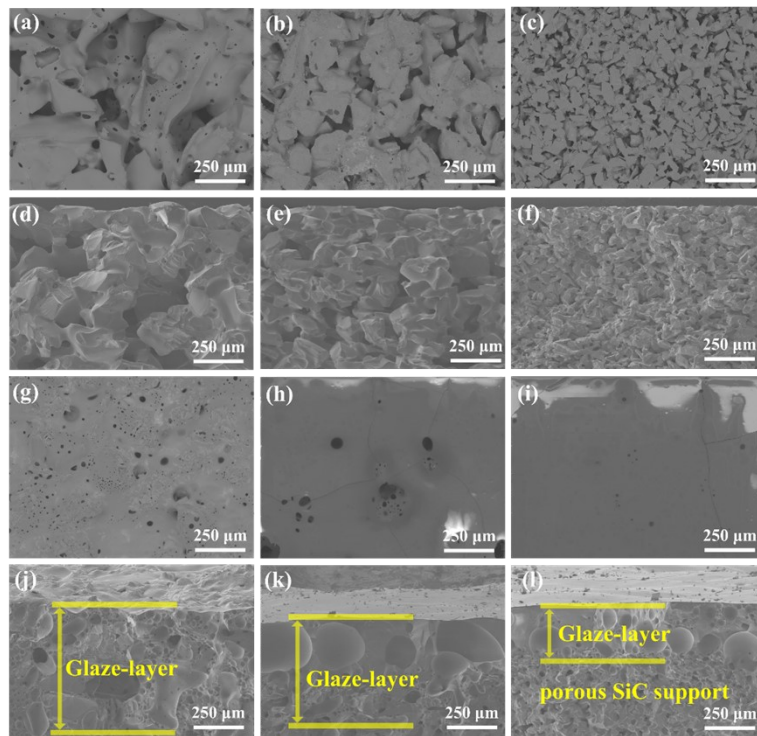

Fig. S2 Surface and Cross-section SEM images of different SiC supports: (a, d) SiC-200, (b, e) SiC-100, (c, f) SiC-50, (g, j) SiC-m200, (h, k) SiC-m100 and (i, l) SiC-m50.
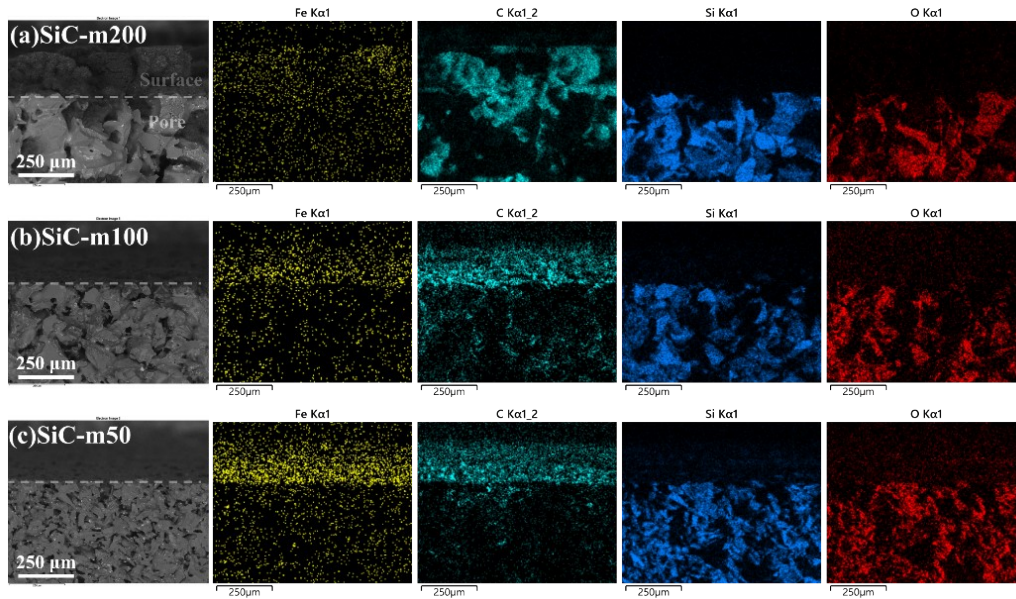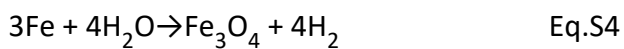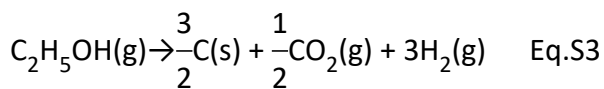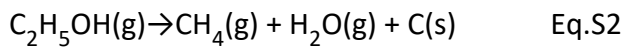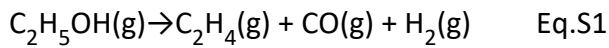
Fig. S3 EDS elements mapping images of Fe, C, Si and O elements from different SiC supports: (a) SiC-m200, (b) SiC-m100 and (C) SiC-m50.

A series of the following reactions will occur in the quartz tube:

$$C_2H_5OH(g) \rightarrow C_2H_4(g) + CO(g) + H_2(g) \qquad \text{Eq.S1}$$

$$C_2H_5OH(g) \rightarrow CH_4(g) + H_2O(g) + C(s) \qquad \text{Eq.S2}$$

$$C_2H_5OH(g) \rightarrow \frac{3}{2}C(s) + \frac{1}{2}CO_2(g) + 3H_2(g) \qquad \text{Eq.S3}$$

$$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2 \qquad \text{Eq.S4}$$

$$3Fe + C \rightarrow Fe_3C \qquad \text{Eq.S5}$$

$$Fe_3C \rightarrow 3Fe + C \qquad \text{Eq.S6}$$

Fe atoms originate from the decomposition of ferrocene[1]. The reactions of ethanol in tube furnace are listed in Eq. S1-S3[2,3]. From Eq. S4, Fe_3O_4 impurities outside of CNTs from catalyst deactivation can be attributed to the oxidation reaction of Fe with H_2O. While the formation processes of Fe and Fe_3C particles inside of CNTs from catalyst decomposition are shown in Eq. S5-S6[4].
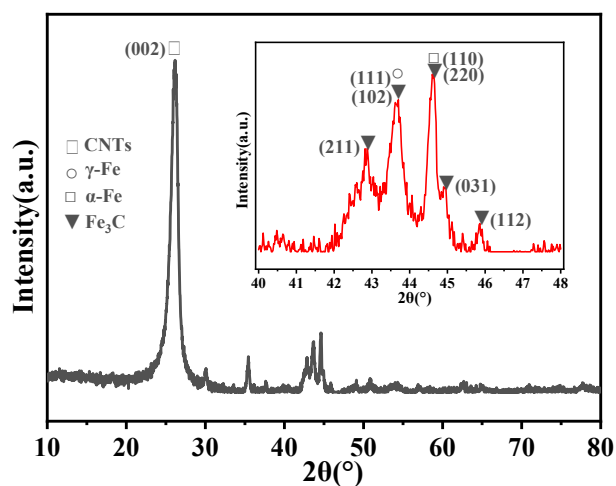
Fig. S4 XRD pattern of CNTs powers collected from the pore channels of the SiC-100 support.
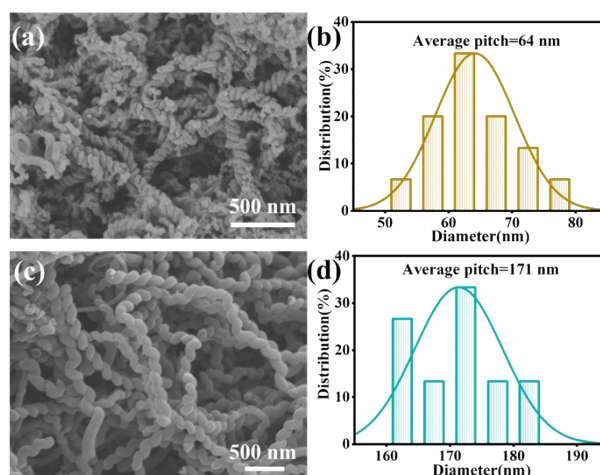

Fig. S5 (a) SEM images and (b) the pitch distribution of S-CNTs on the surface of SiC-m200 support,

(c) SEM images and (d) the pitch distribution of S-CNTs in the pore channels of SiC-m200 support.
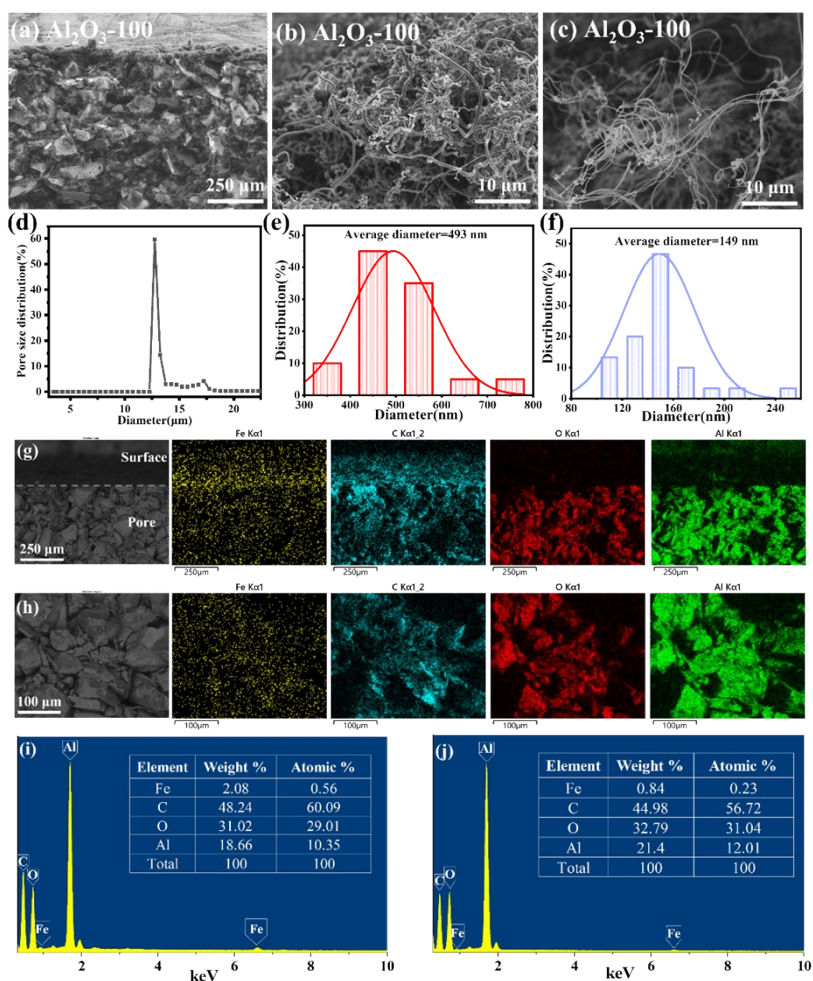
Fig. S6 Characterization results of CNTs on Al_2O_3-m100 support: (a)cross-section SEM image, SEM image of CNTs on the surface (b) and in the pore (c), (d) pore size distribution of Al_2O_3 support, CNTs diameter distribution (e) on the surface and (f) in the pore, EDS elements mapping and spectrum of (g) & (i) the top cross-section and (g) & (i) pore of Al_2O_3

References

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