Supporting Information

Formation of an ink-bottle-like pore structure in SBA-15 by a MOCVD technique

Ying ZHANG [a,b], **Frank Leung-Yuk LAM** [a], **Xijun HU*** [a] ***and*** **Zifeng YAN** [b]

[a]*Department of Chemical and Biomolecular Engineering, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong*
[b]*State Key Laboratory for Heavy Oil Processing, Key Laboratory of Catalysis, CNPC, Universtiy of Petroleum, Dongying 257061, CHINA*
** Corresponding author. E-mail: kexhu@ust.hk.*

The influence of C_2H_2 feeding time and C_2H_2/N_2 ratio on the carbon deposition process was investigated. The N_2 adsorption isotherms of the samples modified with different C_2H_2 feeding time at the same C_2H_2/N_2 ratio of 1/4 are shown in Fig. S1(a). It is found that both samples treated with longer C_2H_2 feeding time (5 and 8 min) exhibit broader hysteresis loops, and their adsorption capacities obviously decrease. As shown in Fig. S1(b), these two samples have almost the same pore size distribution as that of the sample treated with 2 min. However, the BET specific surface area and the total pore volume are significantly decreased (see Table S1). This indicates that increasing the C_2H_2 feeding time can only results in more carbon deposition on the external surface of the SBA-15.

Fig. S2 shows the N_2 adsorption isotherms and pore size distribution of SBA-15 treated with different C_2H_2/N_2 ratios at the same C_2H_2 feeding time of 2 min. The N_2 adsorption isotherm of the sample treated with higher C_2H_2/N_2 ratio (C_2H_2/N_2 =1:1) exhibits a steeper hysteresis loop indicating a more uniform ink-bottle-like pore structure. However the adsorption capacity is much lower than that of the sample treated with a C_2H_2/N_2 ratio of 1/4. The pore size distribution of this sample is narrower, but the peak intensity is much lower. As shown in Table S2, the loss of BET specific area and total pore volume is obvious using a C_2H_2/N_2 ratio of 1/1. It suggests that too much carbon was deposited onto the SBA-15 at higher C_2H_2/N_2 ratio. Using longer C_2H_2 feeding time or higher C_2H_2/N_2 ratio lead to significant loss of BET specific area and total pore volume and can not further modify the pore structure. This may be explained by the polymerization phenomena during C_2H_2 cracking process, which could form aromatic hydrocarbons of larger size before carbon deposition. These large aromatic hydrocarbon molecules could not enter the pore and preferentially deposit on the external surface which is unfavourable for the post modification of the pore structure by the organometallic precursor deposition.

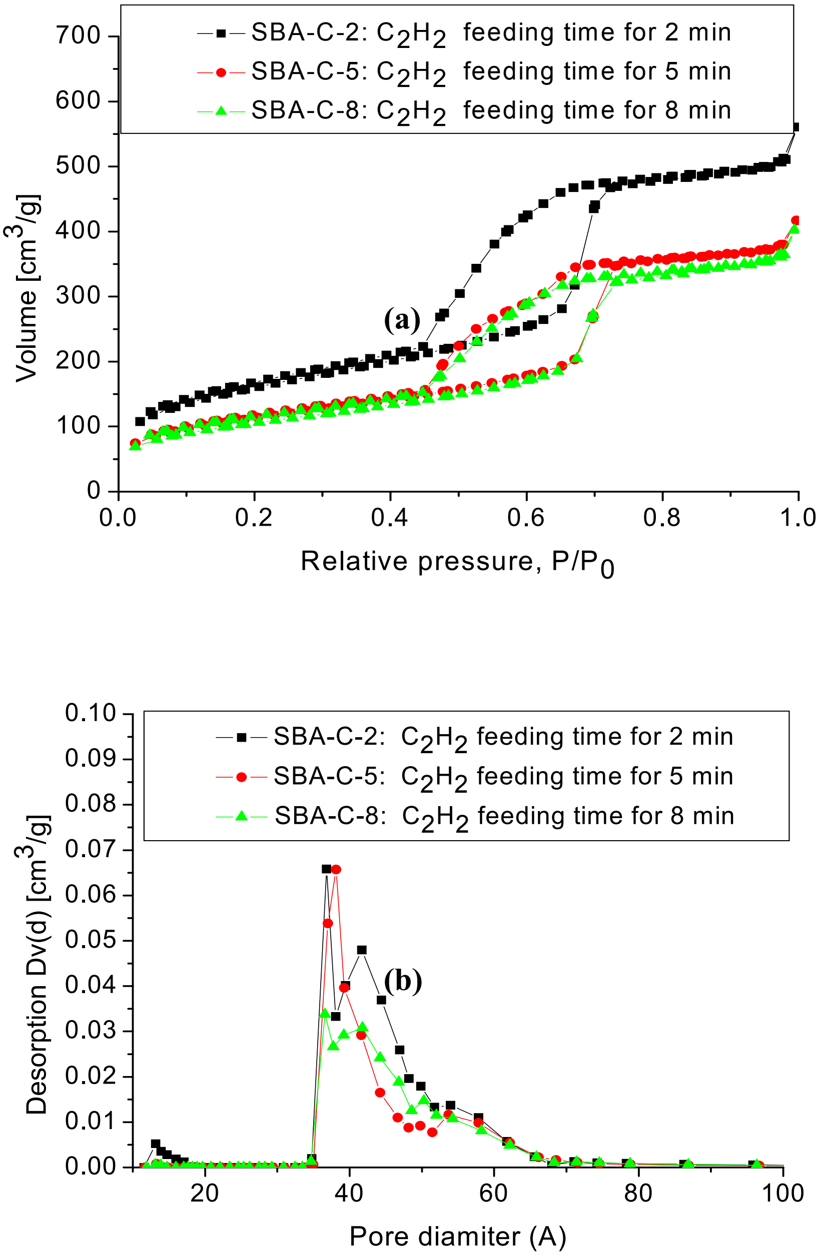

Fig. S1. (a) N_2 adsorption isotherms and (b) pore size distribution of SBA-15 treated with different C_2H_2 feeding time.

Table S1. Pore properties of SBA-15 treated with different C_2H_2 feeding time.

Sample	S_{BET}	$V_{\_t}$	d $_{mouth}$ (nm)
SBA-C-	506.42	0.862	3.68
SBA-C-	356.34	0.5838	3.79
SBA-C-	346.85	0.5160	3.66

*SAB-C-2: SBA-15 treated with C_2H_2 feeding time of 2 min; SAB-C-5: SBA-15 treated with C_2H_2 feeding time of 5 min; SAB-C-8: SBA-15 treated with C_2H_2 feeding time of 8 min.

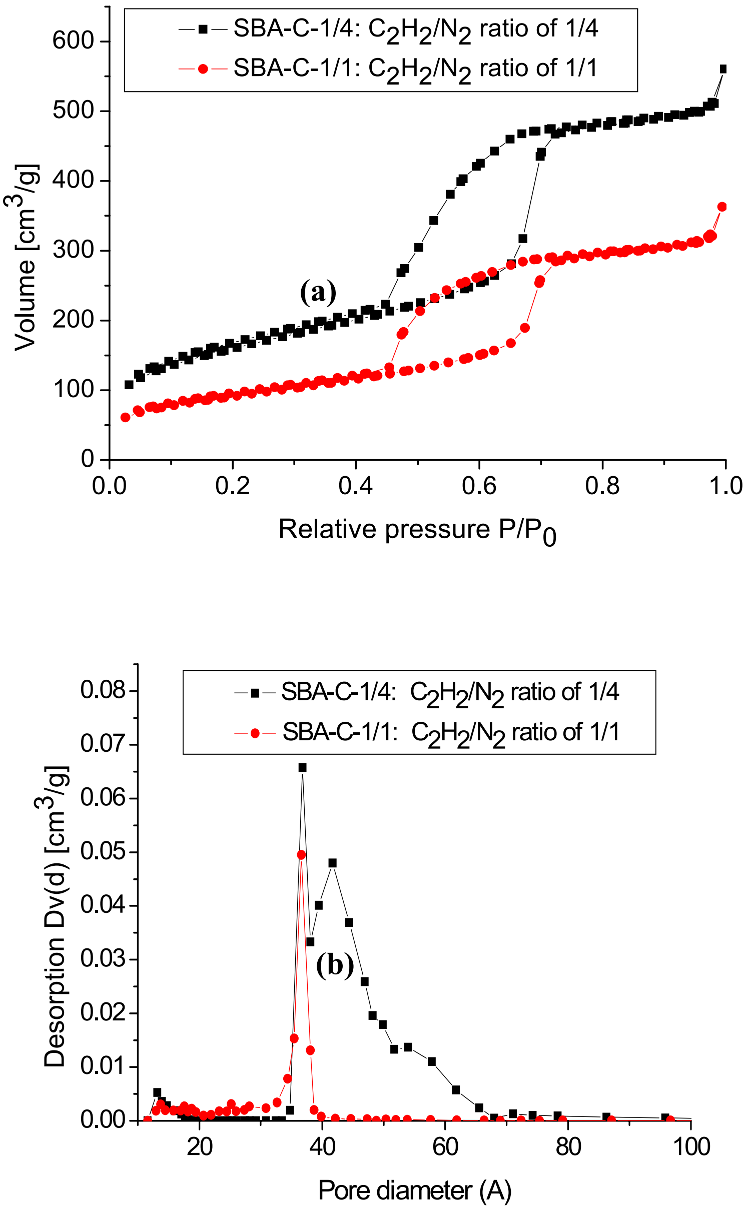

Fig. S2. (a) N_2 adsorption isotherms and (b) pore size distribution of SBA-15 treated with different C_2H_2 /N_2 ratios

Table S2. Pore properties of SBA-15 treated with different C_2H_2 /N_2 ratios

Sample	S_{BET}	V_t	d $_{mouth}$ (nm)
SBA-C-	506.42	0.862	3.68
SBA-C-	316.52	0.4935	3.67

*SAB-C-1/4: SBA-15 treated with C_2H_2/N_2 ratios of 1/4; SAB-C-1/1: SBA-15 treated with C_2H_2/N_2 ratios of 1/1.