Supplementary information

Synthesisof sub-micrometric SAPO-34 by morpholine assisted two-step hydrothermal route and its excellent catalytic MTO performance

Syed ul Hasnain Bakhtiar, Sher Ali,Fulong Yuan, Zhibin Li*, Yujun Zhu*

Key Laboratory of Functional Inorganic Material Chemistry (Heilongjiang University),

Ministry of Education, School of Chemistry and Materials Science, Heilongjiang University,

Harbin 150080, P. R. China.

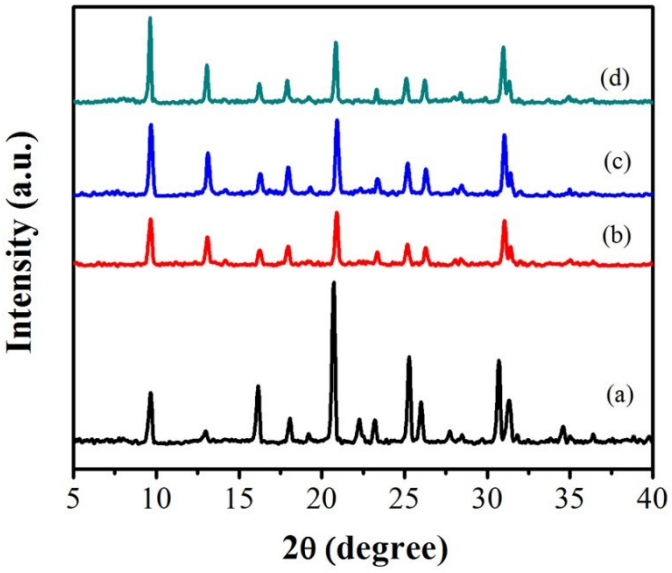

Fig.S1 XRD patterns of sample (a): SP-12and samples synthesized by two-step crystallization without morpholine (b): SP-C2(4h), (c): SP-C2(8h) and (d): SP-C2(12h)

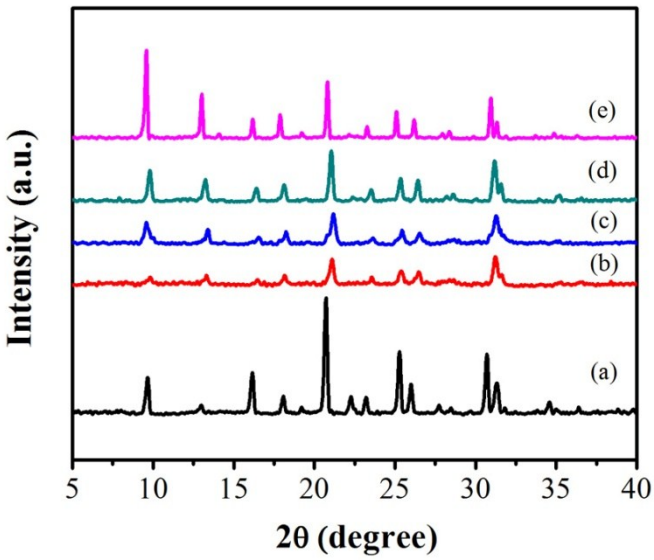

Fig.S2 XRD patterns of sample (a): SP-12 and samples synthesized by two-step crystallization with morpholine (b): SP-MP(3h), (c): SP-MP(6h), (d): SP-MP(9h) and (e): SP-MP(12h)

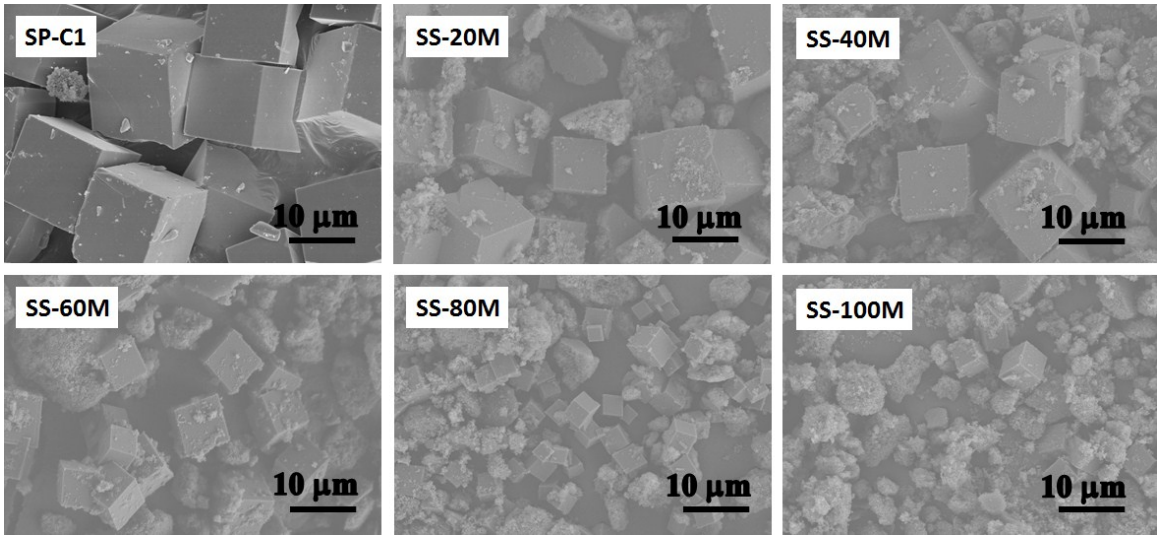

Fig. S3 SEM images of samples synthesized by single step crystallization having equi-amount of morpholine as with the two-step method.

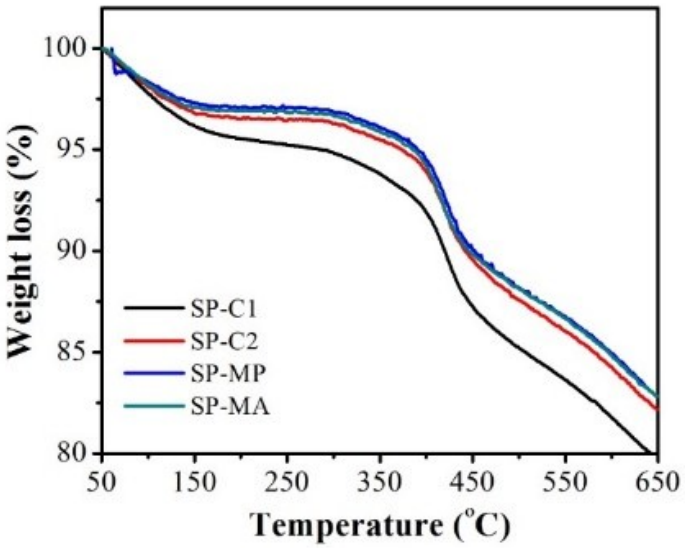

Fig S4. TG curves of the samples with different synthetic routes

Table S1 Crystallite size of the samples calculated from XRD results

Sample	Crystallite size (nm)	Sample	Crystallite size (nm)
SP-12h	54	SP-MP(3h)	29
SP-C2(4h)	52	SP-MP(6h)	39
SP-C2(8h)	57	SP-MP(9h)	48
SP-C2(12h)	68	SP-MP(12h)	50

Table S2 weight loss in TG curves over different samples

Sample	< 200 ºC /%	200-440 ºC / %	440-650 ºC / %	200-650 ºC / %	Total weight loss / %
SP-C1	4.5	7.7	8.3	16.0	20.5
SP-C2	3.4	6.8	7.7	14.5	17.9
SP-MP	3.0	6.6	7.8	14.4	17.4
SP-MA	3.1	6.4	7.8	14.2	17.3

Table S3 Distribution of silicon species (%) by de-convolution of ^{29}Si MAS NMR signals

Sample	ppm	SP-C1	SP-C2	SP-MP	SP-MA
Defects	-78 to -85	11.9	11.7	7.4	6.7
Si4Al	-91	28.6	24.7	59.8	48.1
Si3AlSi	-95	20.9	20.7	11.2	16.5
Si2Al2Si	-100	11.0	12.7	7.7	6.8
Si1Al3Si	-106	8.5	10.0	5.8	6.1
Si4Si	-110	13.9	15.3	10.2	11.2
Si island	-100 to -110	33.5	38.0	23.8	24.0

Table S4 Initial and final selectivity of olefin for conventional and medium replaced sample at 100% methanol conversion at WHSV = 2 h^{-1} and 400 ºC

Sample	C_2selectivity / %		C_3 selectivity / %		C_4 selectivity / %		Total/%	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
SP-C1	25.1	34.1	46.9	44.9	18.5	14.7	90.5	93.7
SP-C2	25.4	36.2	48.3	45	18.2	14.1	91.9	95.3
SP-MP	26.9	40.9	50.6	43.7	16.6	11.9	94.1	96.5
SP-MA	28.1	42.7	52.3	43.5	16.1	10.9	96.5	97.1