

Supplementary data

A sponge-like small pore zeolite with great accessibility to the micropores

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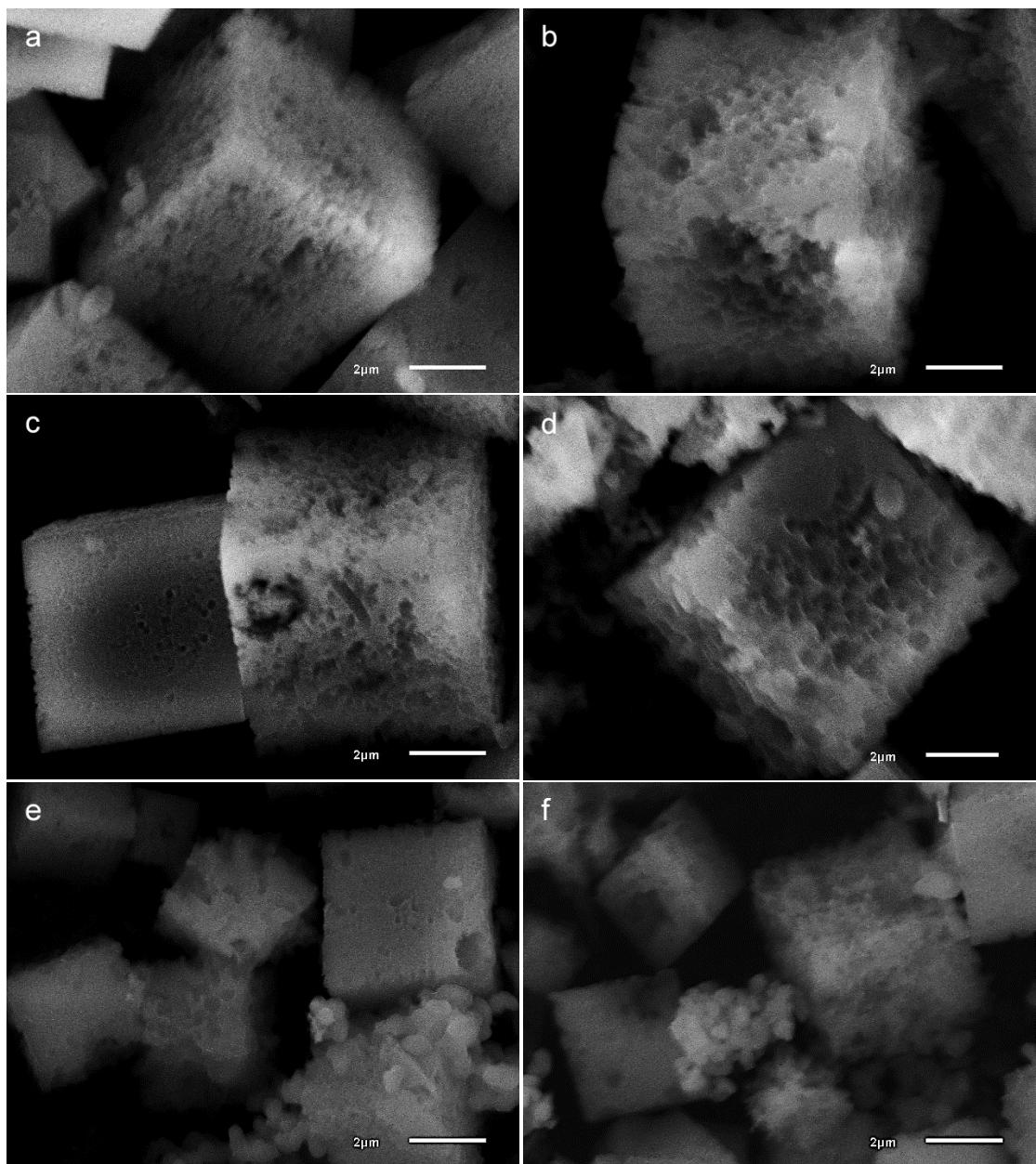
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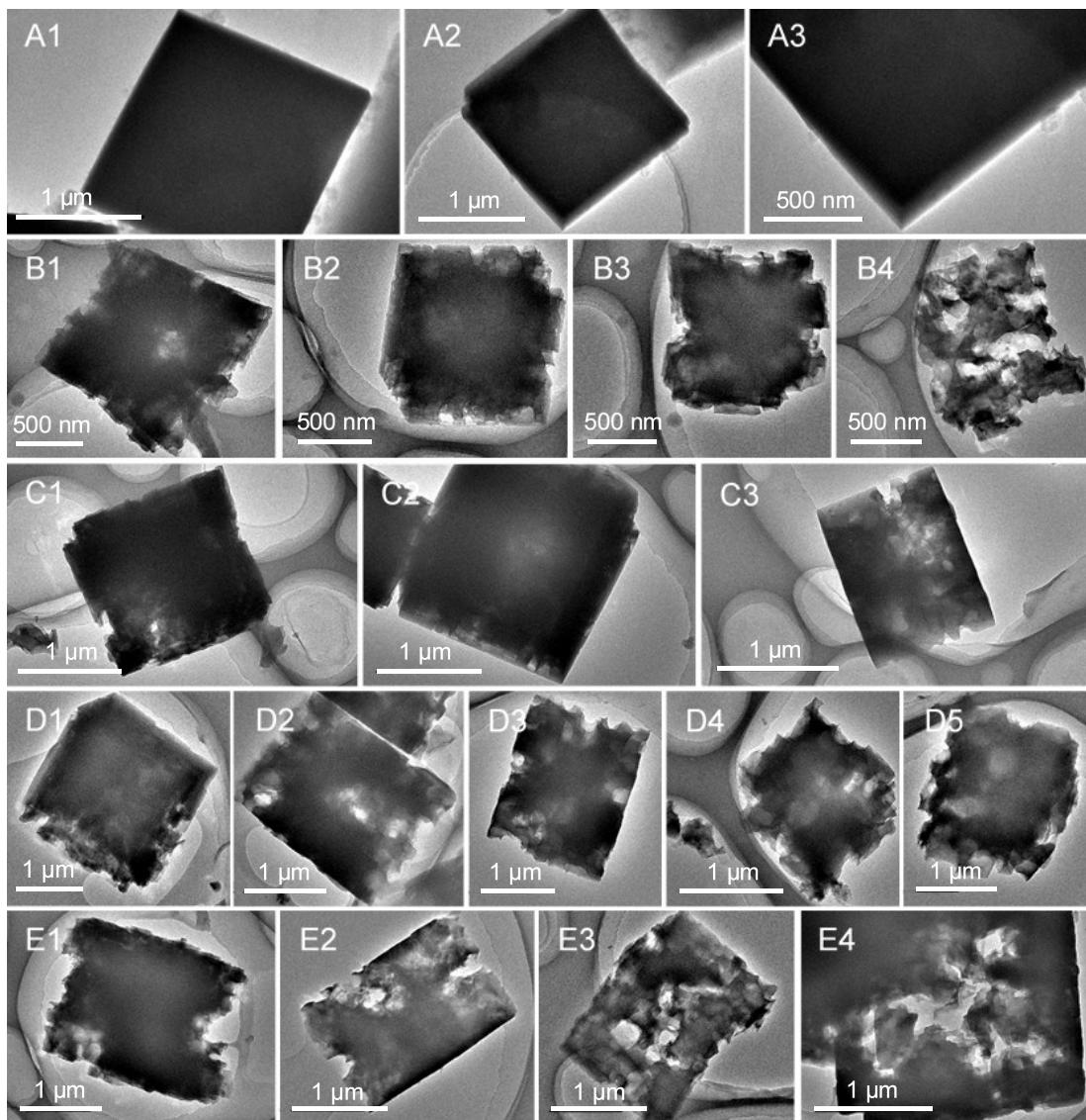
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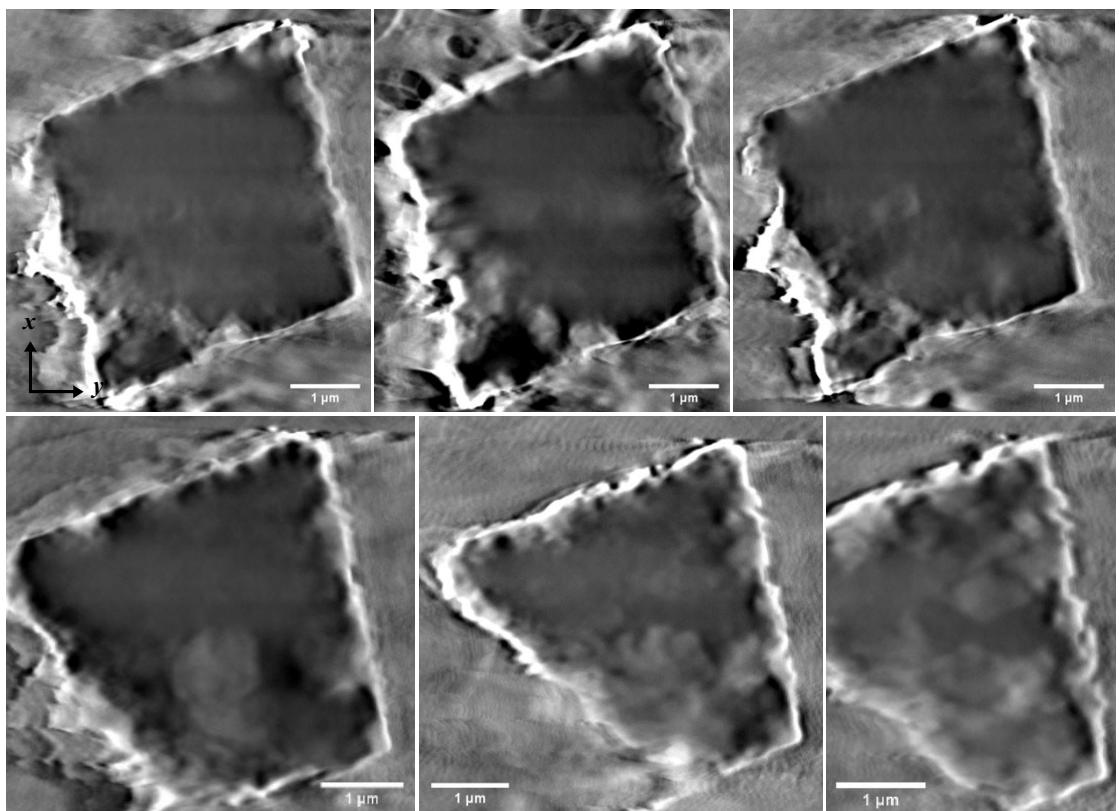
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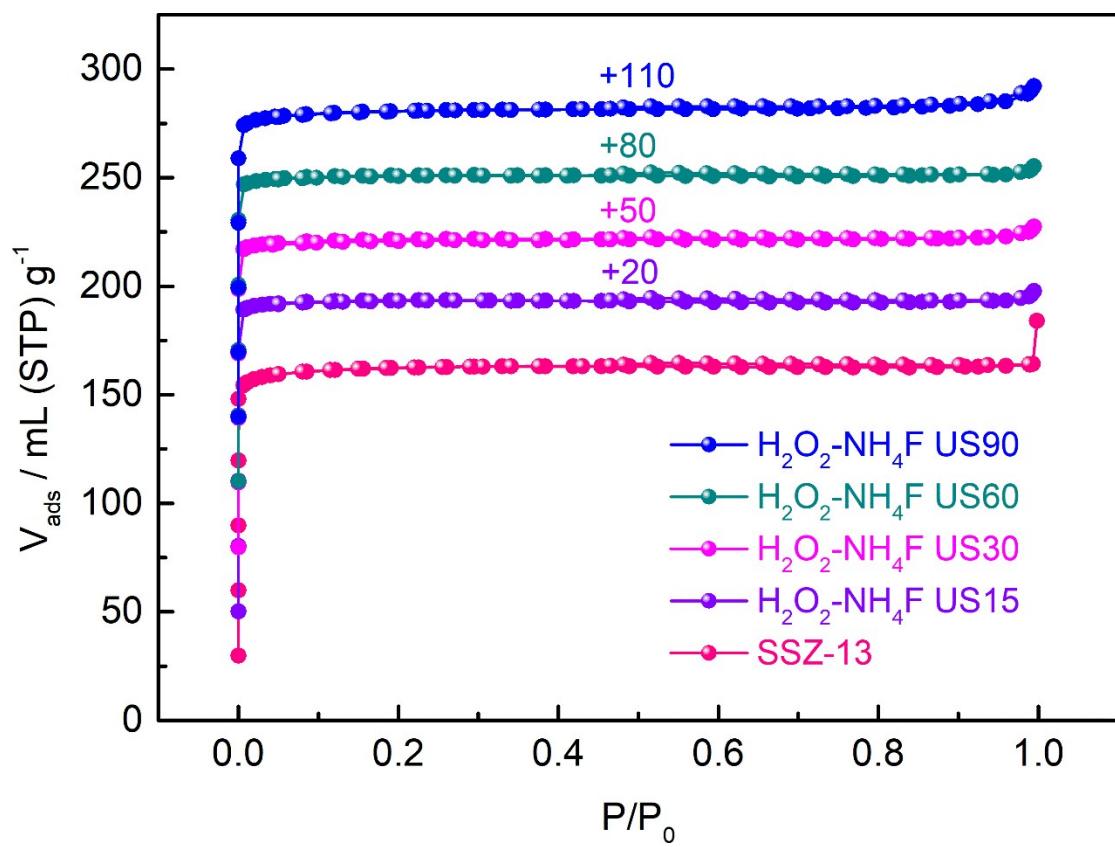
**Fig. S1** SEM micrographs of parent (a) and sponge-like SSZ-13 after 15 min (b), 30 min (c), 60 min (d), 90 min (e), 120 min (f) and 180 min (g,h) of  $\text{NH}_4\text{F}$  treatments in the presence of hydrogen peroxide.



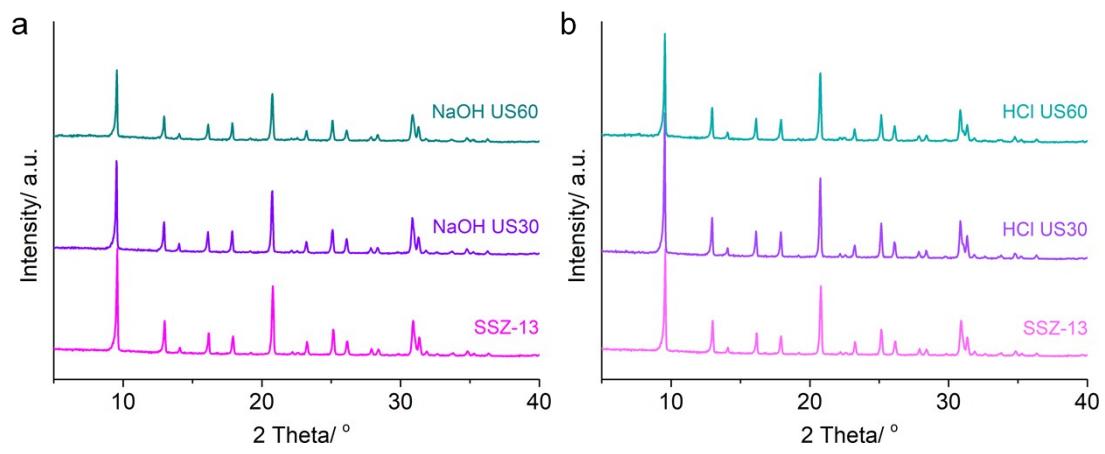
**Fig. S2** TEM micrographs of parent (A1-3) and sponge-like SSZ-13 after 15 min (B1-4), 30 min (C1-3), 60 min (D1-5) and 90 min (E1-4) of NH<sub>4</sub>F treatments in the presence of hydrogen peroxide.



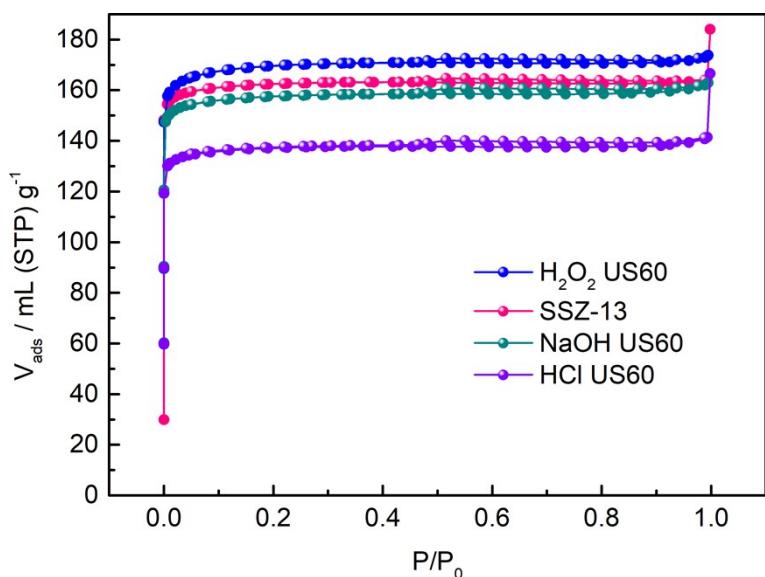
**Fig. S3** TEM tomography slices of  $\text{H}_2\text{O}_2\text{-NH}_4\text{F}$  US30 in the  $xy$  direction.



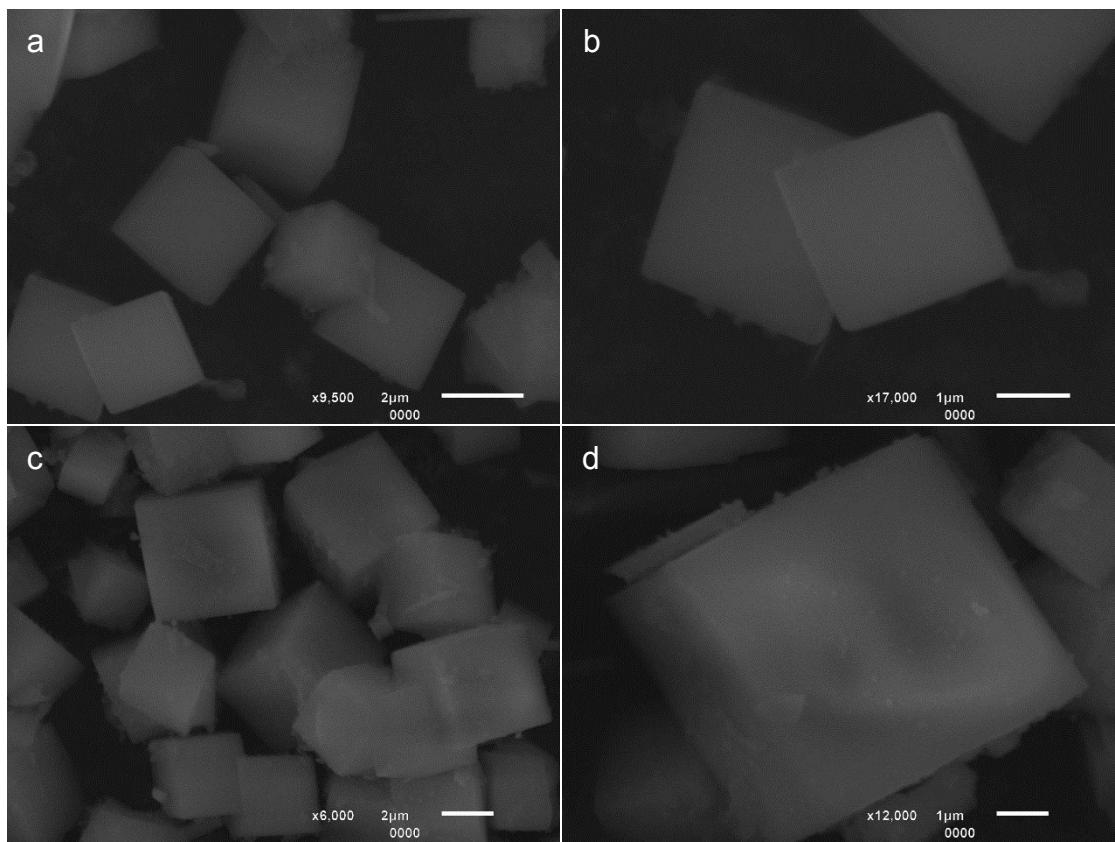
**Fig. S4** Nitrogen sorption isotherms of parent and sponge-like SSZ-13 samples.



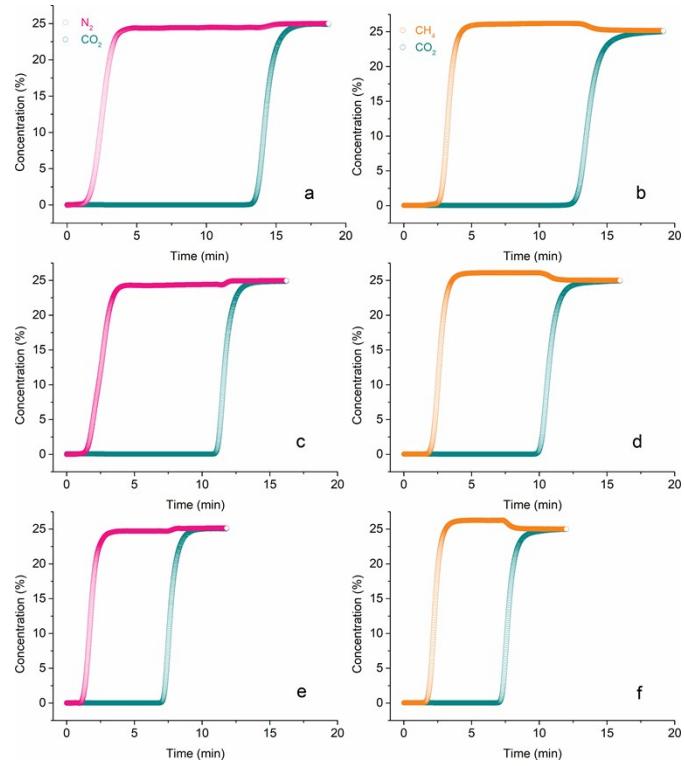
**Fig. S5** XRD patterns of SSZ-13 samples treated in 0.5M NaOH solution (a) and 0.5M HCl solution (b) under US radiation at 20 °C.



**Fig. S6** Nitrogen physisorption isotherms of the SSZ-13 samples treated in 30 wt.%  $\text{H}_2\text{O}_2$ , 0.5M NaOH and 0.5M HCl under ultrasonication for 1 h at 20 °C.



**Fig. S7** SEM micrographs of NaOH US60 (a,b) and HCl US60 (c,d).



**Fig. S8** Breakthrough curves of SSZ-13 (a,b), NH<sub>4</sub>F US60 (c,d) and H<sub>2</sub>O<sub>2</sub>-NH<sub>4</sub>F US60 (e,f) using the N<sub>2</sub>/CO<sub>2</sub> (a,c,e) and CH<sub>4</sub>/CO<sub>2</sub> (b,d,f) gas mixtures at 25 °C.

**Table S1.** Physicochemical properties of the series of SSZ-13 samples.

Sample	$S_{\text{BET}}/\text{m}^2 \text{ g}^{-1}$	$V_{\text{micro}}/\text{cm}^3 \text{ g}^{-1}$	$V_T/\text{cm}^3 \text{ g}^{-1}$	Si/Al <sup>a</sup>
SSZ-13	511	0.24	0.25	7.8
H <sub>2</sub> O <sub>2</sub> -NH <sub>4</sub> F US15	544	0.26	0.27	7.9
H <sub>2</sub> O <sub>2</sub> -NH <sub>4</sub> F US30	539	0.26	0.27	7.7
H <sub>2</sub> O <sub>2</sub> -NH <sub>4</sub> F US60	542	0.26	0.27	7.6
H <sub>2</sub> O <sub>2</sub> -NH <sub>4</sub> F US90	543	0.26	0.27	7.8

<sup>a</sup> Determined by EDX analysis

**Table S2.** Physicochemical properties of the SSZ-13 samples treated in 30 wt.% H<sub>2</sub>O<sub>2</sub>, 0.5M NaOH and 0.5M HCl under ultrasonication for 1 h at 20 °C.

Sample	$S_{\text{BET}}/\text{m}^2\text{ g}^{-1}$	$V_{\text{micro}}/\text{cm}^3\text{ g}^{-1}$	$V_T/\text{cm}^3\text{ g}^{-1}$	Si/Al <sup>a</sup>
SSZ-13	511	0.24	0.25	7.8
H <sub>2</sub> O <sub>2</sub> US60	541	0.24	0.27	7.1
NaOH US60	497	0.23	0.25	6.3
HCl US60	437	0.20	0.22	8.9

<sup>a</sup> Determined by EDX analysis

**Table S3.** Weight loss as a function of the type of etchant and treatment procedure.

Samples	Weight <sub>Initial, g</sub>	Weight <sub>Treated, g</sub>	<sup>a</sup> Weight <sub>Loss, %</sub>
H <sub>2</sub> O <sub>2</sub> -NH <sub>4</sub> F US15	0.308	0.218	29.2
H <sub>2</sub> O <sub>2</sub> -NH <sub>4</sub> F US30	0.308	0.218	29.2
H <sub>2</sub> O <sub>2</sub> -NH <sub>4</sub> F US60	0.308	0.204	33.8
H <sub>2</sub> O <sub>2</sub> -NH <sub>4</sub> F US90	0.304	0.203	33.2
H <sub>2</sub> O <sub>2</sub> US60	0.300	0.276	8.0
NaOH US30	0.302	0.283	6.3
NaOH US60	0.302	0.273	9.6
HCl US30	0.302	0.251	16.9
HCl US60	0.302	0.224	25.8

$$^a \text{Weight loss} = \frac{\text{Weight}_{Initial} (g) - \text{Weight}_{Treated} (g)}{\text{Weight}_{Initial} (g)} \times 100$$