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Improved performance of binder-free zeolite Y for low-temperature sorption heat storage

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Pore size distribution of parent zeolite Y and modified samples





The pore size distributions (PSDs) were calculated from nitrogen adsorption data using an algorithm based on ideas of Barrett, Joyner, and Halenda (BJH) [1]. Pore size distribution of materials has been determined using

the BJH model widely used for this type of samples [2]. Although this model often underestimates pore sizes [3], it is appropriate for comparative purposes.

Minor mesoporosity is observed for acid treated samples, while broad mesopore size distribution of H_4 EDTA treated sample can be seen.

[1]E.P. Barrett, L.G. Joyner, P.P. Halenda, J. Am. Chem. Soc. 73 (1951) 373.

[2] W.W. Lukens, P. Schmidt-Winkel, D. Zhao, J. Feng, G.D. Stucky, Langmuir 15 (1999) 5403.

[3] P.T. Tanev, L.T. Vlaev, J. Colloid. Interf. Sci. 160 (1993) 110.

Structural characterization of modified samples after 20 cycles of adsorption and desorption



Parent NaY

0025HCl



005EDTA



Figure S2: SEM images of samples after 20 cycles between temperatures of 140 $^{\circ}C$ and 40 $^{\circ}C$ under a water vapour pressure of 1.23 kPa

Sample	S _{BET}	V_{tot}	V_{mic}	Vme	S _{ext}
	(m²g-1)	(cm ³ g ⁻¹)	(cm ³ g ⁻¹)	(cm ³ g ⁻¹)	(m²g-1)
Parent NaY	656	0.331	0.300	0.032	40
0025HCl	625	0.318	0.282	0.026	44
005EDTA	676	0.355	0.282	0.071	94
MgNaY- 0025HCl	609	0.313	0.273	0.040	49

Table S1: Textural properties of samples after 20 cycles between temperatures of 140 $^\circ C$ and 40 $^\circ C$ under a water vapour pressure of 1.23 kPa

 V_{tot} at $pp_0^{-1}=0.95$, S_{ext} and V_{mic} determined using the t-plot method, $V_{me}=V_{tot}-V_{mic}$



Figure S3: PSD of samples after 20 cycles between temperatures of 140 °C and 40 °C under a water vapour pressure of 1.23 kPa



Figure S4: Water isotherms of samples after 20 cycles gravimetrically measured at 25°C. Isotherms exhibit Type I isotherms typical for zeolites as highly hydrophilic materials.

Basic characterization of NaMSX



Figure S5: XRD pattern of NaMSX sample shows highly crystalline sample.



Figure S6: SEM image of NaMSX

It shows round zeolite X crystalls covered with binder (sticks).

Table S2: Textural properties of NaMSX sample

Sample	S _{BET}	V _{tot}	V _{mic}	Vme	S _{ext}
	(m ² g ⁻¹)	(cm ³ g ⁻¹)	(cm ³ g ⁻¹)	(cm ³ g ⁻¹)	(m ² g ⁻¹)
NaMSX	557	0.319	0.249	0.070	46

 V_{tot} at $pp_0^{-1}=0.95$, S_{ext} and V_{mic} determined using the t-plot method, $V_{me}=V_{tot}-V_{mic}$



Fig S7: Water adsorption isotherm of NaMSX sample measured at 25 °C.