Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Electronic Supplementary Information

Solid-State Synthesis of Nd-doped Glass: Thermal Collapse of Nd^{3+}-incorporated NaY Zeolite

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1. Preparation of zeolite NaY (FAU) [S1]

Seed Gel: A mixture of water (4.00 g), sodium aluminate (0.45 g) and sodium hydroxide (1.62 g) was added to a 25 wt% sodium silicate solution (8.87 g) followed by vigorous stirring until complete dissolution of the solids. The obtained solution was aged at room temperature for 20 hours.

Feedstock Gel: 10.92 g sodium aluminate and 4.05 g sodium hydroxide were added to 45 g water and the mixture was stirred until complete dissolution of the solids.

Overall Gel: 1.2 g water, 1.38 mL seed gel, 2.3 mL aluminum sulphate (0.88 mol/L) and 2.38 mL feedstock gel were slowly added to 12.5 g sodium silicate solution (25 wt%) in turn under vigorous stirring.

Crystallization: The overall gel mixture was sealed in a Teflon-lined stainless steel autoclave and heated at 100 °C for 3 days. The resulting solid product was recovered by filtration, washed copiously with distilled water and dried at ambient temperature.

References

S1 L. Li, X. S. Zhou, G. D. Li, X. L. Pan, J. S. Chen, *Angew. Chem. Int. Ed.* **2009**, 48 (36), 6678-6682.

Table S1. The molar composition of the NaY and Nd-doped NaY zeolites samples based on the ICP elemental analysis, their corresponding neodymium molar ratios and quality contents, respectively.

Entry	Molar composition	Nd molar ratio (mol %)	Nd mass ratio (wt %)
Sample Ⅰ	$NaAlSi_{2..46}O_{6.92}$	0.000	0.000
Sample Ⅴ	$Nd_{0.03}Na_{0.91}AlSi_{2.46}O_{6.92}$	0.244	1.863
Sample Ⅶ	$Nd_{0.14}Na_{0.58}AlSi_{2.46}O_{6.92}$	1.277	8.396
Sample Ⅷ	$Nd_{0.26}Na_{0.22}AlSi_{2.46}O_{6.92}$	2.450	15.030

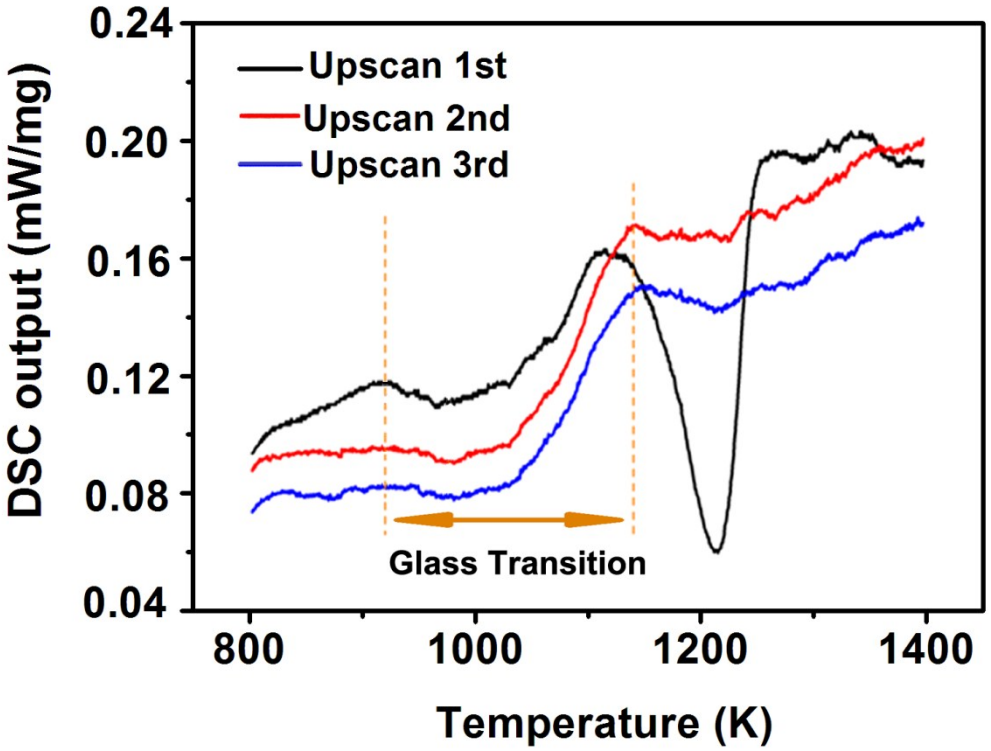

Figure S1. DSC measurements of pure NaY zeolite heated 3 times at a scan rate of 5 ^{o}C/min in Ar atmosphere from 800 K to 1400 K. Under the temperature range of approximately 910 ~1130 K, there is a typical glass transition observed in the 1st, 2nd, 3rd scanning curves, which proves that the final product obtained by the solid-state synthesis is a glassy state.

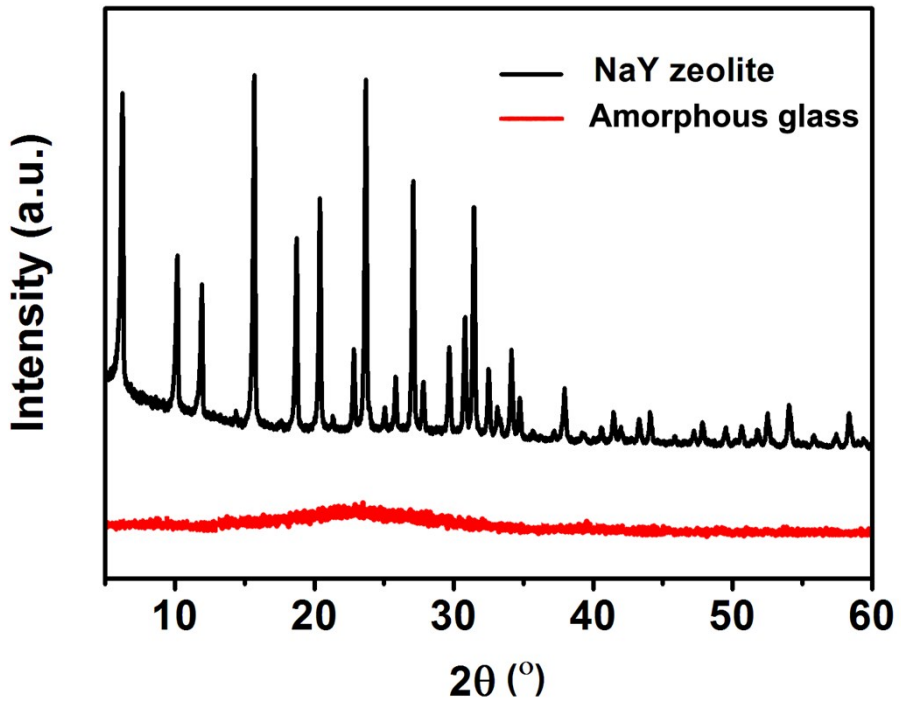

Figure S2. XRD patterns of the amorphous glass product obtained after heated at 1400 K, and its crystalline NaY zeolite precursor.

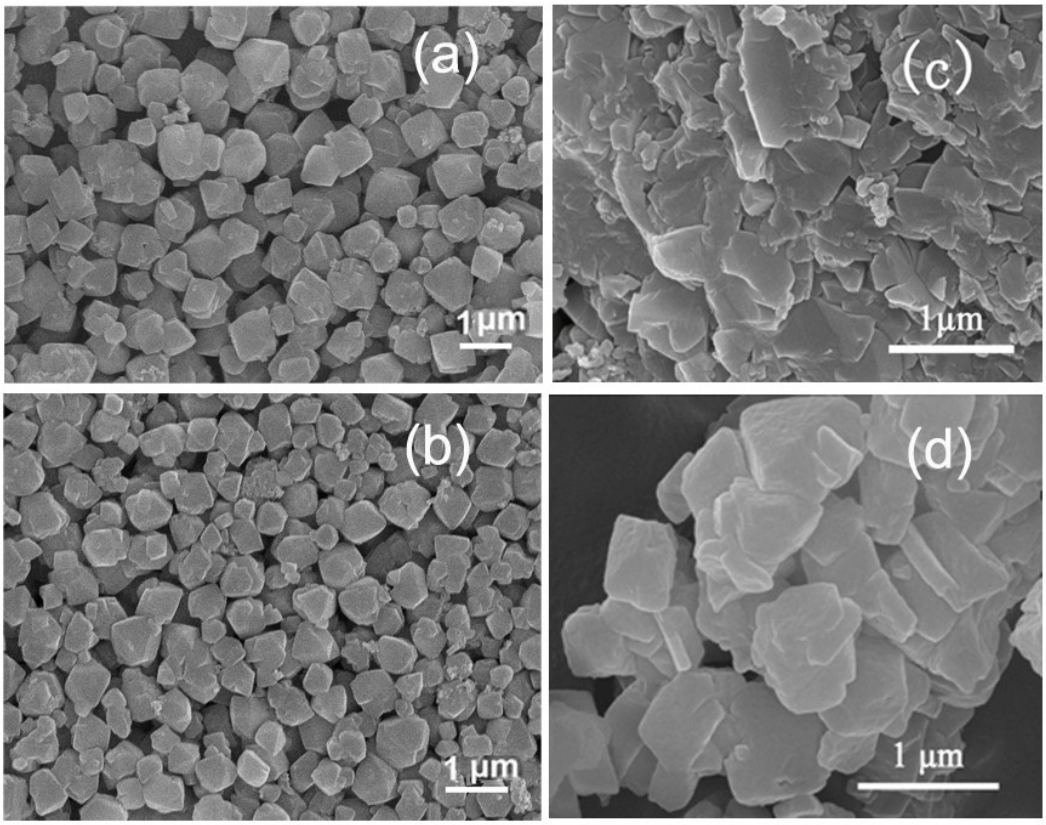

Figure S3. SEM images of (a) pure NaY zeolite (Sample Ⅰ), (b) Nd-NaY zeolite (Sample Ⅷ), (c) pure NaY zeolite after being calcinated at 1073 K for 6 hours, (d) Nd-NaY zeolite after after being calcinated at 1073 K for 6 hours. Comparing Figure (a) and Figure (b), the morphology of NaY and Nd-NaY is very similar before heat treatment. Tiny particles can be observed from the images. However, after calcination at 1073 K for 6 hours, the grain shape of pure NaY zeolite is difficult to be observed (Figure c), but the grain morphology of the Nd-NaY zeolite is still preserved (Figure d). Thus it can be seen that after the samples heated at 1073 K, the grain shape of pure NaY zeolite changed more significantly than that of the Nd-NaY sample. This means the addition of Nd^{3+} cations into the cages of NaY zeolite can increase the thermal stability of zeolite.

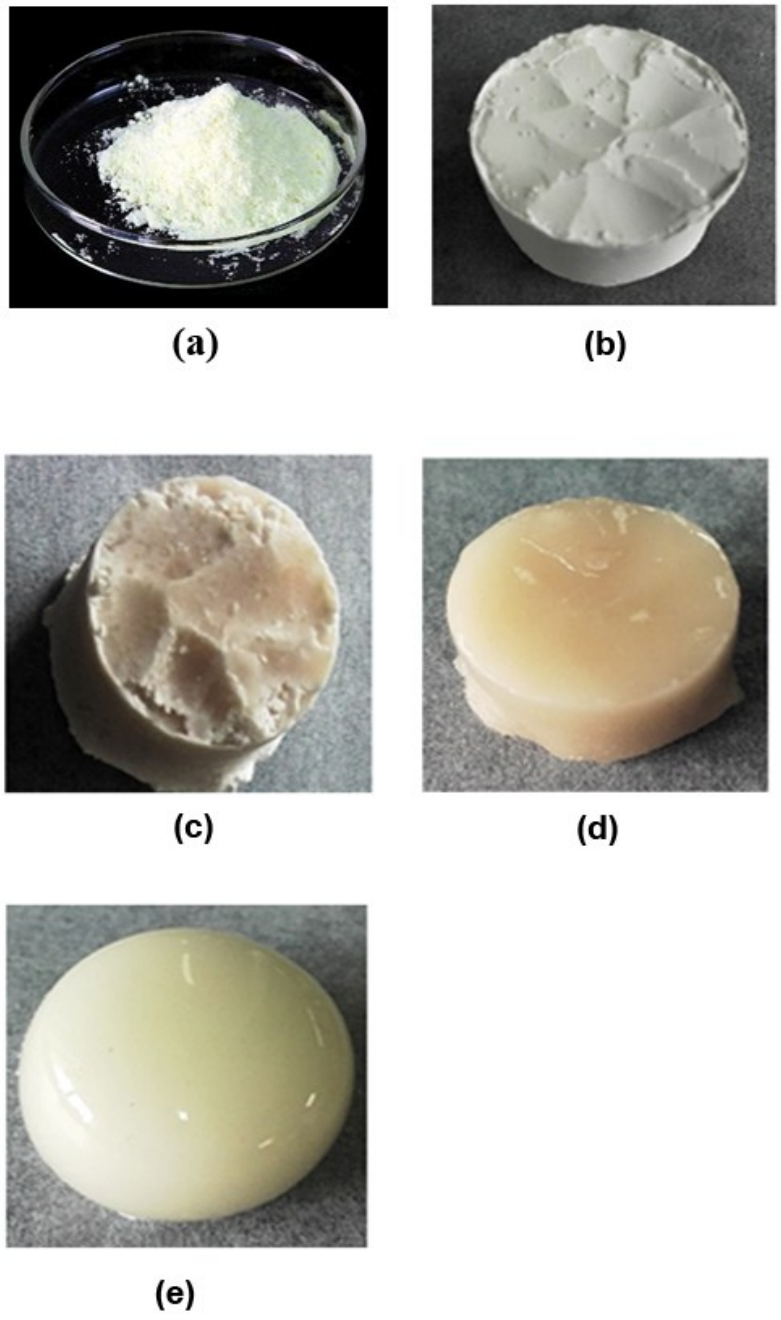

Figure S4. Photographs of Nd-NaY zeolite (Sample Ⅷ) after the calcinations under the temperature of (a) 773 K, (b) 1073 K, (c) 1203 K, (d) 1243 K, (e) 1283 K for 6 hours.

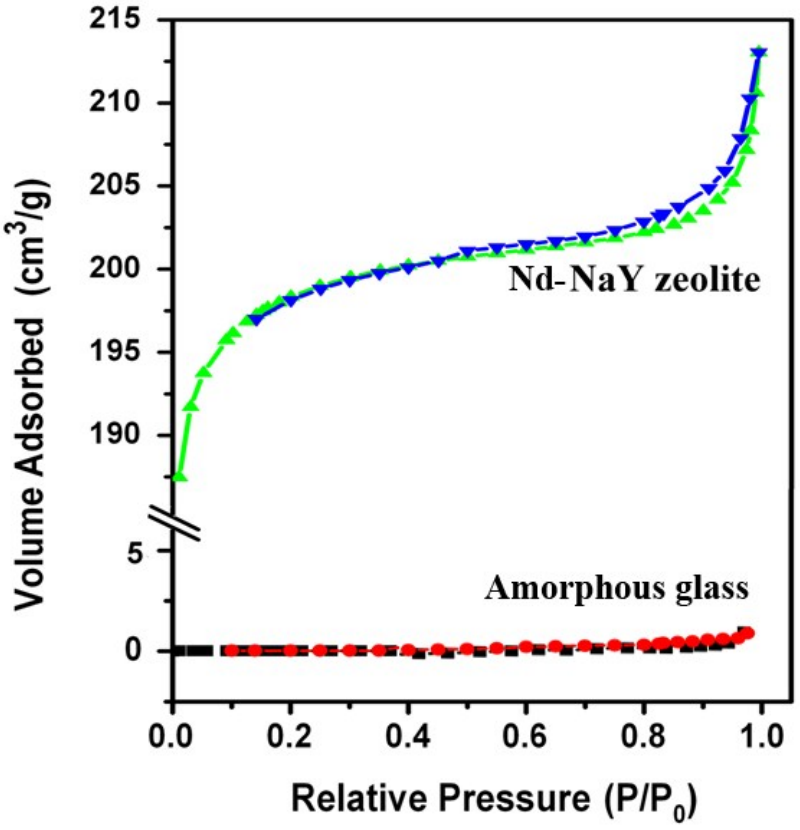

Figure S5. Nitrogen adsorption/desorption isotherms for the amorphous glass product and its Nd-NaY zeolite (Sample Ⅷ) precursor. From Nd-NaYzeolite to the Nd-doped glass product, the BET specific surface area has sharply decreased from 571 m^2g^{-1} to 0.2 m^2g^{-1}, indicating the cages of NaY zeolite precursor have been removed after the thermal collapse process.