

## Supporting information

### Atomic scale niobium implantation in dealuminated industrial H- $\beta$ zeolite catalyst for enhanced furfural production

Yuhui Huang,<sup>a</sup> Yehan Tao,<sup>a,b\*</sup> Qingqing Wang,<sup>a</sup> Jian Du,<sup>a</sup> Jinwen Hu,<sup>a</sup> Jie Lu,<sup>a</sup> Yanna Lv,<sup>a</sup> and Haisong Wang<sup>a\*</sup>

<sup>a</sup> Liaoning Key Lab of Lignocellulose Chemistry and BioMaterials, Liaoning Collaborative Innovation Center for Lignocellulosic Biorefinery, Department of Light Industry and Chemical Engineering, Dalian Polytechnic University, Dalian, 116034, China

<sup>b</sup> Shandong Sun Paper Industry Joint Stock, Jining, 272100, China

#### \*Corresponding authors:

Yehan Tao, E-mail address: taoyh1818@dlpu.edu.cn

Haisong Wang, E-mail address: wanghs@dlpu.edu.cn

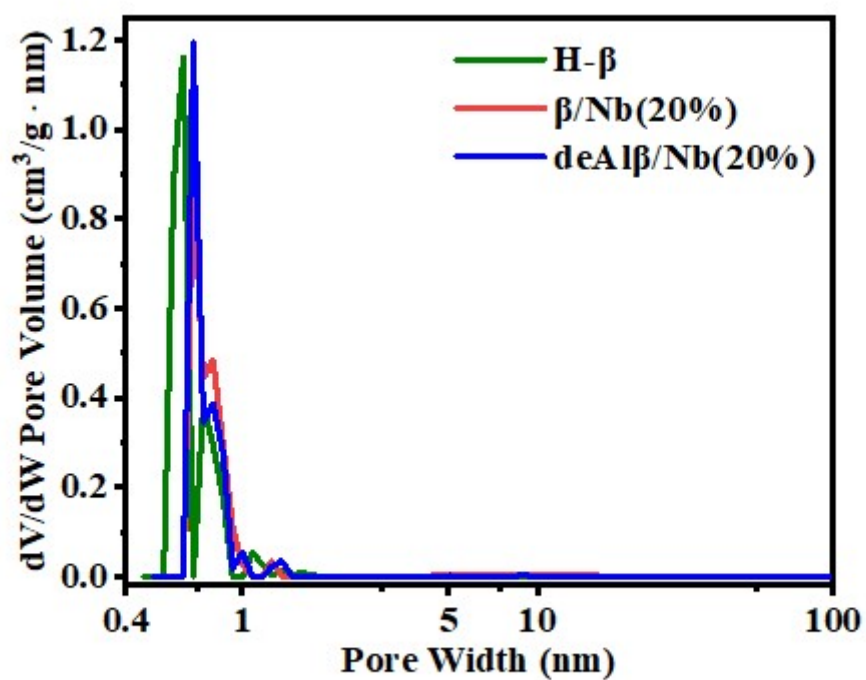


Fig. S1 Pore size distribution of different materials.

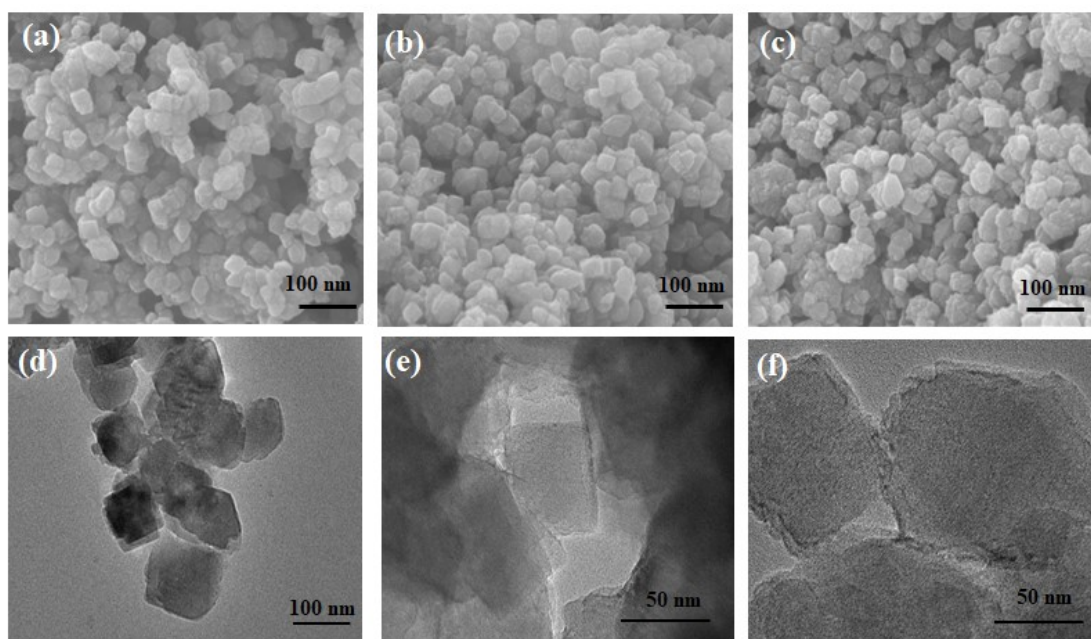


Fig. S2 (a-c) SEM and (d-f) TEM images of H- $\beta$  zeolite,  $\beta$ /Nb(20%) and deAl $\beta$ /Nb(20%) catalysts.

Table S1 Performances of conventional zeolite catalysts for the furfural production.

Catalyst	Substrate	Reaction solvent	Reaction conditions	C <sub>xylose</sub> (%)	Y <sub>furfural</sub> (%)
H- $\beta$ (25) <sup>1</sup>	xylose	Water/Toluene	140 °C/4 h	90	40
H- $\beta$ <sup>2</sup>	Glucose and xylose mixtures	1,4-dioxane	180 °C/2 h	/	63
Modified zeolite <sup>3</sup>	xylose	Water/GVL	180 °C/33 min	/	69.3
Cr-deAl-Y <sup>4</sup>	xylose	Water/n-Butanol	180 °C/30 min	99.7	77.5
deAl $\beta$ /Nb(20%)	xylose/xylan	Water/GVL	130 °C/3 h	100/100	66/50

## References

1. S. B. Kim, S. J. You, Y. T. Kim, S. Lee, H. Lee, K. Park and E. D. Park, *Korean Journal of Chemical Engineering*, 2011, **28**, 710-716.
2. Y. He, R. Zhang, W. Song, H. Liu, J. Zhang, W. Jia and L. Peng, *Chemical Engineering Journal*, 2024, **480**.
3. L. Zhang, G. Xi, Z. Chen, D. Jiang, H. Yu and X. Wang, *Chemical Engineering Journal*, 2017, **307**, 868-876.
4. Y. Wang, Y. Dai, T. Wang, M. Li, Y. Zhu and L. Zhang, *Fuel Processing Technology*, 2022, **237**.