

## Supporting Information

### **Synergistic SiO<sub>2</sub>@NC core-shell nanosphere enhances catalytic hydrogenation of lignin-derived aromatic aldehydes**

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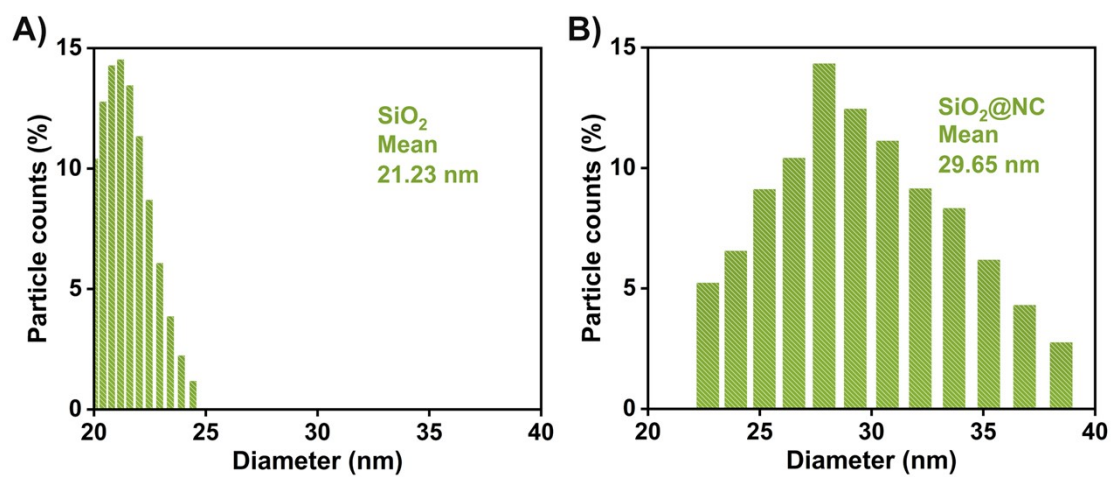
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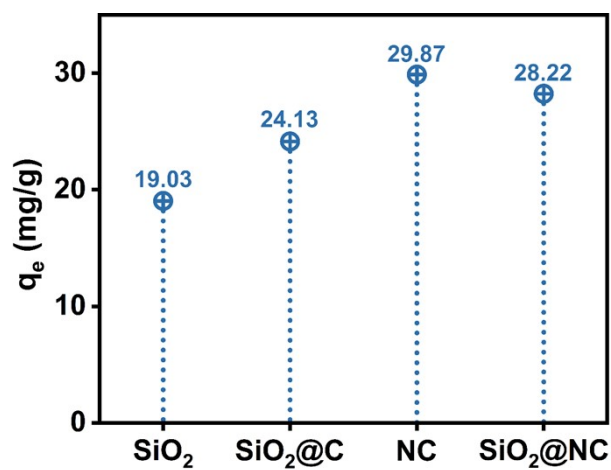
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**Fig. S1 DLS analysis of the catalyst supports.**



**Fig. S2  $\text{Pd}^{2+}$  adsorption of the catalysts.**

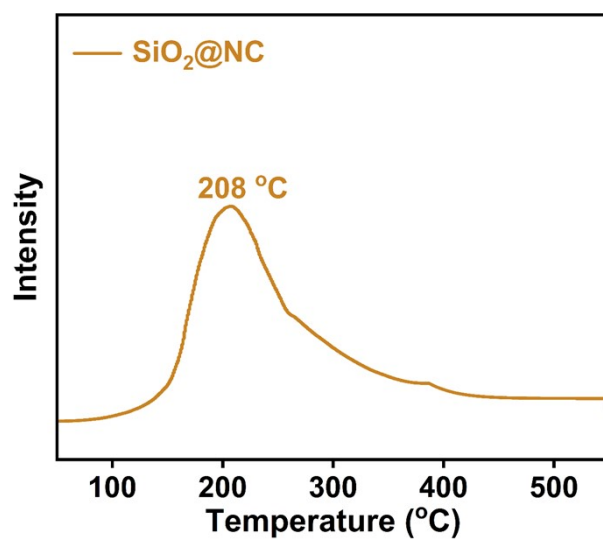


Fig. S3 NH<sub>3</sub>-TPD spectra of SiO<sub>2</sub>@NC.

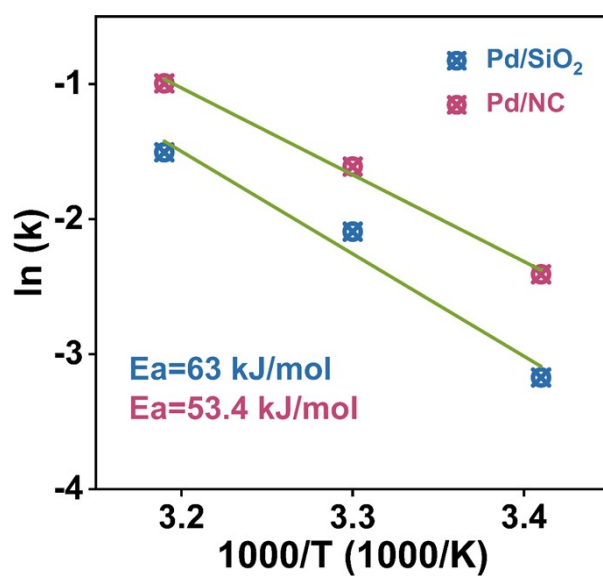
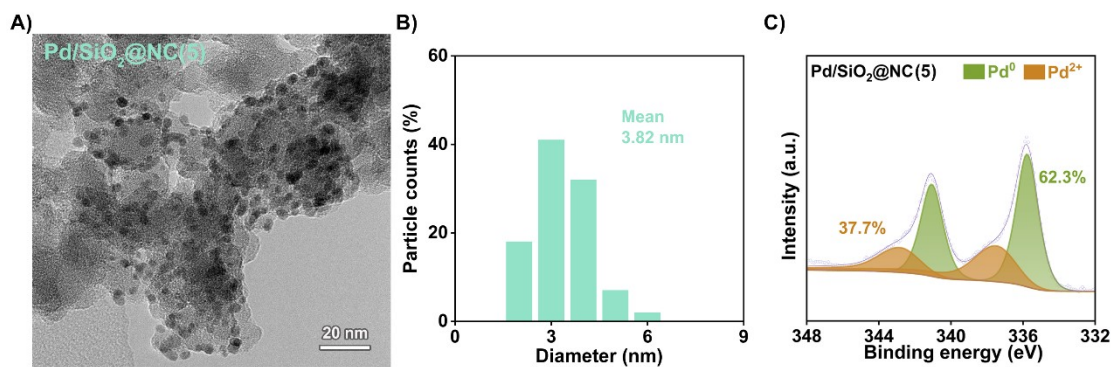
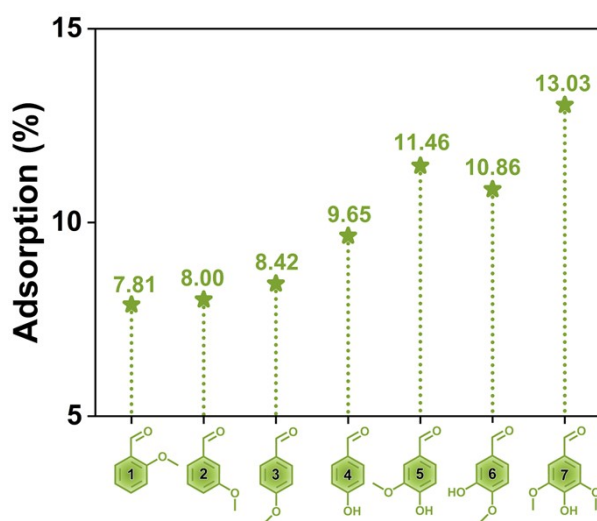


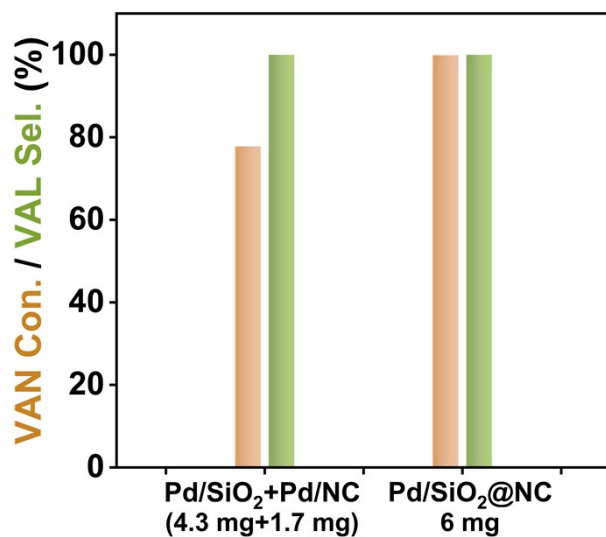
Fig. S4 Activation energy of Pd/SiO<sub>2</sub> catalysis and Pd/NC catalysis based on 5 min.



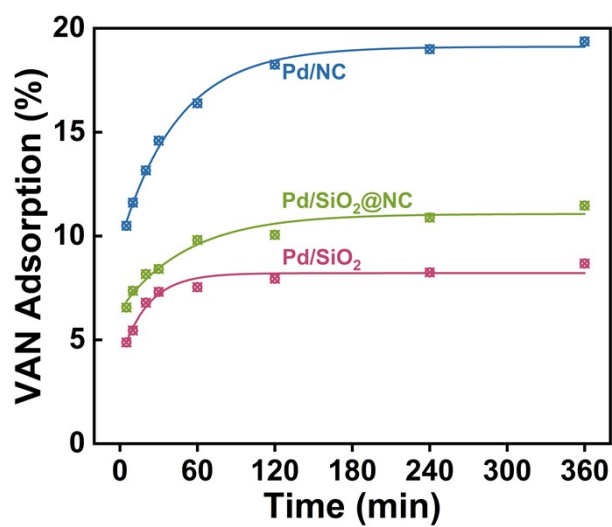
**Fig. S5 (A) TEM image, (B) particle size distribution of Pd particles and (C) Pd 3d spectra of the used Pd/SiO<sub>2</sub>@NC after five recycling cycles.**



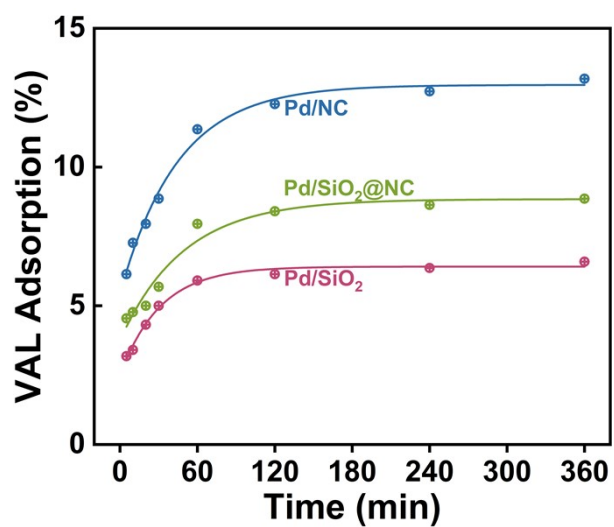
**Fig. S6 Adsorption of the lignin-derived aromatic aldehydes on the Pd/SiO<sub>2</sub>@NC.**



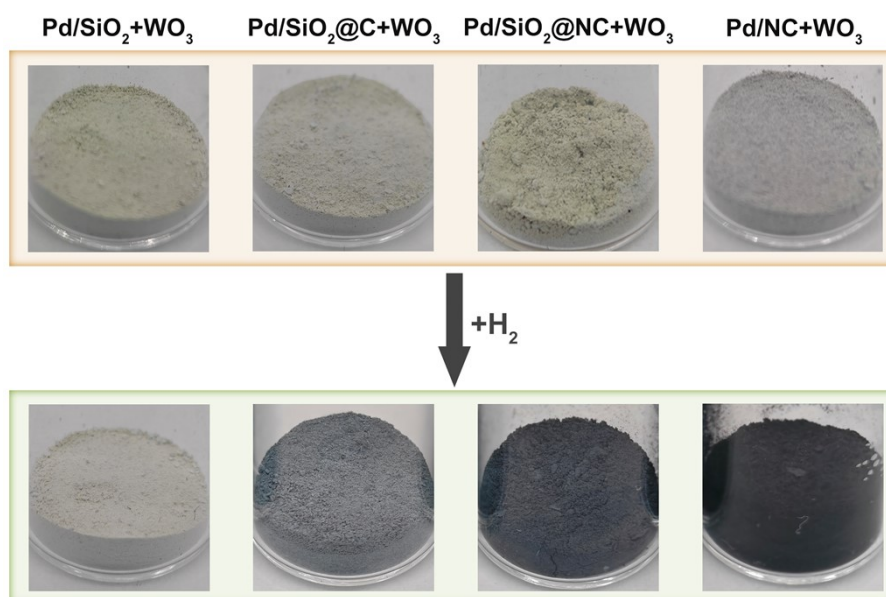
**Fig. S7 Comparing catalysis of the composite catalyst (Pd/SiO<sub>2</sub>+Pd/NC) with Pd/SiO<sub>2</sub>@NC.**



**Fig. S8 VAN adsorption on Pd/NC, Pd/SiO<sub>2</sub>@NC and Pd/SiO<sub>2</sub>.**



**Fig. S9 VAL adsorption on Pd/NC, Pd/SiO<sub>2</sub>@NC and Pd/SiO<sub>2</sub>.**



**Fig. S10 Hydrogen spillover experiments pictures of the catalysts.**