Supporting information

A Robust Co/SiO_2 Catalyst for Sustainable Sorbitol Production: From Batch to Continuous Flow

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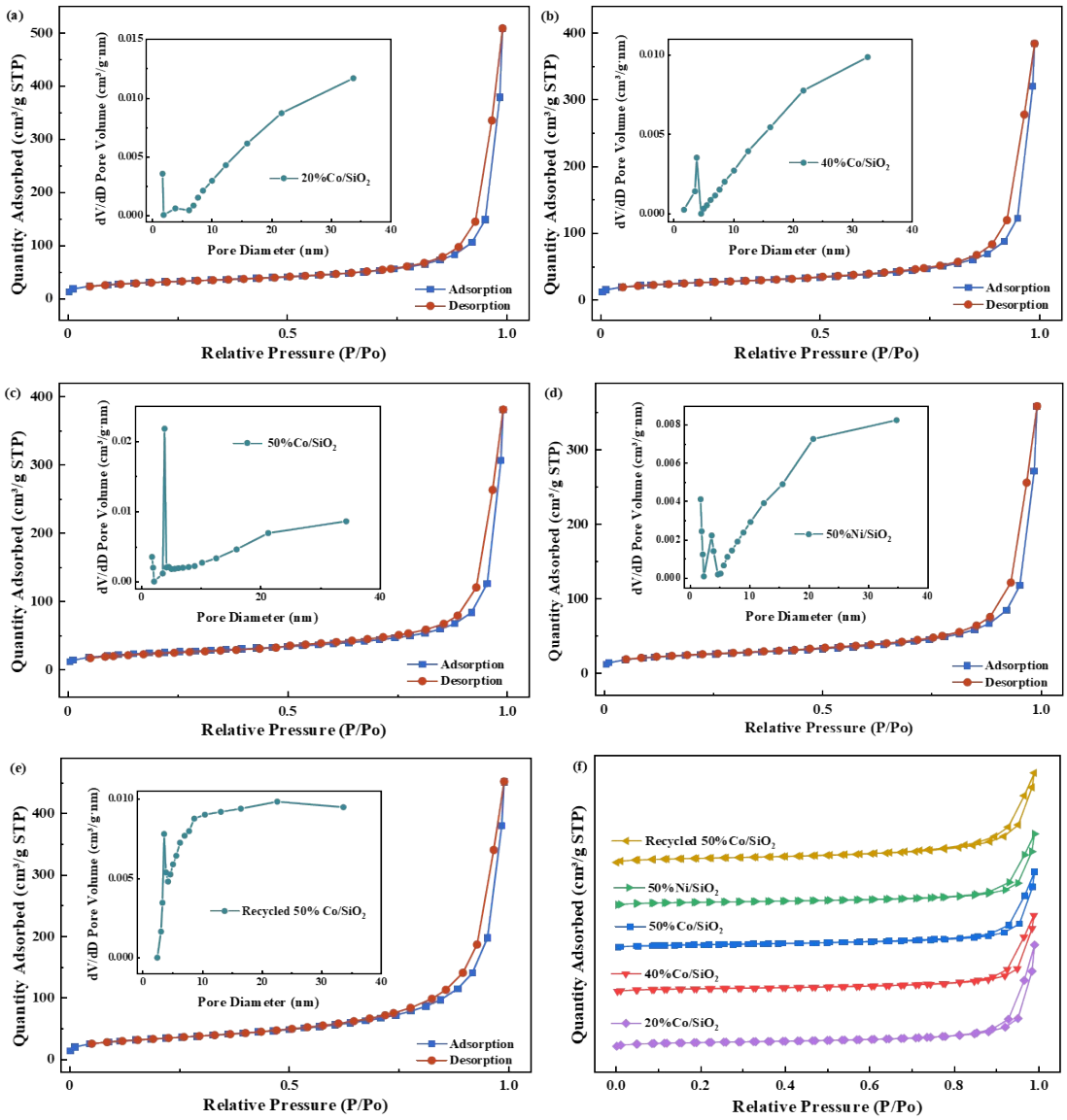

Fig. S1 N_2 adsorption-desorption isotherm and pore size distribution of SiO_2 catalyst: (1) 20% Co/SiO_2, (2) 40% Co/SiO_2, (3) 50% Co/SiO_2, (4) 50% Ni/SiO_2, (5) Recycled 50% Co/SiO_2, (6) SiO_2 catalysts with different loadings.

Effect of the Support on Reaction Activity

Given the widespread application of nickel in conventional hydrogenation processes, metallic Ni was employed to screen suitable supports. Catalysts with a uniform Ni loading of 10% were prepared via the incipient wetness impregnation method. The catalytic performance was evaluated in a 10 wt% glucose solution after 1 hour of reaction, as shown in Fig. S2.

When Al_2O_3, SiO_2, or β zeolite were used as supports, the catalysts exhibited superior performance compared to others, with no significant by-products detected. This indicates that these three supports effectively disperse the Ni active species,

forming selective active sites that promote the directed hydrogenation of glucose to sorbitol while suppressing side reactions.

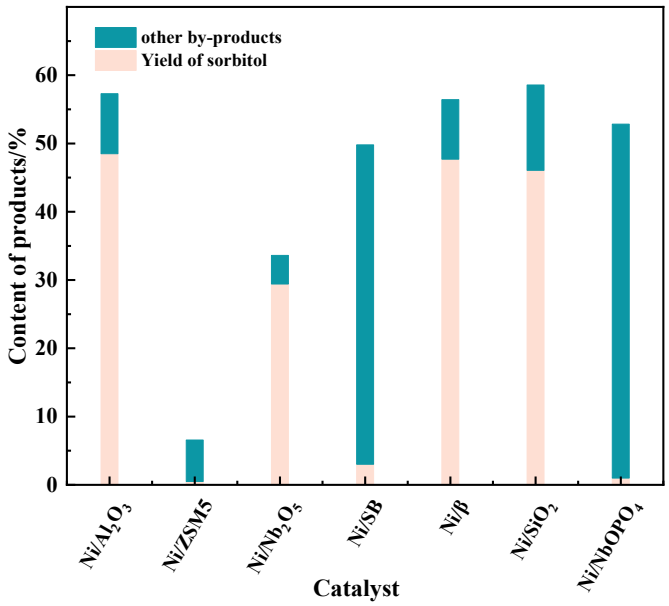

Fig. S2 Comparison of product yield over 10% Ni supported on different supports. Reaction conditions: 2 g catalyst, 5 MPa H_2, 145 ℃, 10 wt% glucose solution.

Since Al_2O_3, SiO_2, and β zeolite exhibited comparable catalytic performance, the Ni loading was increased to 20% to investigate the effect of higher loading on these three catalysts, thereby screening for a more efficient catalyst support.

Fig. S3 Comparison of Catalytic Performance of 20% Ni Supported on two different supports: (a) glucose(10 wt%) conversion, (b) sorbitol yield as a function of time. Reaction conditions: 2 g catalyst, 5 MPa H_2, 145 ℃.

After increasing the Ni content, the catalytic performance of all catalysts improved (Fig. S3). Among the three supports, the catalyst with SiO_2 demonstrated significantly superior performance compared to those with Al_2O_3 and β zeolite, achieving a glucose conversion of 80.2% and a sorbitol yield of 77.3%. This enhanced activity may be attributed to the high specific surface area and suitable pore structure of the SiO_2 support, which can provide more active sites and facilitate reactant diffusion. The advantage of SiO_2 became more pronounced at the elevated loading of 20%, as it enabled better dispersion of metallic Ni, thereby

increasing the number of accessible active sites.