

Electronic Supplementary Material

Kinetics of hydroxylation of phenol with SiC foam supported TS-1 structured catalyst

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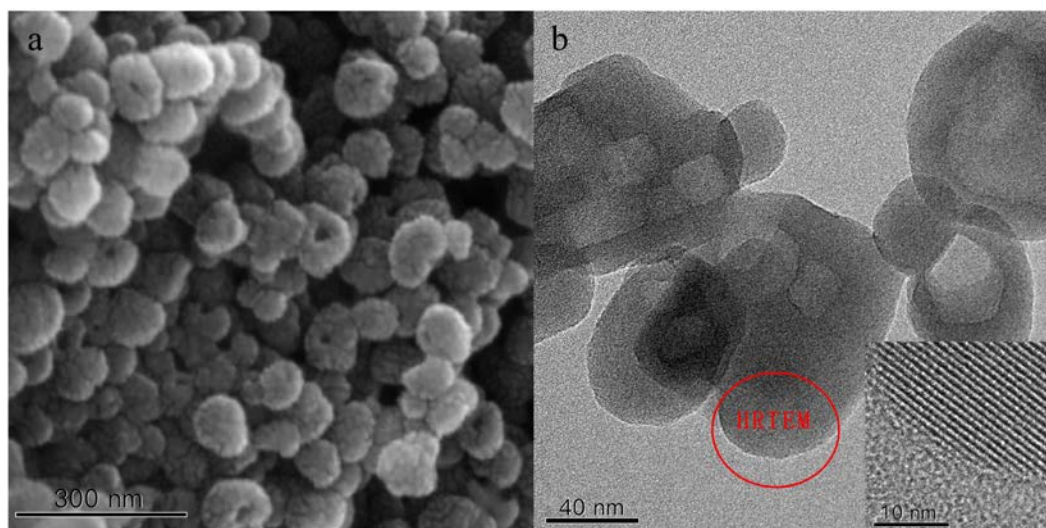


Figure. S1 SEM (a) and TEM (b) images of TS-1 molecular sieve powder

Figure. S1 displays the Scanning Electron Microscopy (SEM) image (a) and Transmission Electron Microscopy (TEM) image (b) of the TS-1 powder used in the experiments. Morphological observations from the SEM image reveal that the TS-1 crystals have distinct boundaries, forming isolated zeolite monocystals with a relatively uniform particle size. The surface of these particles exhibits slight protrusions and a hollow structure, which is also corroborated by the TEM image. Selecting specific regions for high-resolution images, the nanocrystals exhibit lattice stripes oriented in the same direction. This result indicates that the secondary unit crystals of the TS-1 nanocrystal aggregates are uniformly oriented, forming a highly crystalline monocystal with consistent crystal orientation.

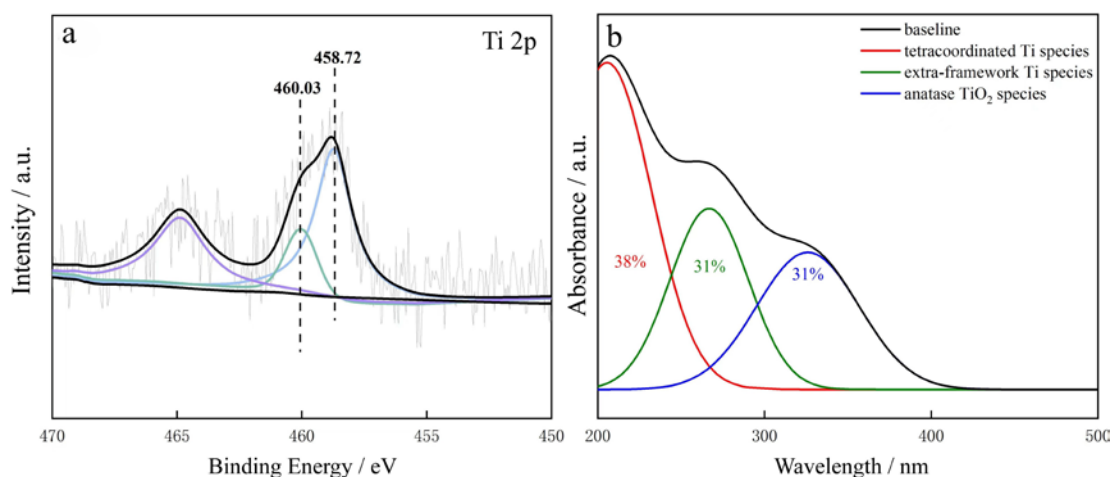


Figure. S2 Ti2p XPS diagram (a) and UV-vis diagram (b) of TS-1 molecular sieve powder

The coordination states of titanium in these samples were investigated using X-ray Photoelectron Spectroscopy (XPS) and Ultraviolet-Visible (UV-Vis) spectroscopy. As shown in Figure S2 (a), titanium atoms denoted as [Ti_I], with a binding energy around 460.0 eV, can be attributed to framework titanium. In contrast, titanium atoms denoted as [Ti_{II}], with a binding energy near 458.7 eV, are indicative of extra-framework titanium.

In the UV-vis diagram (Figure S2, b), the absorption peak at 220nm is skeleton titanium, and the absorption peak at 260-280 nm and 330 nm is non-skeleton Ti and anatase TiO₂. After calculating the integral of peaks area, we found the content of skeleton titanium, non-skeleton titanium and anatase as 38%, 31% and 31%, respectively.

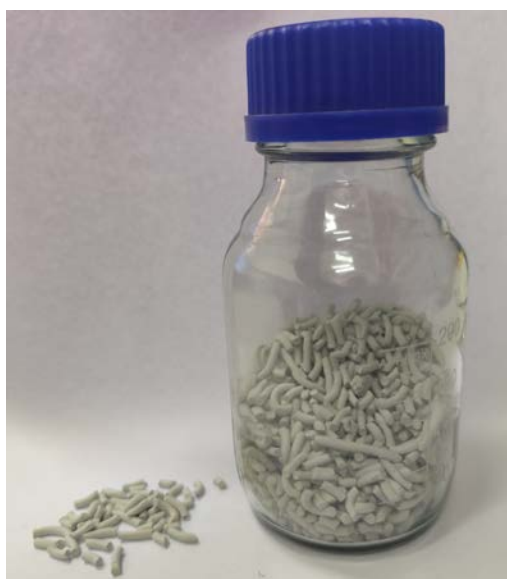


Figure. S3 The TS-1-Extruded catalyst

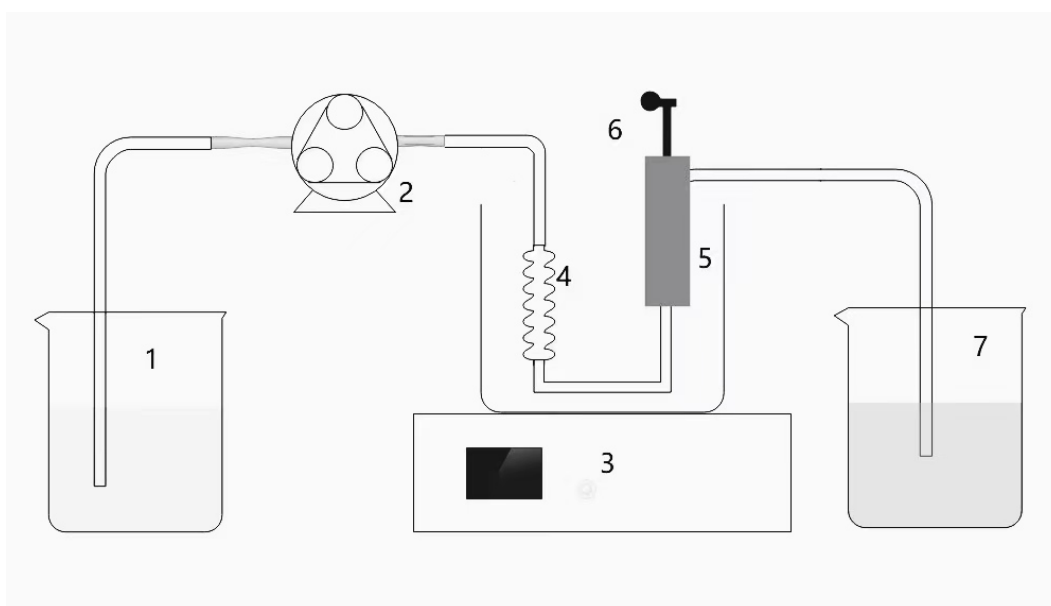


Figure. S4 Diagram of the phenol hydroxylation reaction evaluation device. 1. Raw material solution 2. Peristaltic pump 3. Thermostatic bath 4. Ring heater 5. Fixed bed reactor 6. Thermocouple 7. Waste liquid cylinder

Table.S1 Testing of molecular sieve coating fastness of TS-1-Structured

Cycle number	0	1	2	3
Sample quality/g	12.6188	12.5934	12.5824	12.5819



Figure. S5 The effluent upon addition of potassium iodide and indicator at the space time of 96.41 $\text{g}_{\text{zeolite}} \cdot \text{h} / \text{mol}_{\text{phenol}}$ (left) and 61.95 $\text{g}_{\text{zeolite}} \cdot \text{h} / \text{mol}_{\text{phenol}}$ (right)

Table. S2 Kinetic experiment data of TS-1-Structured

c(phenol)	c(H ₂ O ₂)	con.ph(%)	r(mol*h ⁻¹ *g ⁻¹) 1)	T(K)
0.5300	0.05300	4.83%	0.3238	338
0.5300	0.05300	5.62%	0.3765	343
0.5300	0.05300	6.01%	0.4027	348
0.5300	0.05300	6.67%	0.4469	353

0.5300	0.02972	3.44%	0.2310	353
0.5300	0.03962	5.19%	0.3480	353
0.536.6700	0.05944	7.43%	0.4980	353
0.4240	0.05300	6.46%	0.3465	353
0.6360	0.05300	6.76%	0.5440	353
0.7420	0.05300	6.92%	0.6500	353

Table. S3 Kinetic experiment data of TS-1-Extruded

c(phenol)	c(H ₂ O ₂)	con.ph(%)	r(mol*h ⁻¹ *g ⁻¹)	T(K)
0.5300	0.05300	0.60%	0.04023	338
0.5300	0.05300	0.71%	0.04760	343
0.5300	0.05300	0.81%	0.05430	348
0.5300	0.05300	0.86%	0.05770	353
0.5300	0.02972	0.38%	0.02550	353
0.5300	0.03962	0.59%	0.0395	353
0.5300	0.05944	0.91%	0.06100	353
0.4240	0.05300	0.81%	0.04340	353
0.6360	0.05300	0.92%	0.07400	353
0.7420	0.05300	0.97%	0.09100	353