catalysts

MDPI

Supplementary Material

This PDF file includes:

Table s1 BET data for different crystalline MnO_2.

Catalyst	Pore size	Pore volume	BET surface area
α-MnO_2	11.719	0.298	100.171
β-MnO_2	/	/	/
γ-MnO_2	10.434	0.240	94.184
δ-MnO_2	11.755	0.037	11.083

The results show that the BET surface area of δ-MnO_2 is smaller compared to the α-MnO_2 and γ-MnO_2,(where β-MnO_2 cannot be measured because the specific surface is too small) indicating that the surface area is not the reason for the excellent performance of δ-MnO_2.

Table s2 JCPDS main peaks data of different crystalline MnO_2.

Catalyst	JCPDS Card No.	Three Main Peaks/°		
α-MnO_2	44-0141	12.78	18.10	37.52
β-MnO_2	24-0735	28.68	37.33	56.65
γ-MnO_2	14-0644	22.43	37.12	56.14
δ-MnO_2	80-1098	12.55	25.24	39.60

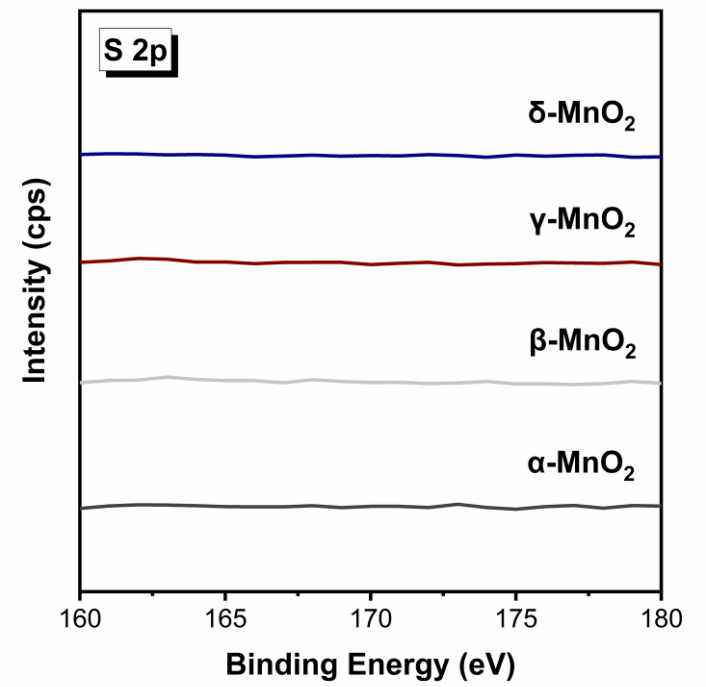

Figure s1. XPS S 2p binding energy of MnO_2 with different crystal types.

We characterized the content of SO_4^{2-} in different crystalline forms of MnO_2 using XPS S 2p (see Fig. r-2). The results show that the S 2p peaks (Near 164 eV) are almost non-existent, indicating that the catalyst is scrubbed clean of SO_4^{2-}. This excludes the influence of SO_4^{2-} on the reaction.

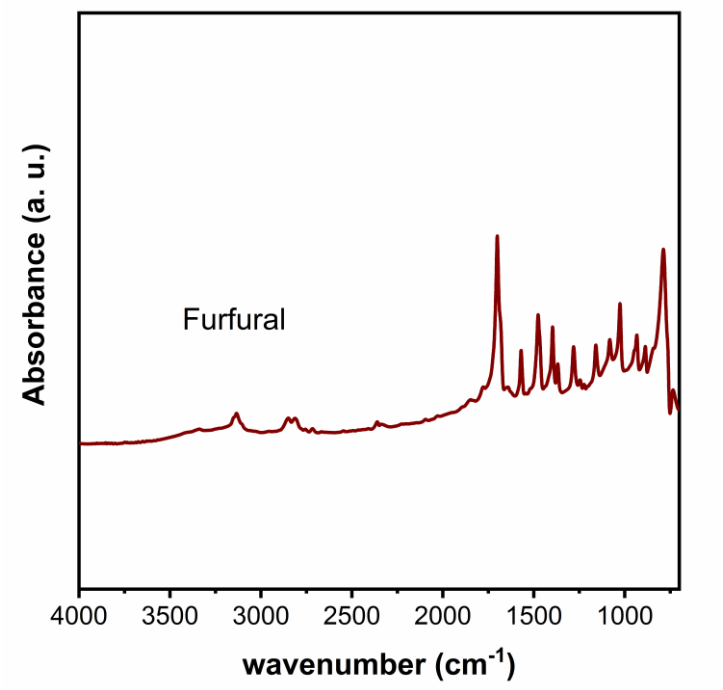

Figure s2. Ex situ DRIFTS spectra of pure furfural.

Figure s3. Reactor for the oxidation of furfural to furoic acid.