Manganese ions in-situ functionalized ZSM-5 for the catalytic oxidation of cyclohexane

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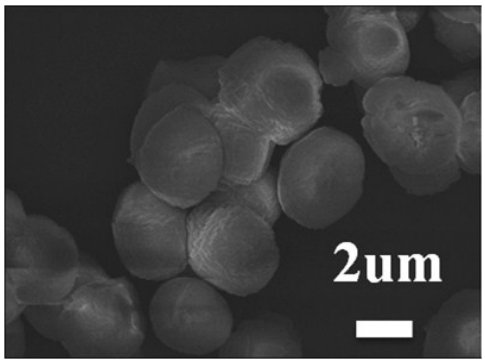

Fig. S1 SEM of P_3 sample used for EDS Mapping shown in fig. 3

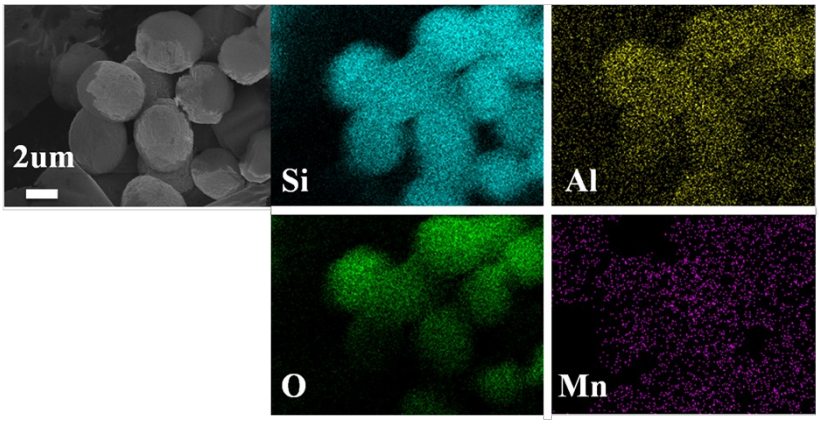

Fig. S2 SEM of P_3 sample after six times catalytic reaction and corresponding EDS mapping: Si (blue-green), Al (yellow), O (green) and Mn (purple)

Table. S1 ICP results for both reaction mixture and the used solid catalysts

sample	SiO_2/Al_2O_3	Mn/(Mn+Si)
reaction mixture	---	
P_3 after 6 times usage	50	1.30

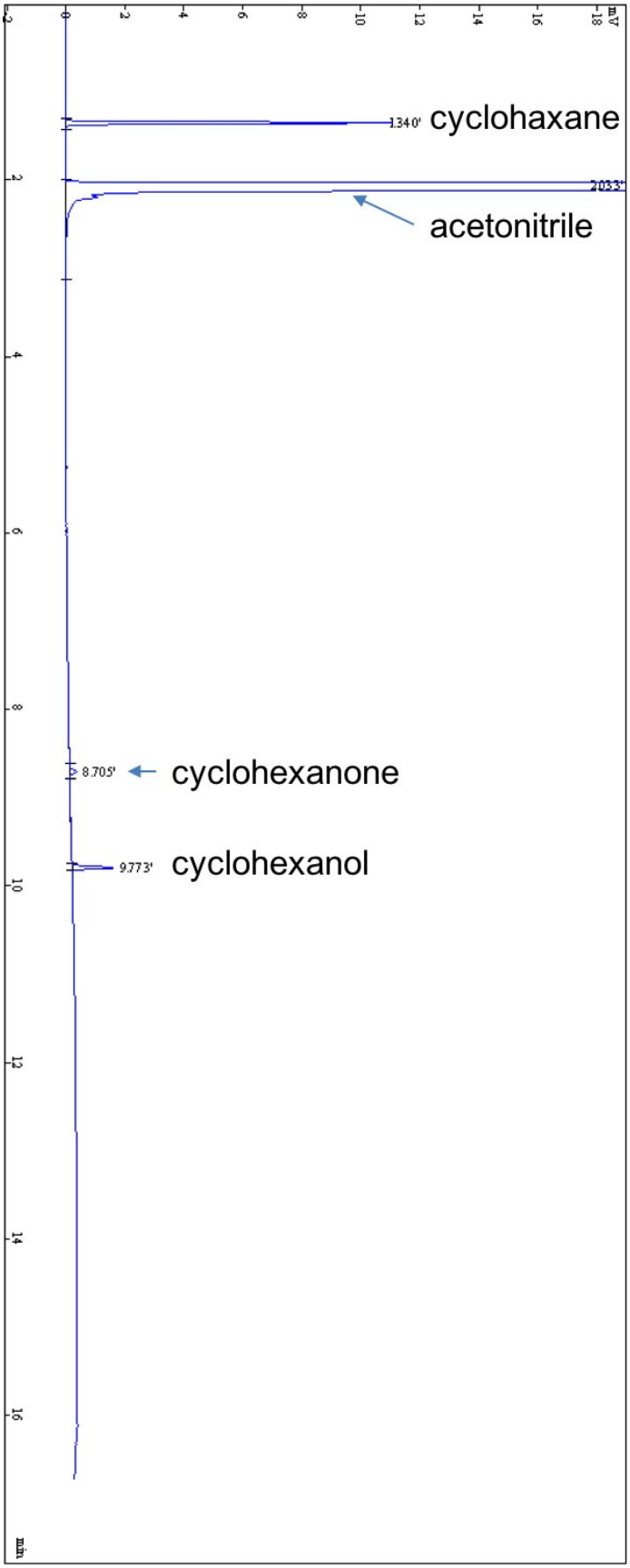

Fig. S3 GC curve of the catalytic products by 2% Mn-ZSM-5, the peaks in different times correspond to different products: 1.340 min (cyclohexane), 2.033 min (acetonitrile), 8.705 min

(cyclohexanone) and 9.773 min (cyclohexanol)

The gas chromatogram (GC) curve was drawing out with concentration of the components from the end of the column plotted against the time after injection. Time at 2.033 is corresponding to acetonitrile functioned as solvent, which is a main component among the product mixture. Cyclohexanone at 8.705 min and cyclohexanol at 9.773 min are the whole composition of the catalytic oxidation of cyclohexane at 1.340 min.

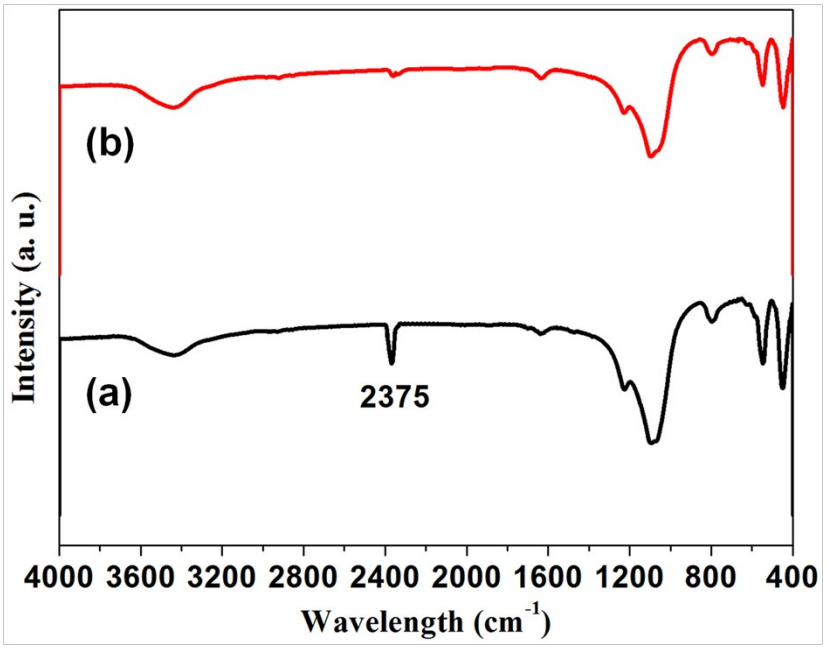

Fig. S4 FTIR spectra of the P_3 sample after five times usage without(a) and with(b) calcination.