

Supporting Information

Magnetic-responsive solid acid catalysts for esterification

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1. EXPERIMENTAL SECTION

Characterization methods. Morphology of the samples was characterized by scanning electron microscopy (SEM, Hitachi S-4800 at 15KV). The surface composition and chemical state of samples was obtained by X-ray photoelectron spectra (XPS) on KRATOS, Ultra ^{DLD} with Al Ka radiation (1486.6 eV). The binding energy was corrected by setting C1s peak at 284.8 eV, and then peak fitting was performed. The crystal structure of samples was recorded by X-ray powder diffractometer (XRD) patterns from 10 to 80 degree were collected on Rigaku D/max-2500 with an incident

wavelength of 0.154 nm and a Lynx-Eye detector. ^{13}C NMR and ^1H NMR spectrum were acquired with a Bruker AVANCE III 500 MHz spectrometer. It was recorded at room temperature in CD_3OD and chemical shifts were given in δ (ppm). Fourier transforms infrared (FTIR) spectroscopy was performed on the sample/KBr pressed pellets after scanning samples for 32 times using a BRUKER EQUINOX55 spectrometer. Magnetic properties of the samples were measured by a vibrating sample magnetometer (VSM, Lake Shore 7307, USA) at 300 K. Thermogravimetric analysis (TGA) was measured by PerkinElmer Pyris 1 TGA from 30 °C to 800 °C in nitrogen atmosphere at scan rate of 10 °C/min. The product of esterification reaction was analyzed by gas chromatography spectrometry (GC-1120, Shanghai Sunny Hengping Scientific Instrument Co., Ltd.) equipped with a OV624 capillary column (25 mm thickness, 30 m length).

2. ADDITIONAL RESULTS

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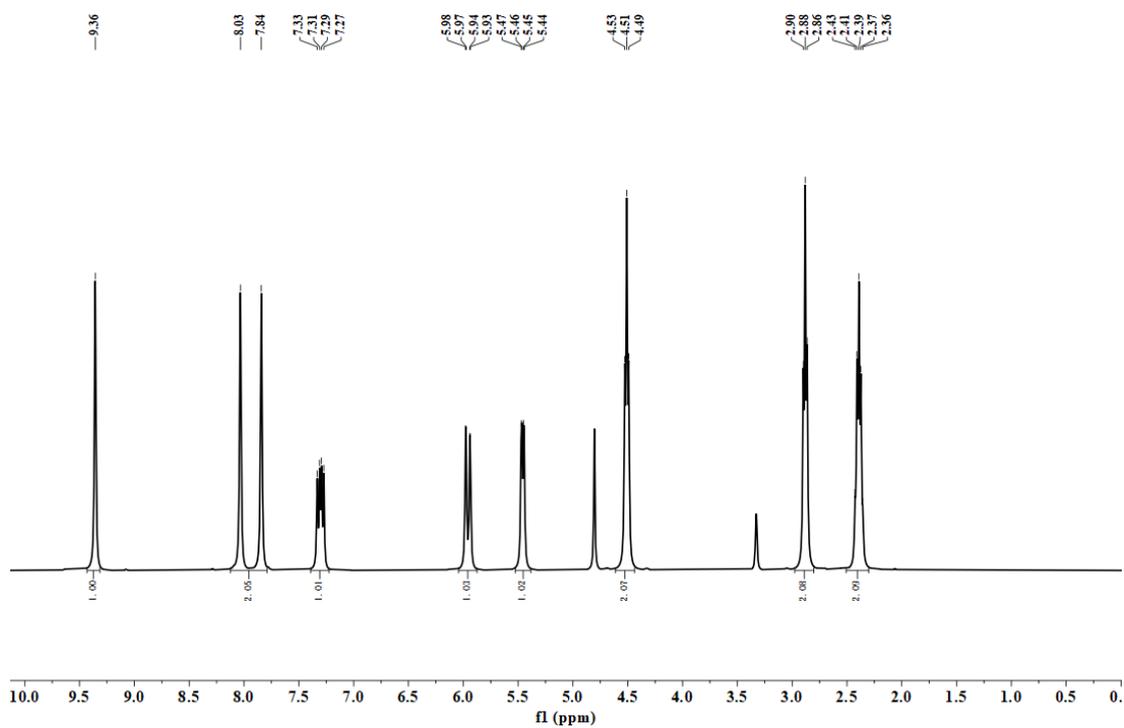


Fig. S1 ^1H NMR spectrum of $[\text{VLIM}]\text{SO}_3$.

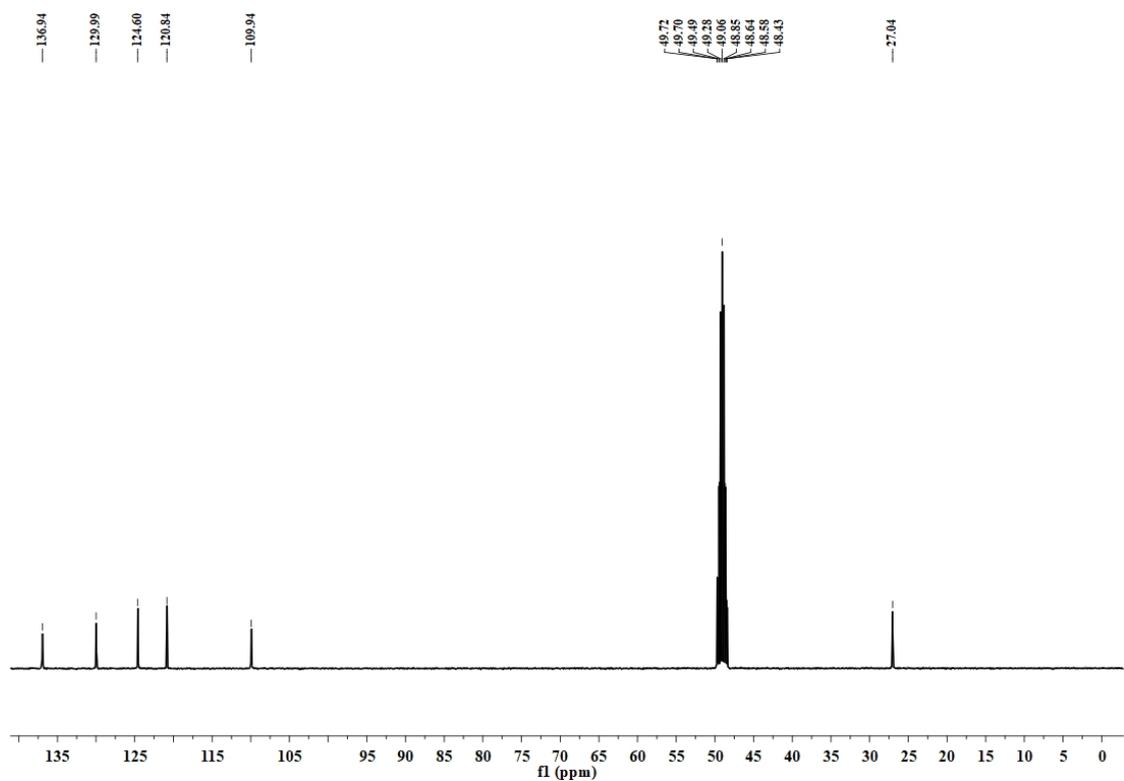


Fig. S2 ^{13}C NMR spectrum of $[\text{VLIM}]\text{SO}_3$.

Table S1

Mass concentration and position BE of O, N, C, S and Si of Fe₃O₄@SiO₂-P[VLIM]SO₃ NPs.

Fe ₃ O ₄ @SiO ₂ -P[VLIM]SO ₃	O	N	C	S	Si
Mass Concentration (%)	39.77	1.41	40.31	1.4	17.11
Position BE (eV)	532.4	401.6	284.4	167.8	103.3

Table S2

Mass concentration and position BE of O, N, C, P, Si and W of Fe₃O₄@SiO₂-P[VLIM]PW NPs.

Fe ₃ O ₄ @SiO ₂ -P[VLIM]PW	O	N	C	P	Si	W
Mass Concentration (%)	38.68	0.81	36.45	0.1	23.25	0.7
Position BE (eV)	532.6	393.7	284.4	133.2	103.3	35.9

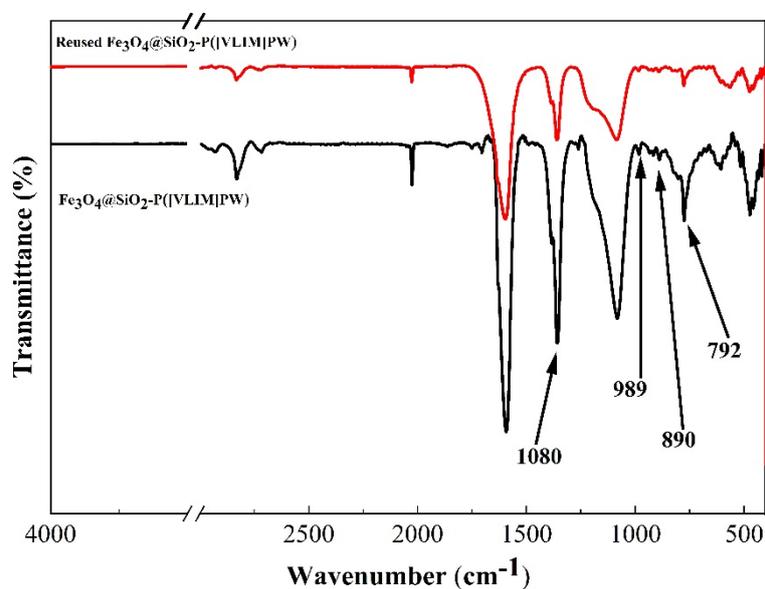


Fig. S3 FTIR spectra of Fe₃O₄@SiO₂-P[VLIM]PW NPs and reused Fe₃O₄@SiO₂-P[VLIM]PW NPs.