Extended Supplementary Information for:

Bifunctional Lewis and Brønsted acidic zeolites permit the continuous production of bio-renewable furanic ethers

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Table S1. Metal content and porosity data for various aluminosilicate and stannosilicate materials. Al content determined by ICP-MS, Sn content determined by EDX spectroscopy and porosity data determined by N2 isotherms; Brunauer-Emmett-Teller surface area (S_{BET}) calculated from BET method, and micropore volume (V_{micro}) derived from the t-plot method

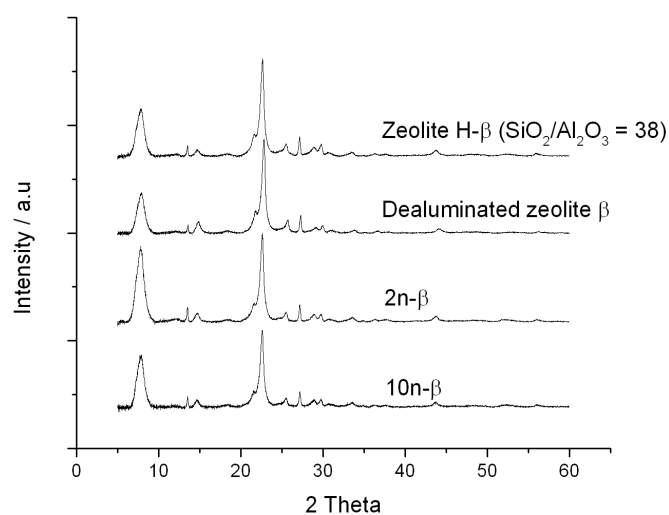| Entry	Catalyst	Al wt. %	Sn wt. %	[a]S_{BET} (m^2 g^{-1})	V_{micro} (cm^3 g^{-1})
1	H-Beta-38	2.30	-	551	0.210
2	deAl-Beta-38	< 0.05	-	596	0.221
3	2Sn-Beta	< 0.05	1.7	563	0.191
4	10Sn-Beta	< 0.05	9.4	525	0.193

Figure S1. XRD analysis of different aluminosilicate and stannosilicate catalysts, including (from top to bottom) zeolite H-Beta (SiO_2/Al_2O_3 = 38), dealuminated zeolite beta, 2Sn-Beta and 10Sn-Beta.

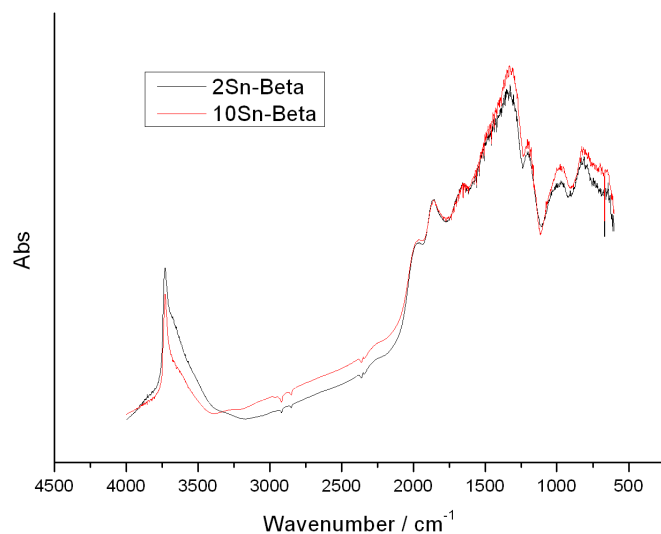**Figure S2.** FTIR analysis of 2Sn-β and 10Sn-β following outgassing at 550 °C. The intensities are normalised to the Si-O-Si absorbances, so that the relative intensities of the OH region bands can be compared.
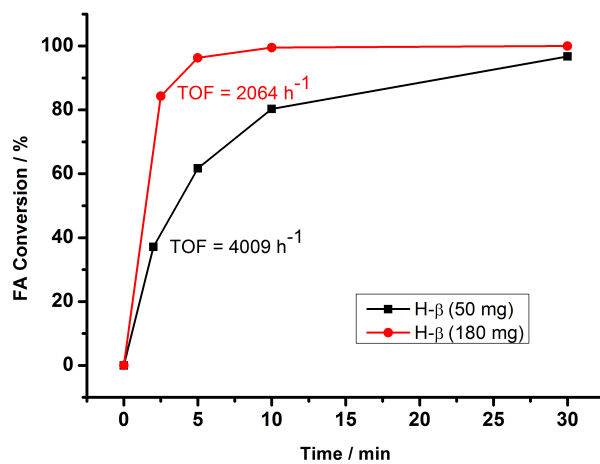

Figure S3. Conversion of FA to BMF as a function of time using H-Beta (300) at different mass loading. Initial TOF is displayed for the two different loadings.
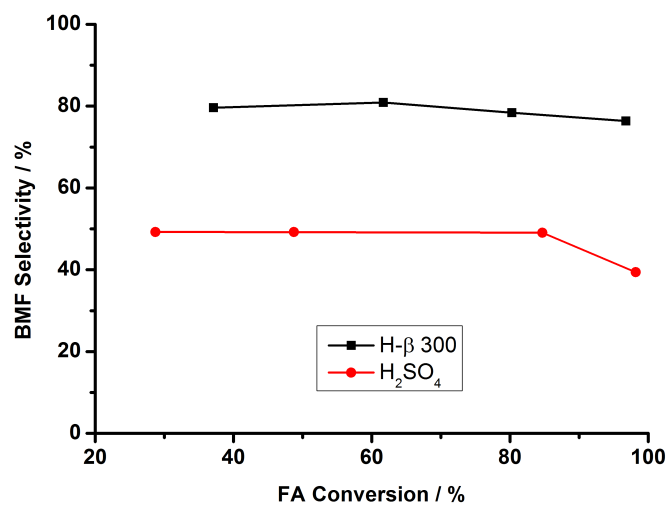
Figure S4. BMF selectivity as a function of FA conversion for H-Beta 300 and sulfuric acid.
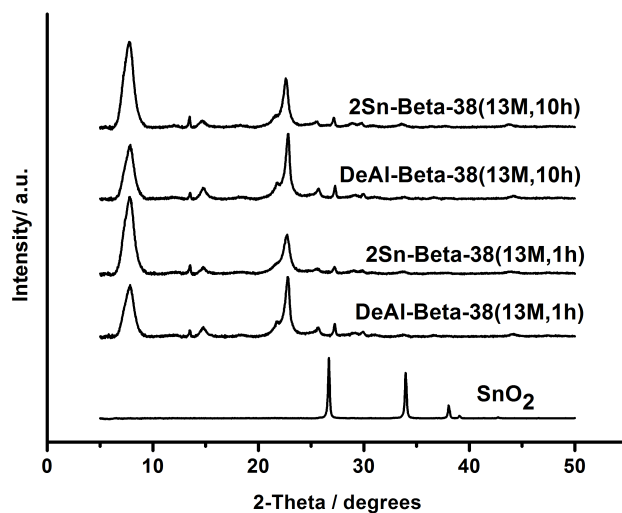

Figure S5. XRD patterns of zeolites treated at different conditions. The dealumination time and concentration are in parentheses. From top to bottom: 2Sn-Beta-38 (13M, 10h), DeAl-Beta-38 (13M, 10h), 2Sn-Beta-38 (13M, 1h), DeAl-Beta-38 (13M, 1h) and SnO_2.
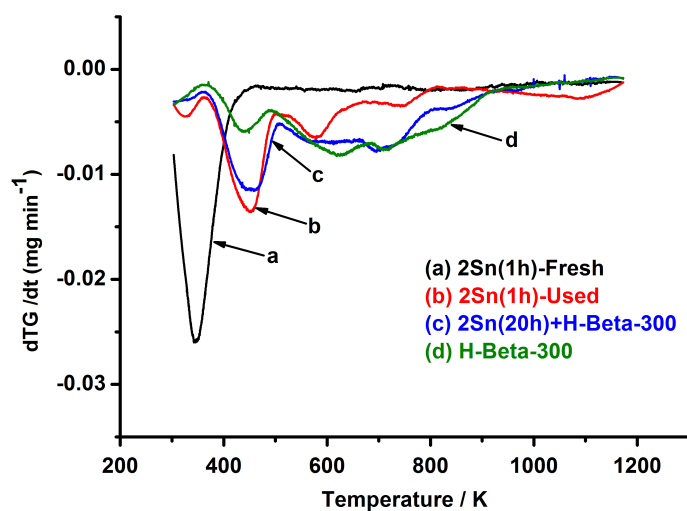
Figure S6. Thermogravimetry analysis of different used catalysts compared against a fresh sample: a) 2Sn(1h) fresh, b) 2Sn(1h) used after FF MPV/etherification, c) physical mixture used after FF MPV/etherification and d) H-Beta 300 used after FA etherification only.
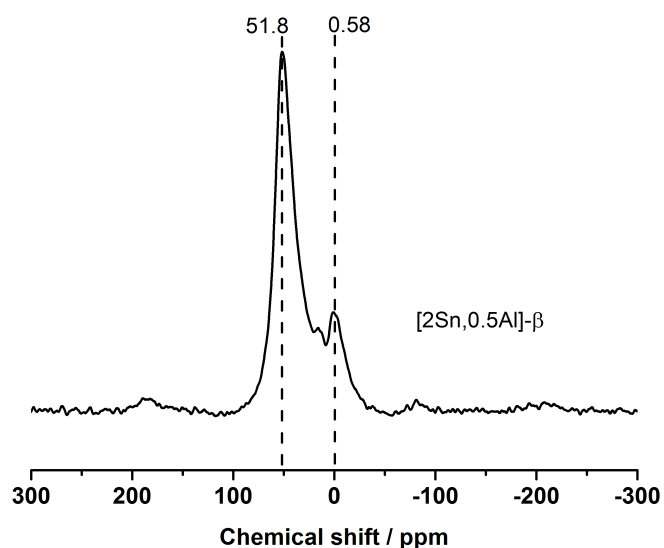

Figure S7. ^{27}Al MAS NMR spectrum of [2Sn, 0.5Al]-β.

Table S2. Porosity data of various fresh, used and regenerated alumino- and stanno-silicate catalysts. Brunauer-Emmett-Teller surface area (S_{BET}) calculated from BET method, and micropore volume (V_{micro}) derived from the t-plot method. Values in italic and underlined correspond to measurements made on used (*i.e. ex reactor*) and regenerated catalyst mixtures, respectively.

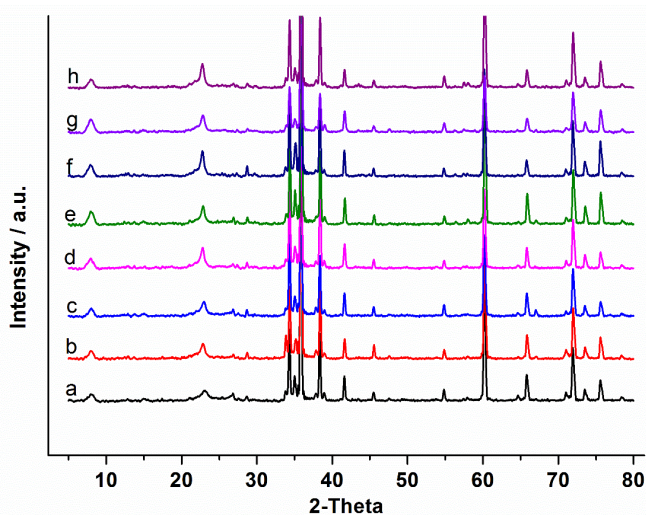| Catalyst	[a]S_{BET} ($m^2 g^{-1}$)	V_{micro} ($cm^3 g^{-1}$)
Al-BEA-38	550.38	0.247
[2Sn,0.5Al]-β undiluted	560.716	0.245
[2Sn,0.5Al]-β (1:4 by weight physical mixture with SiC)	*53.432* (after reaction) <u>93.482</u> (after reaction + regeneration)	*0.022* (after reaction) <u>0.043</u>(after reaction + regeneration)

Figure S8. XRD of different fresh and used zeolite catalysts (20 wt. %) mixed with SiC (80 wt%.). From bottom to top: a) 2Sn(1h)-Beta fresh, b) 2Sn(1h)-Beta used, c) 2Sn(10h)-Beta fresh, d) 2Sn(10h)-Beta used, e) 2Sn(20h)+H-Beta fresh, f) 2Sn(20h)+H-Beta used, g) 2Sn-0.5Al-Beta fresh and h) 2Sn-0.5Al-Beta used.