Supplementary Information

SSZ-70 Borosilicate Delamination Without Sonication: Effect of Framework Topology on Olefin Epoxidation Catalysis

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Calculation of pseudo-first order rate constants:

When comparing reaction rate constants that are based on EBHP conversion at steady-state only with reaction rate constants that are based on all EBHP conversion data (the latter are discussed in the manuscript), the former show a significant benefit of delaminated catalysts Ti-DZ-2 and Ti-UCB-4 over the three-dimensional catalyst Ti-SSZ-70 (see Table S1). The same comparison for Ti-DZ-3 and Ti-ERB-1 does not show a significant difference between the delaminated and the three-dimensional materials.

Table S1: Reaction rate constants k and k' for 1-octene epoxidation with EBHP as oxidant. In order to calculate the rate constants k and k', the average EBHP conversion was calculated using steady-state data only.

Sample	Reaction rate constant k`, mass-based [mL/h·g]	Reaction rate constant k, Ti-based [10^3 mL/h·g]
Ti-DZ-2	94	14.9
Ti-UCB-4	73	21.5
Ti-DZ-3	62	19.4
Ti-SSZ-70	29	11.8
Ti-ERB-1	21	18.0

Calculation for reaction rate constant k', based on catalyst mass:

$$k' = \frac{-\ln\left(1 - X_{EBHP}\right) \cdot \dot{v}}{m_{cat}}$$

Calculation for reaction rate constant k, based on Ti-content:

$$k = \frac{-\ln\left(1 - X_{EBHP}\right) \cdot \dot{v}}{m_{Ti}}$$

X_{EBHP} = average EBHP conversion > 89 hours time on stream

$\dot{v}$ = flow rate [mL/h]; 1.2 mL/h for Ti-DZ-3, 1.1 mL/h for Ti-DZ-2 and 1.0 mL/h for Ti-UCB-4, Ti-SSZ-70 and Ti-ERB-1.

m_{cat} = mass of the catalyst; 0.025 g Ti-UCB-4, Ti-SSZ-70, Ti-DZ-2, Ti-DZ-3 and 0.052 g Ti-ERB-1

m_{Ti} = mass of titanium in the catalyst; $1.6 \cdot 10^{-4}$ g in Ti-DZ-2, $8.0 \cdot 10^{-5}$ g in Ti-DZ-3, $8.5 \cdot 10^{-5}$ g in Ti-UCB-4, $6.1 \cdot 10^{-5}$ g in Ti-SSZ-70, and $6.2 \cdot 10^{-5}$ g in Ti-ERB-1.

UV-vis spectroscopy:

Figure S1 shows UV-vis spectra of fresh, spent (after catalysis) and calcined (after catalysis) Ti-DZ-2, Ti-DZ-3, Ti-UCB-4, Ti-SSZ-70, and Ti-ERB-1. All materials show broader bands due to organic residue, and all delaminated catalysts (Ti-DZ-2, Ti-DZ-3 and Ti-UCB-4) can be recovered via calcination, whereas the three-dimensional catalysts Ti-SSZ-70 and Ti-ERB-1 cannot be fully recovered.

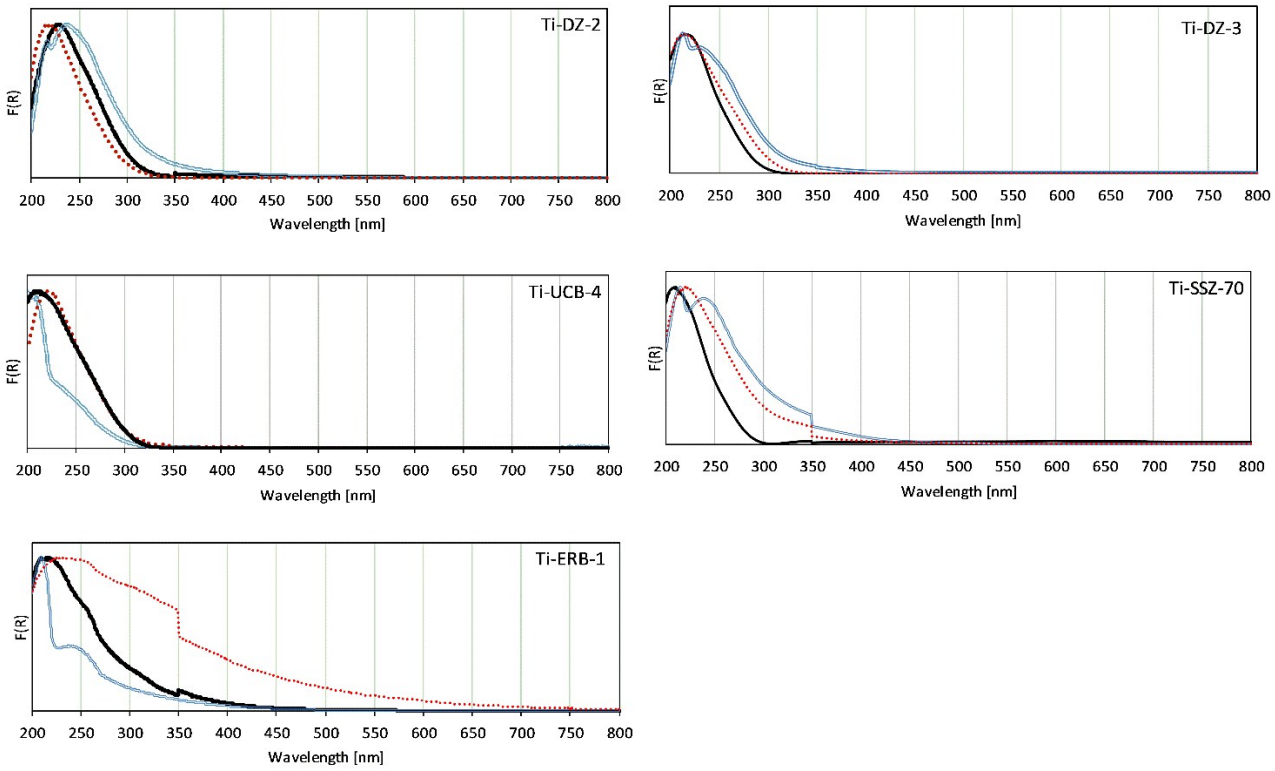


Figure S1: UV-vis spectra of Ti-DZ-2, Ti-DZ-3, Ti-UCB-4, Ti-SSZ-70, and Ti-ERB-1 of fresh catalyst (black straight line), spent catalyst (blue, hollow line) and the spent/calcined catalyst (red, dotted line).

NMR spectroscopy

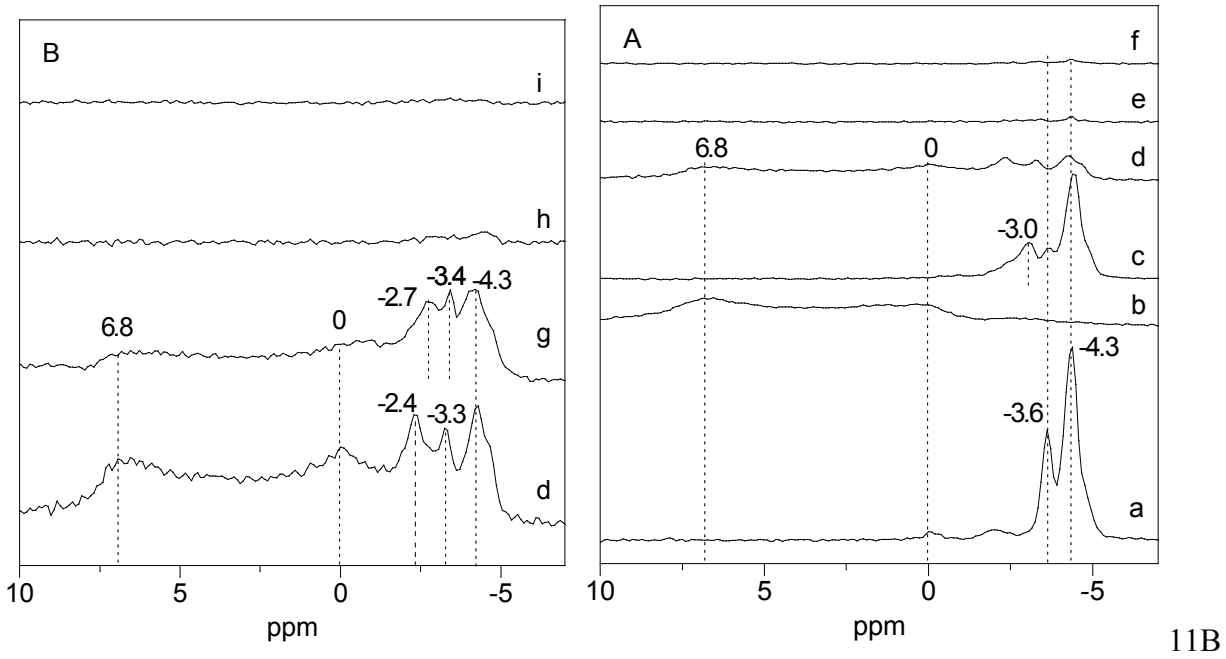
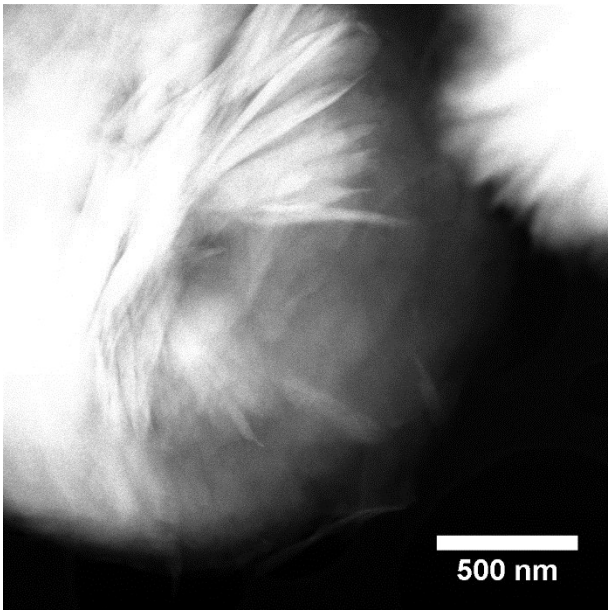


Figure S2. ^{11}B MAS NMR data characterizing (a) B-SSZ-70, (b) calcined B-SSZ-70, (c) DZ-2P, (d) calcined DZ-2P, (e) DZ-2, (f) Ti-DZ-2, (g) UCB-4, (h) UCB-4D, and (i) Ti-UCB-4.

A)



B)

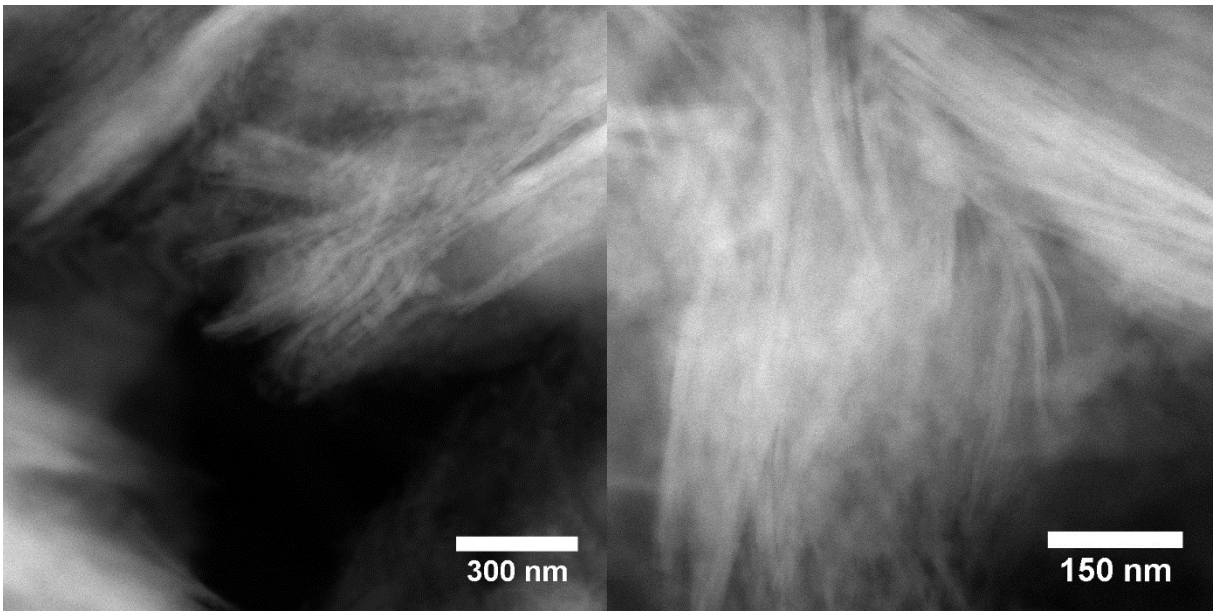


Figure S3: HAADF-STEM images of A) non-delaminated B-SSZ-70 and B) delaminated DZ-2.